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22ND ANNUAL GENERAL MEETING

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THE RESILIENT RESEARCHER

INNOVATING RESEARCH IN
THE NEW NORMAL

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Preface

The Resilient Researcher - Innovating Research in the New Normal was unanimously chosen as the theme for the 20th Annual Scientific Meeting and 22nd Annual General Meeting for IADR Malaysian Section (MalSec). More so, as we foresaw that **resilience** is a fundamental attitude for researchers especially during the SARS-CoV-2 pandemic *(2020, 2021)*, and worldwide dental research initiatives are faced with crosswords as research progress is regularly stunted amidst new norms. Fortunately, resilient researchers from Malaysia, and regional countries in the 20th Annual Scientific Meeting (ASM) have evidently shown that our members and oral science researchers advocated innovative progress of oral and craniofacial research in Malaysia.

The IADR MalSec ASM is an annual event which provides a platform among our members, and researchers from dental institutions in Malaysia to promote dissemination of scientific knowledge, to educate researchers and clinicians to critically assess scientific and technological innovations, to openly discuss issues and challenges in oral and craniofacial research, and to initiate collaborative research opportunities among our members.

We hope that all participants of the 20th Annual Scientific Meeting & 22nd Annual General Meeting have had a pleasant journey with us this year. Special acknowledgments to our President, Associate Professor Dr Siti Mariam Ab Ghani, and Dr Jasmina Qamaruz Zaman, Scientific Research Competition Chair, IADR MalSec ASM for their leadership and guidance throughout planning, and execution of the virtual event.

Our deepest gratitude and appreciation for all the reviewers who helped us maintain the high quality of manuscripts included in the conference proceedings published by IADR MalSec. We would also like to extend our thanks to the members of the organizing team for their hard work. We are now optimistic and full of hope about getting the full paper proceedings as our yearly publication to maximize the dissemination of research findings to a wider audience.

Tengku Dr. Intan Baizura Tengku Jamaluddin
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Editors
20th Annual Scientific Meeting & 22nd Annual General Meeting
IADR MalSec 2021

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Operculitis – The MAHSA Epidemiology

Marcus Cheah Wye Shin[1], Noorun-nisaa Rahmatullah Suhotoo[1], and Yasmine Lee Kai Wen[1]

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Abstract. Operculitis is defined as soft tissue inflammation around the crown of a partially erupted tooth due to the accumulation of plaque and bacteria between the tooth and overlying flap which leads to pain, swelling, radiating pain to the ipsilateral ear, dysphagia and trismus. This 4-year (2018-2021) retrospective study aims to assess the occurrence of operculitis according to age, gender, race, associated third molars, presence of opposing third molar, and angulation of impaction. Patients reported with operculitis in MAHSA Dental Clinic within these years were recorded. Records and orthopantomograms of 108 eligible patients were collected. The data was analysed to determine the correlation of operculitis with age, gender, race, associated third molar, presence of opposing third molar and angulation of impaction. Operculitis was appreciated most in individuals who are from the 18-27 age group (60.58%), and predominant in female patients (54.81%). It also showed prevalence among the Chinese (53.85%). Besides that, operculitis is more frequently seen in the third quadrant (56.73%). The opposing 3rd molar was present in most of the cases (78.85%) and operculitis was prevalent in mesioangularly-impacted mandibular third molars (50.96%). Our study analysed the epidemiology of operculitis among MAHSA Dental Clinic patients over a 4-year period. A comparison of these statistics with similar studies might go a long way in predicting the likely incidence and prophylactic measures to be taken.

Keywords: Operculitis, Impaction, Inflammation, Epidemiology, Angulation

1 Introduction

Operculitis is defined as an inflammation that occurs to the tissues surrounding the third molar. It is commonly found in young adults ranging from age eighteen to early thirties.[1,2] This type of inflammation could be caused by a few factors. In most cases the third molar is partially erupted with a tissue called an operculum that covers a portion of the tooth. This creates a retentive area for food, foreign particles and bacteria to reside in which irritation and infection to the tissues could occur respectively. [2] It could also be caused due to the trauma from the upper teeth that is impinging on the tissues during occlusion. Lastly, stress, pregnancy, poor oral hygiene and upper respiratory tract infections from bacteria are the other causative factors of operculitis to occur. This could both be an acute or chronic condition. In acute cases, the patient usually has severe pain accompanied by swelling of the tissues or nearby lymph nodes, bad breath or bad taste due to the secretions of pus from the inflamed tissues and trismus. However, in chronic cases, the pain would usually be dull or mildly discomforting to the patient for several days with remission. If severe operculitis is not addressed, the infections from the gums could spread to other parts of the face.[3,4]

The objective of our research is to assess the incidence of operculitis in patients of different age, gender and race. This study also targets the evaluation of operculitis prevalence among the associated mandibular third molars, presence of opposing upper molar and the angulation of impaction.

Since there is no research done on the epidemiological data regarding operculitis among MAHSA patients, and that epidemiology is vital in reporting the nature and trend of a particular disease within a region, our goal is to see how our data would differ from other locations within and out of the country that conduct similar studies. And by doing so, we would not only identify the trends but also to formulate a proper treatment plan in order to be prepared when facing similar cases.

2 Materials and Methods

The incidence of operculitis within patients who visited the oral surgery department clinic at MAHSA University from year 2018 to 2021 was retrospectively studied by collecting 309 patient records. The data collection process started once the approval from the Research Management Centre (RMC/ES15/2021) to access patients folders from the record room was granted.

Within these four years with 309 records, we narrowed down our search to patients who had undergone minor oral surgery procedure with positive signs of operculitis, leading to a remaining of 108 patients. Among these 108, we shortlisted the patients in the age group of 18 to 48 years old who had surgical removal of their mandibular 3rd molars performed. Dental record folders of 108 patients who fulfilled the inclusion criteria was traced.

From the dental record, the variables including name of the patient, national IC number/passport number, age, gender, race and the tooth affected were investigated. Our research also aimed to identify the angulation of the affected tooth and presence of the opposing tooth, but unfortunately these details were not mentioned in several of the dental records. Hence, we decided to also utilize diagnostic imaging which is the orthopantomogram for data collection. Out of the 108 identified patients, 4 patients were excluded due to unavailability of their orthopantomogram. Using orthopantomogram, we

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observed the angulation of the third molar and the presence of the opposing third molar.

Once again for our research, we included all those patients who underwent minor oral surgeries for their mandibular 3rd molar removals at MAHSA dental clinic, from ages 18 years old to 48 years old. Those out of this age range were excluded. Patients who underwent normal extraction of their 3rd molars in the clinic following the absence of operculitis were also not included. And as mentioned previously, patients who had incomplete information, mainly the radiographs which could not be retrieved, were excluded as well.

The data was analysed using IBM SPSS version 26. The frequency and percentage obtained from the software were used to summarize the variables.

3 Results

Based on the findings of our studies, we have summarized the results according to a few variables which include age group, gender, race, associated mandibular third molar, presence of opposing third molar and the angulation of impaction the offending tooth.

In short, operculitis was appreciated most in individuals who are from the 18-27 years-old age group (60.58%), and predominantly in females (54.81%). It also showed Chinese (53.85%) being the commonest race to present with operculitis. Besides that, operculitis is more frequently seen in the third quadrant (56.73%). The opposing 3rd molar was present in most of the cases (78.85%) and operculitis was prevalent in mesioangularly-impacted mandibular third molars (50.96%).

Table 1 and 2 shows the prevalence of operculitis with the mentioned variables.

Table 1: Prevalence of operculitis according to each epidemiological variable.

Variables	Frequency (n)	Percentage (%)
Age Group (years old)		
18-27	63	60.58
28-37	36	34.62
38-47	5	4.80
Gender		
Male	47	45.19
Female	57	54.81
Race		
Malay	35	33.65
Chinese	56	53.85
Indian	6	5.77
Others	7	6.73

Table 2: Prevalence of operculitis according to variables found from the orthopantomogram.

Variables	Frequency (n)	Percentage (%)
Associated Mandibular Third Molar		
Tooth 38	59	56.73
Tooth 48	45	43.27
Presence of Opposing Third Molar		
Present	82	78.85
Absent	22	21.15
Angulation of Impaction		
Mesioangular	53	50.96
Distoangular	11	10.58
Horizontal	29	27.88
Vertical	11	10.58

First and foremost, we found out that operculitis was prevalent in the age group of 18 to 27 years old when compared to the other age groups. Among the cases we collected, 60.58% were from 18-27 year-old patients, 34.62% from the age group 28-37, and 4.80% from age group 38-47. This is because the eruption age of third molars is from 17 to 21 years old, which coincides with our first age category[5]. Figure 1 shows the result in regards to age group.

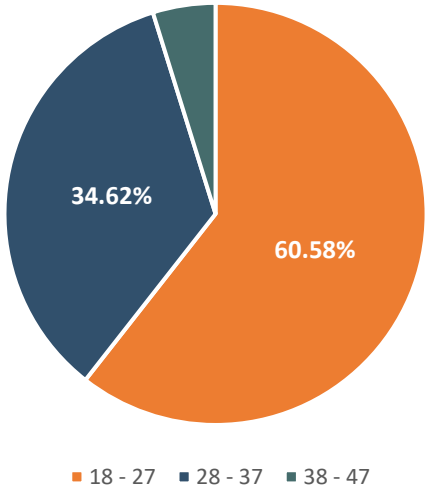

Figure 1: Comparison among age groups

Gender wise, operculitis was seen more in females than males. Female operculitis patients occupy 54.81% of the cases while male patients occupy 45.10%. Mandible of the female stops growing before the third molar erupts, while male jaw continues growing during the eruption time of the third molar. The space available for third molar eruption in females are comparingly less as compared to males, therefore higher risk of impaction, resulting in increased prevalence of operculitis[4]. Figure 2 shows the difference in percentage between the genders.

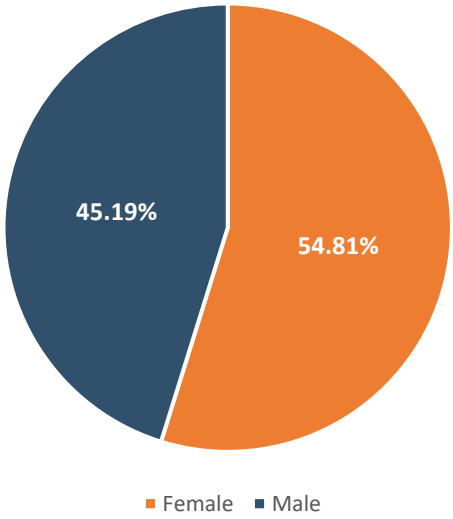

Figure 2: Comparison between gender

Moving on to the different incidence among the races of patients who visited MAHSA University, Chinese patients are 53.85%, Malays are 33.65%, other races are 6.73%, and Indians are 5.77% of the cases. The reason behind this is that Chinese have tapered facial form and wider intermolar width, causing a tooth-jaw discrepancy[9]. Figure 3 reveals the result comparing the cases in association with races.

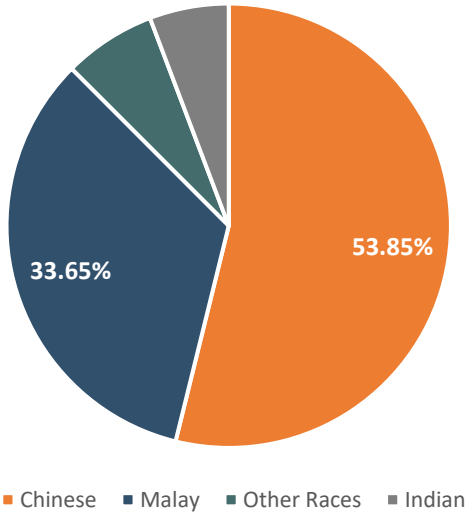

Figure 3: Comparison among races

Apart from that, from the data we have collected, we realised that operculitis occured more in the third quadrant. In other words, tooth 38 is usually the tooth that caused the disease. This is reflected in 56.73% of the cases. The remaining 43.27% is caused by the right mandibular third molar, which is tooth 48. Figure 4 gives a better view of the incidence of opercultis.

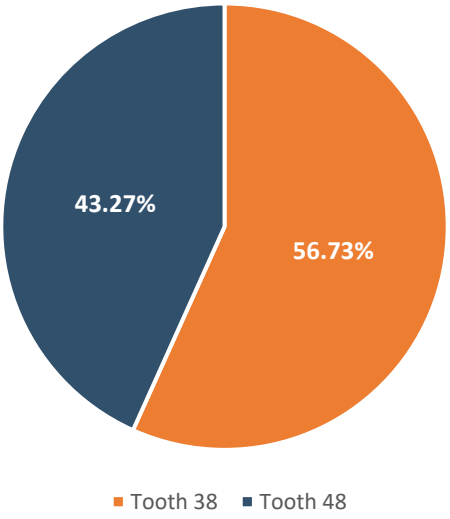

Figure 4: Comparison between the associated third molar

As the presence of opposing third molar was observed, it is shown that most of the patients have opposing upper third molar that occludes on the associated mandibular third molar. This is 78.85% as compared to 21.15% of those who do not have the opposing tooth. This is because the opposing upper third molar exists as an aggravating factor that impinges on the operculum, elevating the chances of inflammation of that soft tissue[15]. Figure 5 represents the result of association of operculitis with the opposing tooth.

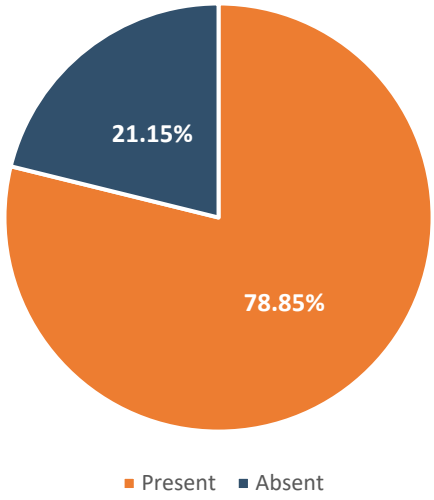

Figure 5: Presence of opposing third molar

Last but not least, it was appreciated that the most common angulation of impaction is mesioangular impaction, which is 50.96%. This is relatively higher than the other type of impaction where horizontal takes up 27.88% of the cases, followed by both vertical and distoangular impaction with 10.58%. This is due to the differential growth rate of the mesial and distal root of the third molar. When the mesial root is underdeveloped, the aid from this root on uprighting the third molar is less, causing more of the offending third molar to be mesioangularly-angulated[9]. Figure 6 compares the prevalence of operculitis in relation to angulation of impaction.

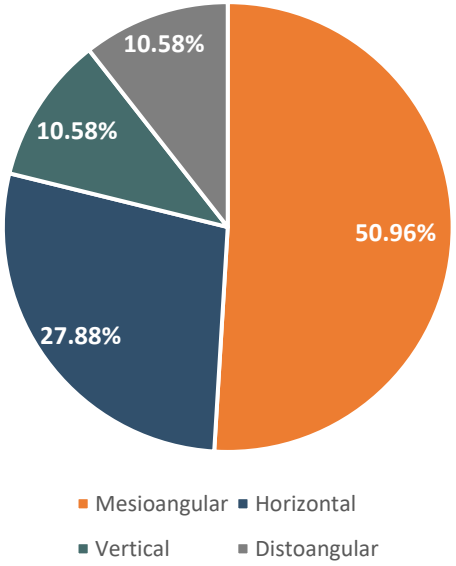

Figure 6: Angulation of impaction

4 Discussion

Age is one of the important epidemiological findings when carrying out a study on the prevalence of operculitis within patients. Studies done by Bataineh et al.[5] have shown similar results in which operculitis occurs commonly within the age group of 20 to 25 years. Other studies[8,11,12,13,16] within the same scope have also supported our results with an age range not exceeding 30. However, a study done by Preeti Singh et al. contradicts our results showing operculitis happening mostly in ages between 26 to 35 years old.[4] This could be due to the reason that operculitis does not occur during, but a few years after eruption of the third molars coupled with some aggravating factors such as long term exposure of irritants within the oral cavity.[4,5] Another study done in Bulgaria showed a different result of operculitis occurring mostly on the third decade.[14]

A number of studies have supported our results in gender. Such as by Preeti Singh et al. with females (62.7%) being more than males (37.3%)[4], Bataineh et al. with females (55.4%) more than males (44.6%),[5] S Manoj Kumar et al. with females (64.9%) more than males (35.1%)[17] and Soh Chen Loong et al. with females (54.0%) more than males (46.0%).[10] However, a result by Rezvi FB et al. showed the opposite, with males being more than females due to the genetic and dietary factors that has an effect on the eruption of the third molars in males.[16] which Operculitis occurs more commonly in females due to the difference in the growth of the jaws as compared to males. [17] The development of the jaws within females tend to slow down or stop during the eruption of the mandibular third molars while in males the jaw continues to develop even after complete eruption of the mandibular third molars.[9,13] Other reasons to explain why this occurs more commonly within females is due to pregnancy. [13] To support this, a study done by Dr. Richik Tripathi, has shown that the incidence of operculitis is most common within the third trimester due to the high levels of estrogen and progesterone which triggers the inflammatory response of the mucosa.[11]

Our study which is conducted in a multi racial country has shown that the prevalence of operculitis is most common in chinese. This is supported by a study done in AIMST Dental Institute showing Chinese (38.8%) having the most cases of at least one impacted tooth as compared to the Malays (30.6%) and Indians (30.6%).[9]

Our results on the associated mandibular third molars seem to match studies from Bitaineh et al. with operculitis occurring more on the left (51.7%) than on the right (48.3%) lower jaw[5], Soh Chen Loong et al. with left (51.9%) more than right (48.1%)[10], and Thomai Katsarou et al. with left being the most common site for operculitis.[12] However studies by Dr. Mahesh Kumar[7] and Thapa VB et al.[15] showed the opposite. Although some researchers have included similar findings, there is no justification as to why operculitis occurs on one side more than the other as of now. This sparks our curiosity to know if further studies on this would prove its significance with operculitis.

Another result obtained by Preeti Singh et al[4], Thapa VB et al.[15] and a study done by Rohit Singh[13] have shown that in cases of operculitis, most patients presented with an opposing upper third molar, which supports our result in this category. The presence of the upper third molar acts as a risk factor of acute operculitis causes by closure of the mouth or during mastication.[13]

The most common angulation seen in our study with patients with operculitis is mesioangular positioned third molar. Our result is supported by studies done by Rosfaima Othman et al.[8], Soh Chen Loong et al.[10], Dr. Richik Tripathi[11], and several others.[13,14] However there are studies by Bataineh et al.[5], Thomai Katsarou et al.[12], Kumar SM et al.[17] and Yimaz S et al.[18] which came out with vertical being the most common angulation. There are also studies that showed that distoangular was instead the most common angulation seen in operculitis.[4,7]. The reason for this angulation is due to the resistance created not only by the mucosa but also the presence of the retromolar pad distaly which during eruption tilts the mandibular third molar distally.[4]

Since our research is a retrospective, descriptive study, we would have further gone into finding out if there were any significant associations among the variables collected together with relating it with the disease entirely. However, the limitations were due to insufficient time within the campus caused by the Covid-19 pandemic. From there, there wasn't enough sample size collected to carry out further investigations without including a control sample group too.

5 Conclusion

Operculitis is more prevalent among female Chinese patients that are aged between 18 -27 years old in cases of mesioangular 38 with the presence of the opposing upper maxillary third molars. With this epidemiological data, we would be able compare and assess the likelihood of operculitis amongst the variables noted on patients that present to the MAHSA dental clinic. From there, we could have a better understanding on the trend of the disease whilst formulating a proper management strategy to treat such patients.

Acknowledgements: Special thanks to our supervisor, Dr. Shareif who has been guiding us in all aspects of our research by providing us endless suggestions, encouragement and to make special arrangements with the

concerned departments and MAHSA clinic staff in order for us to carry out data collection during the lockdown.

We would like to express our sincere gratitude and appreciation to the staff who help coordinate the entire research within these 3 years. The notable staff include Mdm. Nur Sulwana at the start and Dr. Ooi Der Jiun towards the end.

Understanding the full aspect of a research and how it is supposed to be carried out, would not be possible without the help and guidance of biostatisticians, Mdm. Nur Sulwana and Pn. Nuruljannah. Their assistance has helped boost our confidence and ability for us to conduct future research projects.

Lastly, many thanks to the MAHSA clinic staff and radiographers who were present in the campus just to give us access to the patient folders and orthopanthomograms respectively.

References

1. T. Renton, N.H.F. Wilson, Br J Gen Prac, *Problems with erupting wisdom teeth: signs, symptoms, and management*, **66**, 606 (2016)
2. C. Wehr, G. Cruz, S. Young, W.D. Fakhouri, Dent J, *An Insight into Acute Pericoronitis and the Need for an Evidence-Based Standard of Care,* **7**, 88 (2019)
3. R.P. Dhonge, R.M. Zhade, V. Gopinath, R. Amirisetty, Int J Dent Med Res, *An Insight into Pericoronitis,* **1**, 172 (2015)
4. P. Singh, P. Nath, S. Bindra, S.S. Rao, K.V.R. Reddy, Natl J Maxillofac Surg, *The predictivity of mandibular third molar position as a risk indicator for pericoronitis: A prospective study*, **9**, 215 (2018)
5. A.M. Hazza'a, A.B. Bataineh, A. Odat, J Contemp Dent Pract, *Angulation of mandibular third molars as a predictive factor for pericoronitis*, **10**, 51 (2009)
6. C.B.L. Magraw, B. Golden, C. Philips, D.T. Tang, J. Munson, B.P. Nelson, R.P. White Jr, J Oral Maxillofac Surg, *Pain with pericoronitis affects quality of life*, **73**, 7 (2015)
7. M. Kumar, *Correlation of Pericoronitis and the Status of Eruption of Mandibular Third Molar: A clinic Radiographic Study*, **25**, 1 (2013)
8. R. Othman, M.M. Tin-Oi, *Impacted mandibular third molars among patients attending Hospital Universiti Sains Malaysia*, **4**, 7 (2009)
9. S.K. Kanneppady, Balamanikandasrinivasan, R. Kumaresan, S.B. Sakri, Dent Res J, *A comparative study on radiographic analysis of impacted third molars among three ethnic groups of patients attending AIMST Dental Institute, Malaysia*, **10**, 353 (2013)
10. S.C. Loong, T.P. Ge, Kamini, Mas Dent J, *A 7-Year Retrospective Analysis on Surgical Removal of Impacted Mandibular Third Molar at a Tertiary Care Center in Kuantan, Malaysia*, **1**, 43 (2020)
11. R. Tripathi, Int J Adv res, *Incidence of pericoronitis and impacted 3rd molar in pregnant patients visiting dental opd*, **4**, 1737 (2016)
12. T. Katsarou, A. Kapsalas, C. Souliou, T. Stafaniotis, D. Kalyvas, J Clin Exp Dent, *Pericoronitis: A clinical and epidemiological study in greek military recruits*, **11**, 133 (2019)
13. R. Singh, R. Devanna, P. Tenglikar, A. Gautam, Anubhuti, P. Kumari, J Family Med Prim Care, *Evaluation of mandibular third molar position as a risk factor for pericoronitis: A CBCT study*, **9**, 1599 (2020)
14. T. Tsvetanov, IJMRHS, *Association of the Mandibular Third Molar Position to the Pericoronitis,* **7**, 35 (2018)
15. V.B. Thapa, M. Sharma, Amrita, P. Sherchen, *Position of mandibular third molar as a risk factor for acute pericoronitis,* **6**, 55 (2017)
16. F.B. Rezvi, A. Balasubramaniam, M. Chaudhary, *Prevalence of pericoronitis in impacted mandibular third molar: A Retrospective analysis of 86,000 patient records over nine months,* **26**, 286 (2020)
17. S.M. Kumar, H. Al-Hobeira, S. Shaikh, A.A. Siddiqui, J. Syed, R.I. Mian, A.J. Mirza, I.K. Al Ibrahim, IJCMR, *Distribution of Impacted Third Molars based on Gender and Patterns of Angulations in Dental Students of the Hai'l region, Saudi Arabia: A Panoramic Radiograph (OPG) Study*, **4**, 1829 (2017)
18. S. Yilmaz, M.Z. Adisen, M. Misirlioglu, S. Yorubulut, Med Princ Pract, *Assessment of Third Molar Impaction Pattern and Associated Clinical Symptoms in Central Anatolian Turkish Population*, **25**, 169 (2015)
19. S.B. Keng, K.W. Foong, Int Dent J, *Maxillary arch and central incisor dimensions of an ethnic Chinese population in relation to complete denture prosthodontics*, **46**, 103 (1996)

Association between Socioeconomic Status, Dental Caries Status and Body Mass Index of Children from Two Preschools in Kuantan: A Preliminary Report

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Abstract. The association between dental caries and body mass index (BMI) in children has been researched extensively. The socioeconomic status of the families is said to play a significant role in determining the BMI and caries status of the preschool children. Preschool children's dental caries and BMI statuses are of concern among parents. However, the findings in previous research that relate socioeconomic status with dental caries and BMI have been shown to have contradictory results. Thus, this study was conducted with the aim to examine the association between socioeconomic, dental caries and BMI statuses among preschool children in two preschools in Kuantan. The socioeconomic data of the children's families were obtained using a questionnaire. The dental caries was evaluated by a paediatric dentist according to the decayed, missing, and filled teeth (dmft) index. Statistical analyses were performed using SPSS v.22.0 program. A total of 55 Malay preschool children were sampled. The study found no significant association between BMI type and dmft, and no significant association between BMI and household income on chi-square test at $p < .05$. However, a significant difference was found between dmft and socioeconomic status (Kruskal-Wallis test, H statistic = 81.7568 (1, N = 110), p-value < .00001). Further studies with a higher number of subjects are required to increase the reliability of the findings of this preliminary report.

1 Introduction

Dental caries, or commonly known as tooth decay, is one of the highly prevalent chronic diseases that affects children around the globe [1]. As an effect of dental neglect, children could be suffering from multiple decayed teeth and experience pain, events which eventually interfere with the daily activities of these children [2]. A subset of dental caries, early childhood caries (ECC), is a considerable paediatric and public health problem worldwide. ECC is characterised by the presence of at least one decayed, missing, or filled tooth surfaces in any primary tooth, affecting children below 71 months old [3]. It is the most frequent disease of oral cavity in preschool children and results from microbial, genetic, biochemical, socioeconomic, physical, environmental and health-influencing behavioural factors [4]. A severe form of ECC, called severe early childhood caries (S-ECC) is an aggressive form of dental caries classified by the presence of a decayed, missing (due to caries), or filled tooth (dmft) index score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) [5].

Obesity is a result of the interaction among different factors. These include biological, social, behavioural, cultural, environmental and economic factors; individual (e.g. genetics, level of physical activity), family (e.g. parenting style, home nutrition environment), school (e.g. policies on nutrition and physical activity), and environmental factors (e.g. access to healthy foods, parks and recreational areas) [7]. However, it is still not clear about the mechanisms in which these factors lead to obesity among children. Moreover, inequalities in obesity risk between different population groups are poorly understood, including the socioeconomic factors of the families.

Several studies and a recent meta-analysis have shown that education level and socioeconomic status of children's parents significantly influence their oral health status. Preschool children's dental caries and BMI statuses are of concern among parents. However, the findings in previous research that relate socioeconomic status with dental caries and BMI have been shown to have contradictory results. Hence, to contribute to the body of knowledge in this particular area of study by collecting local data, this study was conducted and discussed in this preliminary report with the aim to examine the association between socioeconomic, dental caries, and BMI statuses among preschool children from two preschools in Kuantan.

2 Methodology

Ethical approval (IREC 2020-036) was given by the IIUM Research Ethics Committee (IREC). Parents and children were informed that the participants could withdraw from the study at any time. A written consent was distributed to the parents before including their preschool children in the study.

From November 2020 until April 2021, two preschools were visited to collect the data and samples from the preschool children. They were Beekidz and APC Indera Sempurna, both in Kuantan and are private preschools. The preschools were selected based on their official address with postcodes ranging from 25000 until 26310. In total, 55 preschool children were involved during the data and sample collection. These preschool children came from

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different socioeconomic statuses, and they were categorised based on Pahang's 2019 mean household income as reported by the Department of Statistics Malaysia

Next, to determine the children's dental caries status, the dmft score of the preschool children was evaluated by professional paediatric dentist. Visual inspection was used for registration of dental caries, and the examinations were carried out in daylight using a plane mouth mirror. The body weight and height were recorded so that their body mass index (BMI) could be calculated. The BMI Percentile Calculator for Child and Teen by the Centres for Disease Control and Prevention (CDC) was used as the subjects in this study are preschool children. The calculator can be accessed at the following link: https://www.cdc.gov/healthyweight/bmi/calculator.html.

In this preliminary report, the descriptive data are presented as frequencies and means. For the statistical analyses, the Shapiro-Wilk test of normality was conducted to assess the distribution of the data. As these data were not normally distributed, non-parametric tests were used. The chi-square test was used to determine differences in dmft across the BMI types. To compare the proportional means, univariant statistical analysis was performed using the Kruskal-Wallis non-parametric test with the SPSS v.22.0 program. Moreover, to compare between groups, Mann-Whitney U test was also performed. The level of significance was set to $p<0.05$.

3 Results & Discussion

Table 1 summarises the demographic characteristics of the preschool children from the two preschools.

Table 1. Demographic characteristics of the preschool children from the two preschools.

Demographic characteristics	Frequency n	%
Age (years)		
3	5	9.1
4	18	32.7
5	15	27.3
6	17	30.9
Gender		
Boys	32	58.2
Girls	23	41.8
Race		
Malay	55	100
Kindergarten		
Beekidz	25	45.5
APC Indera Sempurna	30	54.5
Household income category		
T20	29	52.7
M40	20	36.4
B40	6	10.9
BMI (type)		
underweight	11	20.0
healthy weight	26	47.3
overweight	8	14.5
obese	10	18.2
dmft		
0	6	10.9
1–9	43	78.2
10–20	6	10.9

Table 2 shows the summary of descriptive statistics of the 55 preschool children.

Table 2. Descriptive statistics.

N=55	Mean	Range
Age	4.8	3–6
Weight (kg)	18.2	12.9–34.9
Height (cm)	102.26	91–121
BMI	16.5	13.43–17.54
dmft	4.47	0–14
Household income (RM)	7,751.11	1,000–30,000

The mean age of the 55 preschool children was 4.8 years old, ranging from 3 to 6 years old. Most of the preschool children were male (58.2%), while the rest were female (41.8%). All the preschool children were Malay.

Based on BMI Percentile Calculator for Child and Teen by CDC, 20.0% of the preschool children were underweight, 47.3% were healthy weight thus forming majority of the population sampled, while only 14.5% and 18.2% were overweight and obese, respectively. The mean BMI was 16.5. In terms of dmft, most of the preschool children scored 1–9 (78.2%), while only 10.9% of them scored for both 0 and 10–20. The mean dmft was 4.47. There was no significant association between BMI type and dmft at $p < .05$. The chi-square statistic was 4.0162 with p-value of .674491. This finding is similar with that reported by Kumar et al. [7] who also cited three systematic reviews that found no strong evidence of such an association while only one reported a small association.

In terms of the family's household income of the preschool children, most of the 55 preschool children came from families of high socioeconomic status (T20, 52.7%), while only 36.4% and 10.9% of them were from middle (M40) and low (B40) socioeconomic statuses, respectively. The mean household income was RM7,751.11 with a range of RM1,000–RM30,000. There was no significant association between BMI and household income at $p < .05$. The chi-square statistic was 6.564 with p-value of .363056. This finding is consistent with the report from Brazil by Rodrigues Matsudo et al. [8] but is contradictory with the findings in a study from Argentina by Orden, Lamarque and Apezteguía [9].

However, there was a significant difference between dmft and socioeconomic status. On Kruskal-Wallis test, the H statistic was found to be 81.7568 (1, N = 110) with the p-value of < .00001. The result was significant at $p < .05$. This finding is similar with that reported by Ivanisevic et al. [10] in Croatia and by Duangthip et al. [11] in China. Thus, socioeconomic status plays a significant role in determining the dmft of the preschool children.

Given the low number of subjects in the study, the findings from this preliminary report are not suitable to represent the whole population of Kuantan. However, they may give some insights before further investigations are continued in the future especially when sampling processes would be less risky to be conducted during the current pandemic.

4 Conclusion

The study found that there was no significant association between BMI type and dmft. There was also no significant association between BMI and household. However, a significant difference was noted between dmft and socioeconomic status. Further studies involving higher number of subjects are needed to increase the reliability of the findings.

References

1. Lagerweij, M. D., & van Loveren, C. (2015). Declining Caries Trends: Are We Satisfied? *Current Oral Health Reports*, *2*(4), 212–217. https://doi.org/10.1007/s40496-015-0064-9
2. Subramaniam, P., & Surendran, R. (2020). Oral health related quality of life and its association with dental caries of preschool children in urban and rural areas of India. *Journal of Clinical Pediatric Dentistry*, *44*(3), 154–160. https://doi.org/10.17796/1053-4625-44.3.4
3. Anil, S., & Anand, P. S. (2017). Early childhood caries: Prevalence, risk factors, and prevention. *Frontiers in Pediatrics*, *5*(July), 1–7. https://doi.org/10.3389/fped.2017.00157
4. Zheng, Y., Zhang, M., Li, J., Li, Y., Teng, F., Jiang, H., & Du, M. (2018). Comparative Analysis of the Microbial Profiles in Supragingival Plaque Samples Obtained From Twins With Discordant Caries Phenotypes and Their Mothers. *Frontiers in Cellular and Infection Microbiology*, *8*(361), 1–13. https://doi.org/10.3389/fcimb.2018.00361
5. *Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies* (Issue 6). (2016). https://doi.org/10.1016/j.tet.2010.01.028
6. Brown, C. L. (2016). Helping Adolescents With Obesity Establish a Healthier Weight in Young Adulthood. *Journal of Adolescent Health*, *58*(2016), 380–381. http://dx.doi.org/10.1016/j.jadohealth.2016.01.009
7. Kumar, S., Kroon, J., Lalloo, R., Kulkarni, S., & Johnson, N. W. (2017). Relationship between body mass index and dental caries in children, and the influence of socio-economic status. *International Dental Journal*, *67*(2), 91–97. https://doi.org/10.1111/idj.12259
8. Matsudo, V. K. R., de Moraes Ferrari, G. L., Araújo, T. L., Oliveira, L. C., Mire, E., Barreira, T. V., Tudor-Locke, C., & Katzmarzyk, P. (2016). Socioeconomic status indicators, physical activity, and overweight/obesity in Brazilian children. *Revista Paulista de Pediatria*, *34*(2), 162–170. http://dx.doi.org/10.1016/j.rppede.2015.08.018
9. Orden, A. B., Lamarque, M. S., & Apezteguía, M. C. (2019). Trend in childhood obesity reflects socioeconomic status in Argentina. *Annals of Human Biology*, *46*(2019), 531-536. https://doi.org/10.1080/03014460.2019.1694070
10. Ivanisevic, Z.; Uzarevic, Z.; Lesic, S.; Vcev, A.; Matijevic, M. Oral Health of Children from the SOS Children's Village in Croatia. *International Journal of Environmental Research and Public Health 2021*, *18*(616), 531–536. https://doi.org/10.3390/ijerph18020616
11. Duangthip, D., Chen, K. J., Gao, S. S., Lo, E. C. M., Chu, C. H. (2019). Early childhood caries among 3- to 5-year-old children in Hong Kong. *International Dental Journal*, *69*(2018), 230–236.

Platelet Rich Fibrin in The Treatment of Infrabony Defects. A Randomized Control Trial

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Abstract. The present study aimed to investigate the effectiveness of PRF in the treatment of infrabony defects in comparison with open flap debridement. In this single centred double-blinded, spilt-mouth design, 28 patients with 56 bilateral defects (28 per group) were randomized as PRF + open flap debridement (experimental group) or Open flap debridement alone (control group). Evaluation of soft tissue and hard tissue parameters showed significant improvement in clinical and radiographic assessment in the test group over the control group at the end of 6 months. The data concludes the use of PRF as the sole grafting material for the treatment of periodontal infrabony defects.

1. Introduction

Periodontitis is a disease of the periodontium characterized by the irreversible loss of supporting structures.[1] Bone defects, if left untreated, can result in the progression of the disease and further attachment loss. Hence, various surgical combinations and regenerative protocols have been tried in an attempt to provide significant clinical benefits.[2] The ability of polypeptide growth factors and its ability to regulate cell proliferation, chemotaxis and differentiation have been investigated by several authors.[3] But the routine use of these growth factors has been limited due to the non-availability of an ideal carrier.[4] Platelet Rich Fibrin (PRF) described by Choukroun is a second-generation autologous platelet concentrate enriched with platelets and growth factors and has been shown to stimulate proliferation of osteoblasts and periodontal ligament cells in the treatment of periodontal diseases.This promising results reported in the healing of hard tissue and soft tissues[5] have prompted us to use PRF in the regeneration of periodontal tissue in infrabony defects. This study aimed to assess the clinical effectiveness of autologous PRF + open flap debridement with open flap debridement alone in the management of infrabony periodontal defects.

2. Methodology

The study was designed as a double-blinded, single centred, controlled clinical trial with a split-mouth design. The study protocol was approved by the Institutional Review Board (IRB) governing the use of human subjects in clinical experimentation. 28 systemically healthy patients with pairs of infrabony defects were enrolled in the study by a single examiner. Procedures were explained and consent was obtained from these patients.

2.1 Sample size calculation

The sample size calculation was done for the number of sites required for each treatment group as a split-mouth study was designed. The ideal sample size to assure adequate power for this clinical trial was calculated as described by Chan [6].

To detect a mean difference in clinical attachment level of 0.38 in a site with a standard deviation of 0.44 at an alpha level of 0.05 and a beta level of 0.20 (i.e., power=0.80), a sample size of n=23 per group was required. An additional 20% site (5 sites) per group were included for the study, considering potential loss or refusal of the subjects to participate in the study. Thus, giving a sample size of n=28 sites in each group.

First phase of therapy

This part included oral hygiene instructions, scaling and root planing. Six to eight weeks following phase 1 therapy, periodontal evaluation on parameters like pocket depth, clinical attachment and the plaque scores were performed to confirm the suitability of the sites. The inclusion criteria of the patients enrolled in the study were two similar infrabony defects The inclusion criteria of the patients enrolled in the study were two similar infrabony defects with a probing depth ≥6 mm and radiographic evidence of bony defect ≥4mm(3 wall and 2 wall defects)and Plaque score <1.5(Tureskey modification of Quigley Hein Index) after phase 1 therapy. Patients with any underlying systemic illness and smoking habits were excluded from the study.

The sites were divided into experimental and control groups at the time of periodontal surgery by a lottery method. The control group consisted of sites treated with open flap surgery and the experimental group included sites treated with flap surgery followed by placement of PRF. All the clinical examinations and radiographic evaluations were performed by a single examiner who was masked to the treatment group to which a patient was assigned. Intra examiner calibration was performed in five patients on one aspect of two teeth at 3 different times. Calibration was accepted if measurements were similar to the millimetre at a >90% level. The clinical parameters evaluated were probing depth (PD), recession (REC) and clinical attachment level (CAL). The clinical parameters evaluated were probing depth (PD), recession (REC) and clinical attachment level (CAL). Radiographs were also taken to assess the defect depth and position of the alveolar crest. Cemento-Enamel Junction (CEJ) was taken as a fixed reference point from which the defect depth and position of the alveolar crest were measured. All these parameters were evaluated at baseline and after 6 months. Although evaluation of plaque score was not done during the

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intervals,reinforcement of oral hygiene and professional plaque removal was done whenever necessary during every recall visits (every month for a period of 6 months)

2.2 Surgical procedure

All periodontal surgical procedures were performed by a single operator. A full-thickness muco-periosteal flap was elevated and defect debridement was carried out to remove sub-gingival calculus and inflammatory granulation tissue in both the groups. In the experimental group after debridement, PRF was placed in the defect.

2.2.1PRF preparation

20ml blood was drawn from each patient in the experimental group by venipuncture of the right antecubital vein. Blood was collected in 2 sterile glass test tubes without anticoagulants and immediately centrifuged in a Remi R8 centrifuge. RPM1600 was calculated by substituting values of 400g and 14cm radius in the below formula.

$$RCF = 1.12 * r * (RPM/1000)^2 \qquad (1)$$

PRF matrix was separated from the underlying RBC clot, cut into small parts and was placed into the infrabony osseous defects. The operator ensured that the defect was overfilled in the experimental group. Surgical flaps were repositioned to the pre-surgical level and sutures were placed. Control sites were also treated similarly except for the preparation and placement of the PRF matrix.

2.2.2Post-surgical care

The patient was advised to use 0.2% Chlorhexidine digluconate, rinsing twice a day for 1 week. Sutures were removed on day 7 and mechanical plaque control using roll technique was resumed at surgical sites. The patients were recalled once a month for oral hygiene reinforcement and prophylaxis. Clinical and radiographic measurements were recorded at 6 months post-surgically.

2.3 Statistical analysis

Statistical analysis was done using IBM SPSS v26. The intergroup comparisons of means at baseline and after 6 months were analyzed using an independent t-test. The intragroup comparisons between the durations were analyzed using paired t-test.

3. Observation and results

The study group consisted of 28 patients with a mean age of 30.43+7.41 years with paired bilateral infra bony defects. There were 23 females and 5 males in the study group. The mean plaque score at the baseline was 1.22+0.25. Proper oral hygiene maintenance was ensured throughout the study by oral hygiene instructions and oral prophylaxis when required.

Table 1. Experimental group parameters evaluated at Baseline and 6 months.

Parameter	Baseline (Mean±SD)	6 months (Mean±SD)	Mean difference (Mean±SD)	p value
Pocket Depth	7.45±0.870	2.72±0.96	4.72±0.88	<0.001
Recession	0.86±1.026	0.76±0.83	0.10±0.31	0.083
Clinical Attachment Level	8.31±1.137	3.48±1.50	4.82±0.84	<0.001
Infrabony Defect	4.86±0.915	3.10±1.04	1.75±0.98	<0.001

Analysis of the data showed that, statistically significant differences between the baseline and 6 months with pocket depth,clinical attachment level and infrabony defect (P<0.001). Recession showed no statistical significant difference between the baseline and 6 months (P=0.083) (Table 1)

Table 2. Control group parameters evaluated at Baseline and 6 months.

Parameter	Baseline (Mean±SD)	6 month (Mean±SD)	Mean difference (Mean±SD)	p value
Pocket Depth	7.00±1.00	4.62±0.86	2.37±0.67	<0.001
Recession	0.45±0.686	1.59±1.21	-1.13±0.69	<0.001
Clinical Attachment Level	7.52±1.271	6.21±1.5	1.31±1.0	<0.001
Infrabony Defect	4.62±0.677	3.90±0.97	0.72±0.59	<0.001

Analysis of the data showed that, statistically significant differences between the base line and 6 months with respect to all the parameters (P<0.001). (Table 2).

Table 3. Comparison of the experimental and control group at the end of 6 months

Parameter	Experimental	Control	P value
Probing Depth	2.72±0.96	4.62±0.86	<0.001
Recession	0.76±0.83	1.59±1.21	0.004
Clinical Attachment Level	3.48±1.50	6.21±1.5	<0.001
Infra Bony Defect	3.10±1.04	3.90±0.97	0.004

Comparison of the parameters at the end of 6 months in both, the experimental group and the control group, showed a significant difference in clinical attachment levels (P<0.001) and probing depth (P <0.001) recession(P=0.004)infrabony defects(P= 0.004)(Table 3).

4. Discussion

A split-mouth design was used in our study as it removes a lot of inter-individual variability from the estimates of the treatment effect. The present study excluded smokers as they can significantly influence the outcomes of regenerative periodontal surgery.[7] Cochrane oral health review on the evidence available till 2018 stated that there is very low-quality evidence that platelet concentrates and open flap debridement may bring some benefit in the treatment of infra bony defects.[8] Hence we decided to

work on this area. Our study aimed to find out if the addition of platelet concentrates improve surgical treatment outcomes of infra bony defects. Polypeptide growth factors have been investigated as possible signalling factors for enhancing periodontal regeneration. An abundant source of such growth factors is available in the form of autologous platelet concentrates.[9] Therefore, the use of autologous platelet concentrates to enhance the predictability of infrabony defect treatment is justified.

Several commercial techniques and protocols for obtaining PRF preparation have been proposed. However, the data on the potential effect of these PRF components on hard and soft tissue healing is still conflicting. This could be related to the different protocols resulting in different products. The literature shows that there has been an overlapping use of various trade names such as PRF, L-PR, etc. and the studies have not used the same protocol. The parameters that can affect the product depends on the dimension of the rotor, RPM, time, rotor angulation and relative centrifugal force (RCF) and these may influence regeneration success with PRF.[10] The present study used Remi R8C series centrifuge with swing-out heads for the preparation of PRF. Parameters were standardized using the formula below.

$$RCF = 11.18 * r * (N/1000)^2 \qquad (2)$$

where N is revolutions per minute and r is the radius in cm.[11]

In this study, patient blinding to the treatment provided was not possible as it involved the collection of blood samples. However, blinding of the outcome assessment was done as the person performing clinical and radiographic evaluations were masked to the treatment done.

The baseline levels of probing depth,and depth of the defects were comparable for both experimental and control groups in our study. Okuda et al[12] reported that clinical attachment level gain after regenerative or conventional therapy is dependent on initial pockets and deeper the initial PD, the greater the PD reduction and CAL gain. The results of our clinical trial showed statistically significant improvement in clinical and radiographic parameters between the two groups. The mean gain in attachment level at the experimental site was 4.82±0.84 whereas for the control sites it was 1.31±1.0. The reduction in probing depth in the experimental site was 4.72±0.88 and 2.37±0.67 for the control sites (Table 1&Table 2).The improved reduction in pocket depth seen in the experimental group could be attributed to the enhanced soft tissue healing of PRF. These findings were in accordance with the findings of Choukroun et al[13] and Dohan et al.[14]

In the present study the mean reduction in the defect of the experimental group was 1.75±0.98 and in the control, it was 0.72±0.59 (Table 1&Table 2). This was statistically significant and the results were similar to the reports of Chang et al.[15] and Thorat et al.[16] The improvement in the treatment of bone defects is based on the growth factors stored in the platelet granules that are released on activation. Basic fibroblast growth factors and blood proteins are known to act as cell adhesion molecules for osteoconduction. These may serve as biological mediators with the ability to regulate cell proliferation, chemotaxis and differentiation. Platelet derived growth factors has been shown to have a significant regenerative impact on periodontal cells and osteoclast. The experiment and control groups showed uneventful post-operative healing and no adverse complications were seen in either group.

5. Limitations

In our study, outcomes of therapy were assessed using clinical and radiographic parameters as done in most clinical studies on periodontal regeneration. True periodontal regeneration can only be assessed in histological sections which could not be done in the present study due to ethical concerns. The follow-up time for this clinical trial was 6 months which can be considered relatively short to assess bone regeneration. A longer follow-up time may be better suited to evaluate bone regeneration. The present study design used standardized intraoral radiographs to assess changes in infrabony defect depth. The use of an advanced radiographic technique such as digital subtraction radiography would have enabled better precision in assessing new bone formation.

6. Conclusion

PRF, an autologous platelet concentrate, prepared as per the protocol of Choukroun is a simple and inexpensive product. The use of platelet rich fibrin significantly improved the clinical and radiographic parameters that were assessed in this study when used as a graft material in periodontal osseous defects compared to open flap debridement alone. Thus we can conclude that adjunctive use of PRF with conventional open flap debridement may be potentially used in the treatment of intrabony defects.

References

1. B. L. Pihlstrom, B. S. Michalowicz, N. W. Johnson, Lancet **366**,1809-1820 (2005)
2. D. L. Cochran, A. Jones, L. Heijl, et al., J. Periodontol. **74**,1269-1281 (2003)
3. K.Darnell, Joni A Cirelli, W. V Giannobile . Expert Opin Drug Deliv. 5, 647–662 (2006)
4. D.D. Bosshardt, A. Sculean, Periodontol. 2000 **51**, 208-219 (2009)
5. M. Del Fabbro, M. Bortolin, S. Taschieri, et al., J. Periodontol. **82**, 1100-1111 (2011)
6. Y.H. Chan, Sing Med J 44, 172–174 (2003)
7. M.S. Tonetti, G.P. Prato, P. Cortellini. J. Clin. Periodontol. **23**, 548-556 (1996)
8. M. Del Fabbro, L. Karanxha, S. Panda, et al. Coch. Database Sy. Revi. Issue 11. Art. No.: CD011423(2018). Available from DOI: 10.1002/14651858.CD011423.pub2
9. W.V. Giannobile. J. Periodontol. **67**, 545-553 (1996)
10. R. J. Miron, N. R. Pinto, M. Quirynen, et al., J. Periodontol. **90**, 817- 820 (2019)
11. R. Miron, J. Choukroun, S. Ghanaati, Int. J. Growth Factors Stem Cells Dent. **1**, 80-89 (2018)
12. K. Okuda, H. Tai, K. Tanabe, et al., J. Periodontol. **76**, 890-898 (2005)
13. J. Choukroun, F. Adda, C. Schoeffler, et al., Implantodontie **42**, 55-62 (2001)
14. D.M. Dohan Ehrenfest, L. Rasmusson, T. Albrektsson, Trends in Biotech. **27**, 158-167 (2009)
15. Y.C. Chang, K.C Wu, J.H. Zhao, et al., J. Dent. Sci. **6**, 181-188 (2011)
16. M. Thorat, A.R. Pradeep, B. Pallavi, J. Clin. Periodontol. **38**, 925-932 (2011)

Skeletal Patterns Assessment with Geometric Morphometric Method in A Sample of The Malay Population

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Abstract. The traditional measurement of malocclusion relies on cephalometric techniques. Nowadays, the geometric morphometric method for shape analysis could provide better perception and capabilities of measuring the size and shape variations of malocclusion. This study aimed to investigate the size and shape variations of the hard tissue patterns in different skeletal relations in adult Malays using 2-dimensional geometric morphometrics method from lateral cephalograms. 188 lateral cephalograms of subjects (aged 18–40 years) were collected and comprised of Class I, II, and III skeletal relations with 117 females and 71 males for all analyses. A total of 10 hard tissue landmarks were applied on lateral cephalograms using tpsDig2 (Ver.2.31) software. The MorphoJ (Version 1.07A) software was used for the data analysis. Hard tissue patterns in skeletal relations showed 16 Principal Components (PCs) which indicated that variances existed in 16 different dimensions. Procrustes ANOVA and Canonical variate analyses showed size and shape differences between Class II and III between gender groups ($P < 0.0001$). The results of our study provided novel wireframe models for hard tissue patterns of different skeletal relations. Those models of wireframe could be used as a guide in diagnosis and treatment planning by orthodontists and maxillofacial surgeons.

Keywords: skeletal patterns, geometric morphometrics method, hard tissues

1 Introduction

The conventional cephalometric analysis calculates linear distance, angular and area measurements, and ratios. However, the analysis of the shape details was only calculated as size-based measurement. The new method, which is geometric morphometric method in cephalometric analysis of craniofacial morphology helps in further details of shape analysis [1]. The geometric morphometric method (GMM) can be used as a useful tool to define the three-dimensional shape of surfaces. Variability can be measured via the Principal Component Analysis (PCA) and can contribute to identification of shape patterns and origins of shape variation, regardless of size changes [2].

It is substantial to consider the cephalometric characteristics of the type of malocclusion present with the patient before diagnosis and orthodontic planning. Diagnosis and treatment planning have been dependent for many years on the norms of Caucasian groups, which differ from Malay norms. There are studies accomplished in Malaysian sub-ethnic groups which evaluated the cephalometric norms of subjects [3-5]. Bahaa et al. [6] compared the dento-skeletal characteristics of untreated Class I and Class III malocclusions in Malay female subjects. Although these studies included hard tissue evaluation by using cephalometric analysis of Malaysian sub-ethnic groups, these studies had evaluated a specific malocclusion, and did not involve assessment of all types of malocclusions or did not differentiate the gender groups. Recently, a research study of Class I, Class II, and Class III malocclusions in the adult Malaysian population was conducted on hard tissue patterns from lateral cephalograms using the geometric morphometric method [7]. There are previous studies that also used the geometric morphometric method on dental and skeletal patterns, which were conducted on Chilean samples [8] and on Caucasian samples [9]. These studies characterized hard tissue patterns of different skeletal relations derived from the lateral cephalogram based on the geometric morphometric method.

The GMM is the first method that visualizes and compares mean shape and deviation of types of malocclusions as a model or wireframe shape by Principal Component Analysis (PCA). The statistical procedure of PCA is used for reducing many variables into a few dimensions that reflect data variation. PCA explores and visualizes the shape variation of the patterns in wireframe graphs and Principal Component (PC) scores. One of the important advantages of GMM over previous methods is the ability to determine the percentage of shape variances explained by each PC score which allows us to keep just the most important and significant components for further analysis [2,10-12]. The result of this study could be helpful and effective for orthodontists in diagnosis and providing treatment plans and treatment outcomes for patients in Malaysia. To our knowledge, this is the first study that evaluated hard tissue patterns of different skeletal patterns using the geometric morphometric method.

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2 Method

This study was a retrospective study and was conducted at the Faculty of Dentistry, Universiti Teknologi Mara (UiTM) and Faculty of Dentistry, Universiti Sains Islam Malaysia (USIM). Data were taken from UiTM Dental Centre, and USIM Dental Clinic databases, whereas these cases included male and female subjects of the Malay ethnic group in different age groups. This research was approved by the Research and Ethics committee of UiTM and USIM. Ethics approval codes for this study were {REC/09/2020 (MR/245)} from UiTM and (USIM/JKEP/2021/125) from USIM. The inclusion criteria for the patients were subjects aged between 18-40 years old, Malay ethnic group patients, diagnostically acceptable lateral cephalograms, and patients with full permanent dentition (excluding the 3rd molars) [13]. Patients with craniofacial anomalies, patients with a history of orthognathic surgery, history of orthodontic treatment, non-Malay, and patients with mixed dentition were excluded in this study. The sample size was determined using G*Power 3.0.10 software calculation. The sample size for each type of skeletal relation group was 64. In this study, a total of 188 lateral cephalograms of skeletal relations were collected and comprised of 64 patients from Class I, 64 patients from Class II, and 60 patients from Class III skeletal relations with the age range of 18-40 years and comprised of 117 females and 71 males for all analyses.

A total of 10 hard tissue landmarks were applied on lateral cephalograms using tpsDig2 software (Ver.2.31) (Table 1). The MorphoJ software (Version 1.07a) was used for the data and shape analysis.

Table.1. Definition of hard tissue landmarks

No	Landmarks	Definition
1	Nasion (N)	The most anterior point of the frontonasal suture in the middle.
2	Anterior Nasal Spine (ANS)	The tip of bony anterior nasal spine in the middle or median plane.
3	A-point (A)	The deepest point on the curved bony outline between the anterior nasal spine (ANS) and prosthion (Pr).
4	B-point (B)	The deepest midline points on the mandible between infradentale and pogonion.
5	Pogonion (Pog)	The most anterior point on the symphysis of the mandible. (Graber).
6	Menton (Me)	Lower most point of the contour of the chin.
7	Gonion (Go)	The midpoint mediolaterally on the posterior border of each gonial angle.
8	Posterior Nasal Spine (PNS)	The intersection of a continuation of the anterior wall of the pterygopalatine fossa and the floor of the nose.
9	Condylyion (Cd)	Most medial aspect of condyle. Bilateral structure (Lew).
10	Sella (S)	The midpoint of sella turcica or hypophyseal fossa or pituitary fossa.

Firstly, the data underwent landmarking application using tpsDig2 (Ver.2.31) software. The coordinates of the landmarks were exported to MorphoJ (Version 1.07A) for further shape and statistical analysis, followed by shape analyses inclusive of Generalized Procrustes Analysis (GPA), Procrustes ANOVA, Principal component analysis (PCA), Canonical variate analysis (CVA), and Discriminant function analysis (DFA) to determine the differences in morphology and size [14].

3 Result

In the present study, Principal component analysis has displayed the major features of shape variation of hard tissue patterns in Class I, Class II, and Class III skeletal relations. The results of the principal component analysis produced 16 principal components, which indicated that variances existed in 16 different dimensions in the data. In this study, the PC1 to PC5 showed significant differences among the 16 principal components and that cumulatively accounted for almost 80% of total shape variance (Table 2).

Table.2. Eigenvalues, percent variance, and cumulative percent of each principal in hard tissue pattern in different skeletal relations

PC	Eigenvalues	Percent variance %	Cumulative variance %
1	0.00153771	31.235	31.235
2	0.00130909	26.591	57.825
3	0.00054143	10.998	68.823
4	0.00026447	5.372	74.195
5	0.00023989	4.873	79.068
6	0.00022904	4.652	83.720
7	0.00017632	3.581	87.302
8	0.00016299	3.311	90.613
9	0.00012024	2.442	93.055
10	0.00010512	2.135	95.190
11	0.00007556	1.535	96.725
12	0.00007023	1.427	98.152
13	0.00003770	0.766	98.917
14	0.00002367	0.481	99.398
15	0.00002132	0.433	99.831
16	0.00000831	0.169	100.000

The shape changes associated with the PCs were shown in different wireframe graphs for all 16 PCs. In figure 1, the wireframe graphs of PC1 to PC3 showed changes of their mean shape and variations. All 10 hard tissue landmarks displayed some level of variation from the mean. A-point, ANS, B-point, Pogonion, Menton, and Gonion showed the most obvious variance from the mean, while the Condylion, Sella, Nasion, and posterior nasal spine showed moderate or no variance in the specimens. In conclusion, there were different ANB angles in different skeletal relations.

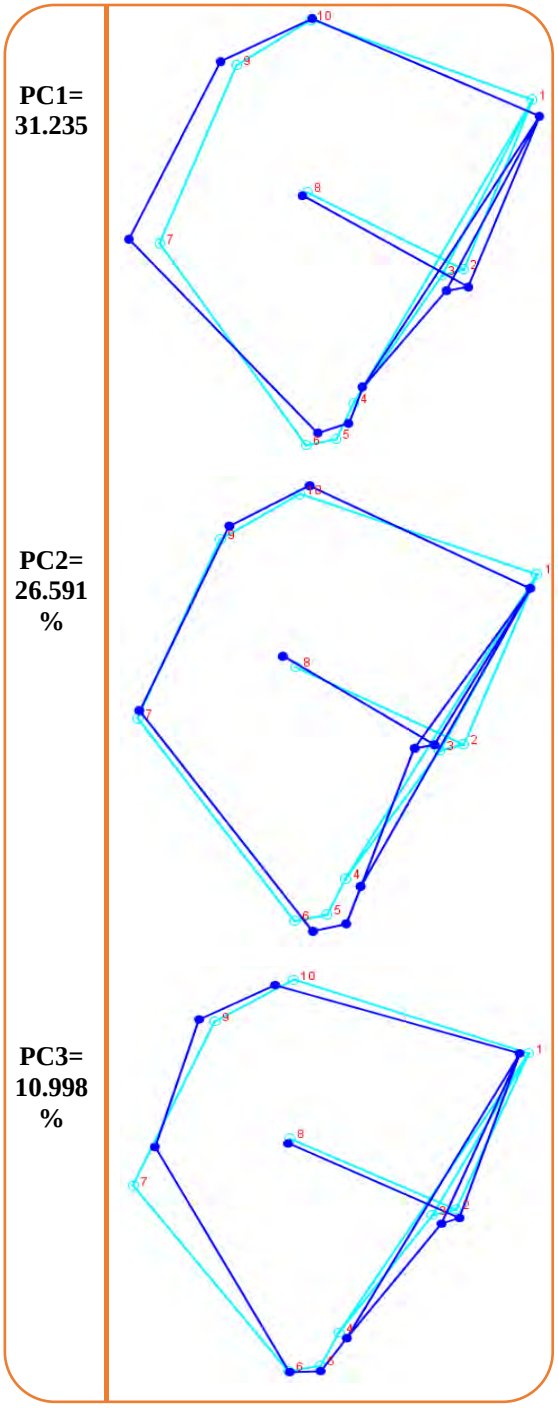

Fig.1. Wireframe graphs of PC1, PC2, and PC3 shapes of hard tissue pattern in different skeletal relations

The Procrustes ANOVA in GMM evaluated the variation among individuals and error measurement in specimens. The result of the Procrustes ANOVA analysis represented the different effects (skeletal relations and gender groups) that were demonstrated for centroid size and shape. In this study, the gender groups showed significant differences in centroid size (p<0.01), while the skeletal relations showed no differences (p>0.01). Procrustes ANOVA showed significant variation of shape for skeletal relations and gender groups (p< 0.0001).

The Canonical variate analysis (CVA) was done to find the differences between three different types of skeletal relations in the shape feature. There was a significant difference between Class I, Class II, and Class III skeletal relations. Class II and Class III exhibited the highest Mahalanobis distance and Procrustes distances (P< 0.0001). It showed significant shape and size differences in hard tissue patterns between Class II and Class III skeletal relations (Figure 2).

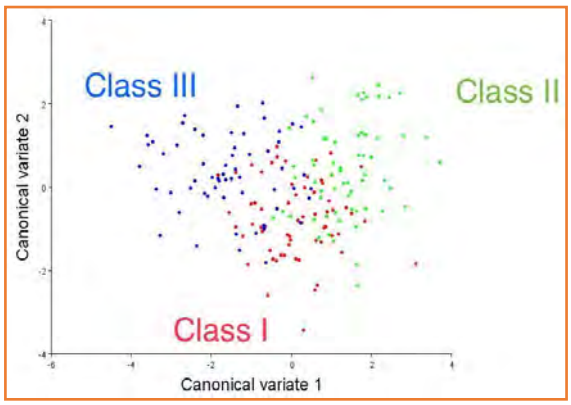

Fig.2. Shape difference between Class I, Class II, and Class III skeletal relations

In CVA, the Mahalanobis distances and procrustes distances showed significant differences in size and shape between gender groups (P< 0.0001) (Figure 3).

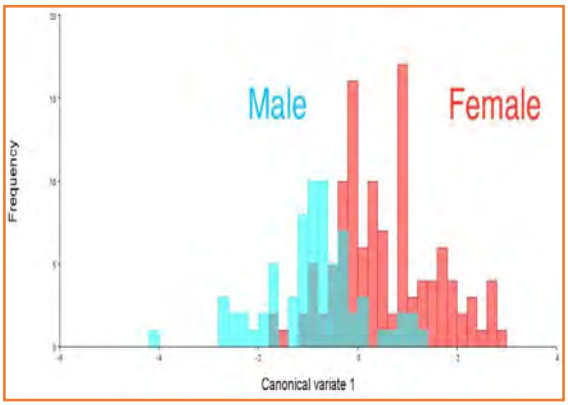

Fig.3. Hard tissue differences between males and females of Class I,II, and III skeletal relations in CVA

The other statistical analysis was done by SPSS (version 26) software. Independent t-test was used to compare the males and females differences. The results of t-test showed, there were significant differences between males and females (p< 0.05) (Table 2).

Table.2. Independent t-test between males and females

Gender	N	Mean	Std. Deviation	Std. Error Mean	P-value
Female	117	7.171137	.3996864	.0369510	.004
Male	71	7.326236	.3552805	.0421640	

Note: **p< 0.05, significant differences

Discriminant function analysis (DFA) in different skeletal relations showed the most classification accuracy for Class II and Class III skeletal relations, with success rates of 93.7% and 86.6 %, and after cross validation, 90.6%. and 83.3% respectively. The classification accuracy was 74.3% for females and 83% for males, while the classification rate from cross validation showed about 66.6% females and 87.3% males were correctly classified.

4 Discussion

The geometric morphometric method is a powerful and useful method for research and in clinical fields, while cephalometric radiography is commonly used for individual diagnosis of malocclusion in orthodontic treatment. Cephalometric analysis has multiple drawbacks which includes being 2-dimensional, linear in nature, and does not allow partitioning of shape and size components. Treatment of skeletal problems is considered complicated in orthodontics. Thus, dentoskeletal diagnosis is an essential step in the process of treatment planning. This study demonstrated shape variations of hard tissue patterns in different skeletal relations.

The GMM is a unique approach for shape measuring since it does not rely on traditional angles or linear distances (size measures). GMM has several advantages over previous methods. One of the advantages of geometric morphometrics over traditional morphometrics is that shape differences may be visualized immediately as computer animations or graphics, and coordinated data in 2D or 3D dimensions can be used for shape variation analysis [15]. GMM has the ability to determine the percentage of shape variances explained by each PC which allows us to keep the most important and significant components for further analysis, and for visualizing shape variations in the wire frame models by PCA [11].

In PCA, different skeletal relations showed 16 PCs or variances. The shape variations for hard patterns in Class I, II, and III skeletal relations were obviously different (Figure 1), and each skeletal relation showed different variances which showed shape differences between Class I, II, and III very clearly. While a previous study on the Malaysian population based on GMM showed 14 PCs [7] and the difference between our result and their result was the number of landmarks that were used in the study.

CVA in the present study showed shape differences between three skeletal relations. The shapes of different skeletal relations had overlapping, as Class I located between Class II and III, the skeletal Class II and III had very negligible overlapping (Figure 2). Also, in CVA, the highest Mahalanobis distances and Procrustes distances were exhibited by Class II and III among skeletal relations and showed significant differences between Class II and III skeletal relations ($P<$ 0.0001). Our findings display similarity and agree to a great extent with previous studies that also used the geometric morphometric method on dental and skeletal relations; Muñoz & Soto [8] found that Class I, II, and III had statistically significant differences in a sagittal maxillo-mandibular relationship. Freudenthaler et al. [9] evaluated different malocclusion groups on Caucasians and reported there were significant differences in mean shape among malocclusion groups where the shape and size of the mandible showed more variations. Woon et al. [7] reported a similar result that there were significant differences of ANB angle in all malocclusion groups. As mentioned in our study, the skeletal Class II and III shapes were very different and had very negligible shapes overlapping in CVA. Moreover, previous different studies also reported significant differences between Class II and III relations [7-9]. The shape and size of the condyle and the glenoid fossa based on morphometric study showed that condylar shape was significantly different between Class II and Class III [16]. The mandibular symphysis morphology had significant differences in skeletal Class II and III and gender groups. Skeletal Class II patients showed greater skeletal symphysis and dentoalveolar lengths, while the Class III skeletal group showed greater vertical symphysis dimension, chin length, and symphysis convexity [17].

DFA in our study in different skeletal relations showed the most classification accuracy for Class II and Class III skeletal relations with success rates of 93.7% and 86.6 %, and after cross validation, 90.6%. and 83.3%, respectively, which was very similar to Woon et al.[7] that reported the Class II and class III showed highest classification accuracy with success rates of 80% and 71% respectively.

5 Conclusion

The geometric morphometric method is a powerful and useful method for research and application in clinical fields, while cephalometric radiography is commonly used for individual diagnosis of malocclusion in orthodontic treatment. In this study, the different skeletal relations had shown different shape and size variations of hard tissue patterns by the geometric morphometric method. Evidently, there were different ANB angles in different skeletal relations.

The results of our study provided novel wireframe models for hard tissue patterns of Class I, II, and III skeletal relations for the Malay ethnic group. The models of wireframe could be used as a guide in diagnosis, and treatment planning by both orthodontists and maxillofacial surgeons. The results can also be used to develop a diagnostic software for hard tissue patterns, which can assist orthodontists and maxillofacial surgeons to achieve a more successful and stable treatment outcome for their patients.

References

1. McIntyre, G. T., & Mossey, P. A. European Journal of Orthodontics, **25**, 3 (2003).
2. Huanca Ghislanzoni, L., Lione, R., Cozza, P., & Franchi, L. Progress in Ortho, **18**, 1 (2017).
3. Purmal, K., & Alam, M. K., & Zam, N. M. Z. International Medical Journal, **20**, 1 (2013).
4. Purmal, K., Alam, M. K., & Zam, N. M. Z. International Medical Journal, **20**, 3 (2013).
5. Purmal, K., Alam, M. K., & Zam, N. M. Z. International Medical Journal, **20**, 2 (2013).
6. Bahaa, O., Khamis, M. F., & Alam, M. K. International Medical Journal, **21**, 3 (2014).
7. Woon, C. K., Jamal, N. A. A., Mohd Noor, M. N. I., Abdullah, S. M., Ibrahim, N. M., Norman, N. H., & Alias, A. Anatomy and Cell Biology, **52**, 4 (2019).
8. Díaz Muñoz, A., & Manríquez Soto, G. International Journal of Odontostomatology, **8**, 1 (2014).
9. Freudenthaler, J., Čelar, A., Ritt, C., & Mitteröcker, P. Journal of Orofacial Orthopedics, **78**, 1 (2017).
10. Bookstein, F. L. Medical Images Analysis, **1**, 3 (1997).
11. Mitteroecker, P., & Gunz, P. Evolutionary Biology, **36**, 2 (2009).

12. Webster, M., & Sheets, H. D. *The* Paleontological Society Papers, **16**, (2010).
13. Taju, W., Sherriff, M., Bister, D., & Shah, S. Original article Association between severity of hypodontia and cephalometric skeletal patterns : a retrospective study, European Journal of Orthodontics, **40**,2 (2018).
14. Klingenberg, C. P., & Montero, L. R. Distances and directions in multidimensional shape spaces: Implications for morphometric applications. Systematic Biology, **54**,4 (2005).
15. James Rohlf, F., & Marcus, L. F. Trends in Ecology and Evolution, **8**,4 (1993).
16. Katsavrias, E. G., & Halazonetis, D. J. American Journal of Orthodontics and Dentofacial Orthopedics, **128**,3 (2005).
17. Linjawi, A. I., Afify, A. R., Baeshen, H. A., Birkhed, D., & Zawawi, K. H. Saudi Journal of Biological Sciences, **28,**1 (2021).

Salivary And Urinary Nickel Level Among Healthy Malay Population: A Preliminary Report

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Abstract. Nickel is one of the common trace metal elements used in manufacturing industries. It has been documented that the effect of low amount and long-term exposure to nickel is cytotoxic, genotoxic, and carcinogenic. Nickel bio-monitoring has been done by various countries to monitor nickel level. However, the nickel level varies significantly within and between populations and geographical regions. As a result, there is limited information on established baseline nickel level in our population which leads to the difficulty for comparison during nickel exposure. The objective of this study was to determine the baseline nickel level in saliva and urine samples for the healthy Malay population. Fourteen healthy Malay subjects were recruited in this study. Unstimulated whole saliva and urine samples were collected in the morning and stored at -20 ºC. All the samples were subjected to Inductively Coupled Plasma Optical Mass Spectrometry (ICP-MS). Statistical analysis was performed using IBM SPSS Version 27. The results indicate that the nickel level in urine was higher compared to saliva. The baseline nickel level demonstrated in saliva was 4.80 ppb (95% CI: 2.23, 7.38) and in urine was 5.88 ppb (95% CI: 3.49, 8.27). Our study is a preliminary report of the baseline salivary and urinary nickel level among healthy Malay population and can be applied for further health-related and population-based studies to nickel.

1 Introduction

Nickel is the twenty-fourth most abundant metal element found in the earth's crust, and extensively distributed in the environment, air, water, and soil. Trace elements such as nickel are essential components in biological structures of cells, and have been reported to play important roles in human metabolic and physiological processes [1]. Nickel is one the common trace metals used in manufacturing industries such as production of coins, jewellery, nickel-cadmium batteries, and as a catalyst in food and chemical industries [2]. Nickel in metal alloys were used in dentistry as well due to their exceptional mechanical properties [3,4]. Long-term exposure to nickel, even in small amounts, has been shown to be cytotoxic, genotoxic, and carcinogenic. This has led to numerous research conducted worlwide to determine the trace element levels in different biological samples [5–8]. Nevertheless, the nickel level can vary significantly within and between populations and geographical regions, depending on dietary habits, genetic variation, lifestyle and occupational environment. Two studies carried out in France used whole blood to analyse baseline nickel level using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) technique but reported different results [9,10]. Moreover, with similar analytical technique and sample used, the documented baseline nickel level in saliva were heterogenous [11,12]. Other studies which used blood serum to analyse the baseline nickel level conducted their experiment using different methods and reported different values [13,14].

Furthermore, published reports indicated that even with the same analytical technique used, a standardised level of nickel baseline has not been confirmed. Most other studies used ICP-MS due to its lowest detection limit and highly sensitive analytical technique for the determination of trace elements of clinical interest such as nickel from biological samples [9,13,15]. Different types of biological samples were used in the past such as blood and hair. However, these types of samples are invasive, complex sample preparation and technique sensitive [15,16]. In this study, the use of saliva and urine have several advantages such as non-invasive collection, less discomfort, straightforward sample collection and easy to store and transport. In addition, salivary and urinary mechanisms play an important role in excreting nickel from the body and can reflect the baseline nickel level in human [17,18].

The baseline nickel level reported varies between previous studies. These contributes to the wide variability of baseline nickel level in human [15,19]. As a result, there is little information on established baseline nickel level of nickel in Malay population and this leads to the difficulty for comparison during nickel exposure. This study aims to determine the baseline nickel level in saliva and urine samples among healthy Malay population.

2 Materials and Methods

This prospective study was conducted at the Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai. Buloh Campus. Ethical approval was granted from UiTM Research Ethics Committee on 28th March 2019 (reference number: 600-IRMI (5/1/6)). Fourteen voluntary subjects were conveniently selected based on stringent inclusion and exclusion criteria. Subjects must be in permanent dentition and have no history of orthodontic treatment. Subjects who have any systemic illnesses, under long-term drug therapy, presence of amalgam restorations or oral and body prostheses, presence of tongue or lip piercing, smoker or had betel nut chewing habit were excluded.

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2.1 Sample collection

All sample collections were done in the morning. Subjects were instructed to rinse their mouth thoroughly before saliva collection, and to minimise their orofacial movements. 5 ml of unstimulated whole saliva was collected using passive drooling method into a 50 ml sterile plastic centrifuge tube. For urine collection, subjects were provided with a 50 ml sample collection bottle, and were asked to collect urine after discarding the first flush. Instructions were given not to contaminate the collection bottle by wiping or rinsing the internal surface of the bottles. Each sample was then stored immediately at -20 ºC freezer until further analysis.

2.2 Sample analysis

Inductively Coupled Plasma Mass Spectrometry (ELAN® ICP-MS 9000 Perkin Elmer) was used to determine the nickel level in the collected sample. For each sample, the test was repeated three times, and mean reading was taken as the final value of nickel level. All results were detected by ELAN® ICP-MS Instrument Control Software version 3.4, and presented as mean nickel level.

2.3 Statistical analysis

Results obtained were subjected to statistical analysis using Statistical Software for Social Science (IBM SPSS Statistics, Version 27). The level of statistical significance was set at $p<0.05$. Descriptive analysis was used to analyse socio-demographic data inclusive of age and gender.

3 Results

The results of this study showed that the mean (SD) subjects' age was 31.27 (3.74) years old, and 71% (n=10) were female. All the included subjects were Malays. Data in Table 1 showed the proportion of female subjects were more than two times higher than male. However, there was no difference of nickel level observed between genders ($p>0.05$).

Table 1. Frequency analysis based on gender.

Gender	Frequency	Percent
Male	4	28.9
Female	10	71.1
Total	14	100.0

As shown in Table 2, the mean nickel level exhibited in saliva was 4.80 ppb (95% CI: 2.23, 7.38) and in urine was 5.88 ppb (95% CI: 3.49, 8.27). The results also showed that the nickel level in urine was higher compared to saliva.

Table 2. Baseline nickel level in saliva and urine among Malay population.

Samples	Baseline nickel level (95% CI)
Saliva	4.80 ppb (2.23, 7.38)
Urine	5.88 ppb (3.49, 8.27)

4 Discussion

The International Agency for Research on Cancer (IARC) has identified nickel, and its compound as human carcinogens, and the toxicity depends on the physico-chemical characteristics, the dosage, route of exposure and solubility of the nickel compounds in humans [20,21]. It is well documented that nickel induced changes in tumour suppressor p53 gene, cell apoptosis and cancer risks. Other than that, nickel can cause a variety of health effects, such as contact dermatitis, cardiovascular disease, asthma, lung fibrosis, and respiratory tract cancer.

The baseline level of nickel in a population is essential for nutritional and clinical monitoring of potential exposures. Due to increased exposure to trace elements including nickel element, there have been several studies to establish reference ranges in France, Australia, Pakistan and Iran [9,11,12,15].

Previous studies strongly emphasised that the evaluation of the baseline nickel level should be conducted in different populations, as the levels may vary significantly between geographical regions, depending on dietary habits, genetic variation, lifestyle and occupational environment. Thus, these factors support the need to evaluate the nickel level among the Malaysian population as reported in this study [15,19]. To the best of our knowledge, this study represents the first preliminary report of the baseline level of salivary and urinary nickel levels among the Malay population due to the small number of subjects. In this present study, we observed that the mean salivary and urinary nickel level was 4.80 ppb (95% CI: 2.23, 7.38) and 5.88 ppb (95% CI: 3.49, 8.27), respectively. There has been a study involving Malaysian population using blood serum and the reported mean nickel level was 5.12 ppb [13]. These reported baseline nickel values for Malaysian population are similar but consideration must be taken that different biological samples were used. We believe our baseline nickel level in saliva and urine can be utilised in future research involving nickel element among Malay population.

In this study, saliva and urine were collected as biological samples to evaluate the nickel level. Human saliva composition was proven by numerous past studies that it can provide information to many clinical, experimental and diagnostic protocols [22,23] while urine has the ability to reflect systemic nickel levels in human due to its metabolic route is through the kidneys [6,18]. Both saliva and urine are considered more tolerable to subjects because they involved non-invasive techniques, accessible, convenient and require simpler handling and sample preparation [24–26].

Khlifi *et al*. reported that there was no significant difference in blood nickel level for men and women [27]. This is in line with our results where we found that there was no difference of nickel level observed between genders. However, our subjects consisted of 71% female. In contrast, Gil et al. have found higher blood and saliva nickel levels in women [28].

It is noteworthy to mention that different methods of sample preparation and analytical technique used will provide heterogenous results. In this study, ICP-MS was used to analyse the level of nickel in the saliva and urine samples, which was similar to recent studies [5,8,29]. ICP-MS is a robust and widely used technique, have low detection limit and highly sensitive for nickel analysis [30].

The baseline nickel level in saliva and urine for Malay population found in this study was 4.80 ppb (95% CI: 2.23, 7.38) and 5.88 ppb (95% CI: 3.49, 8.27), respectively. A future population-based study with larger sample size using different biological samples is suggested.

5 Conclusion

This is the first preliminary study that reports the nickel level in saliva and urine among Malay subjects. Results showed that the baseline level of nickel in saliva was 4.80 ppb (95% CI: 2.23, 7.38) and in urine was 5.88 ppb (95% CI: 3.49, 8.27). We believe our study can be applied for the determination of nickel level in different study as for example long term use of orthodontic appliance. It could be useful in future research that requires a baseline nickel level. Additional studies are required to establish the nickel baseline level for a larger Malaysian population using different biological samples.

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References

1. Gumienna-Kontecka, E., Rowińska-Zyrek, M. & Łuczkowski, M. The Role of Trace Elements in Living Organisms. *Recent Adv. Trace Elem.* 177–206 (2017).
2. Patra, A., Dutta, A., Jatav, S. S., Choudhary, S. & Chattopadhyay, A. Horizon of nickel as essential to toxic element. *Int. J. Chem. Stud.* **7**, 1185–1191 (2019).
3. Givan, D. A. *Precious metal alloys for dental applications. Precious Metals for Biomedical Applications* (Woodhead Publishing Limited, 2014).
4. Proffit, W. R., Fields Jr, H. W. & Sarver, D. M. *Contemporary orthodontics*. (Elsevier Health Sciences, 2007).
5. Moghadam, M. G. *et al.* Biomonitorization of metal ions in the serum of Iranian patients treated with fixed orthodontic appliances in comparison with controls in eastern Iran. *Environ. Sci. Pollut. Res.* **26**, 33373–33386 (2019).
6. Guo, Y., Liu, Y., Zheng, Y., An, N. & Bai, L. Urinary nickel ion evaluation of adolescents during the initial period of orthodontic fixed treatment. *J. Hard Tissue Biol.* **23**, 295–302 (2014).
7. Mudjari, S., Achmad, H., Erwansyah, E., Sabir, A. & Riuwpassa, I. E. Analysis of Nickel and chromium levels in the gingival crevicular fluid and hair of patients treated with fixed orthodontic appliances: A longitudinal study. *J. Int. Dent. Med. Res.* **12**, 151–155 (2019).
8. Dwivedi, A., Tikku, T., Khanna, R., Maurya, R., Verma, G. & Murthy, R. Release of nickel and chromium ions in the saliva of patients with fixed orthodontic appliance: An in-vivo study. *Natl. J. Maxillofac. Surg.* **6**, 62 (2015).
9. Nisse, C., Tagne-Fotso, R., Howsam, M., Richeval, C., Labat, L. & Leroyer, A. Blood and urinary levels of metals and metalloids in the general adult population of Northern France: The IMEPOGE study, 2008–2010. *Int. J. Hyg. Environ. Health* **220**, 341–363 (2017).
10. Goullé, J. P. *et al.* Metal and metalloid multi-elementary ICP-MS validation in whole blood, plasma, urine and hair: Reference values. *Forensic Sci. Int.* **153**, 39–44 (2005).
11. Amini, F., Jafari, A., Amini, P. & Sepasi, S. Metal ion release from fixed orthodontic appliances - An in vivo study. *Eur. J. Orthod.* **34**, 126–130 (2012).
12. Butt, M., Mengal, N. & Ahmed, M. A Comparison of Nickel Ion Release In Saliva Between Orthodontic and Non-Orthodontic Patients. *Pakistan Armed Forces Med. J.* **70**, 328–332 (2020).
13. Mohammed Nawi, A., Chin, S. F. & Jamal, R. Simultaneous analysis of 25 trace elements in micro volume of human serum by inductively coupled plasma mass spectrometry (ICP-MS). *Pract. Lab. Med.* **18**, e00142 (2020).
14. Satija, A., Sidhu, M. S., Grover, S., Malik, V., Yadav, P. & Diwakar, R. Evaluation of Salivary and Serum Concentration of Nickel and Chromium Ions in Orthodontic Patients and their Possible Influence on Hepatic Enzymes: An in vivo Study. *J. Indian Orthod. Soc.* **48**, 518–524 (2014).
15. Komarova, T., McKeating, D., Perkins, A. V. & Tinggi, U. Trace element analysis in whole blood and plasma for reference levels in a selected queensland population, Australia. *Int. J. Environ. Res. Public Health* **18**, 1–15 (2021).
16. Imani, M. M., Delavarian, M., Arab, S. & Sadeghi, M. Assessment of hair nickel and chromium levels in patients with a fixed orthodontic appliance: A systematic review and meta-analysis of case-control studies. *Postep. dermatologii i Alergol.* **36**, 261–266 (2019).
17. Daniel, F. I., Feller, G. V., Krieger, H. A. de C., Grando, L. J. & Dos Santos, C. R. Correlation Between Salivary and Blood Nickel Concentration in Smokers and Nonsmokers. *Biomed. J. Sci. Tech. Res.* **9**, 6866–6870 (2018).
18. Holm, A. & Aabenhus, R. Urine sampling techniques in symptomatic primary-care patients: A diagnostic accuracy review. *BMC Fam. Pract.* **17**, 1–9 (2016).
19. Khaneh Masjedi, M., Haghighat Jahromi, N., Niknam, O., Hormozi, E. & Rakhshan, V. Effects of fixed orthodontic treatment using conventional (two-piece) versus metal injection moulding brackets on hair nickel and chromium levels: a

double-blind randomized clinical trial. *Eur. J. Orthod.* **39**, 17–24 (2017).
20. Genchi, G., Carocci, A., Lauria, G., Sinicropi, M. S. & Catalano, A. Nickel: Human health and environmental toxicology. *Int. J. Environ. Res. Public Health* **17**, (2020).
21. IARC (International Agency for Research on Cancer). Agents Classified by the IARC Monographs, Volumes 1-121. *IARC Monogr. Eval. Carcinog. Risks to Humans* **1**–**123**, 1–17 (2018).
22. Michalke, B., Rossbach, B., Göen, T., Schäferhenrich, A. & Scherer, G. Saliva as a matrix for human biomonitoring in occupational and environmental medicine. *Int. Arch. Occup. Environ. Health* **88**, 1–44 (2014).
23. Pfaffe, T., Cooper-White, J., Beyerlein, P., Kostner, K. & Punyadeera, C. Diagnostic potential of saliva: Current state and future applications. *Clin. Chem.* **57**, 675–687 (2011).
24. Jayachandran, S. Review of salivary diagnostics – A current scenario. *J. Indian Acad. Oral Med. Radiol.* **32**, 205 (2020).
25. Pathiyil, V. & Udayasankar, R. Salivary Diagnostics. in *Saliva and Salivary Diagnostics* vol. 37 562–570 (IntechOpen, 2019).
26. Wang, J., Schipper, H. M., Velly, A. M., Mohit, S. & Gornitsky, M. Salivary biomarkers of oxidative stress: A critical review. *Free Radic. Biol. Med.* **85**, 95–104 (2015).
27. Khlifi, R. *et al.* Biomonitoring of cadmium, chromium, nickel and arsenic in general population living near mining and active industrial areas in Southern Tunisia. *Environ. Monit. Assess.* **186**, 761–779 (2014).
28. Gil, F. *et al.* Biomonitorization of cadmium, chromium, manganese, nickel and lead in whole blood, urine, axillary hair and saliva in an occupationally exposed population. *Sci. Total Environ.* **409**, 1172–1180 (2011).
29. Nayak, R. S., Khanna, B., Pasha, A., Vinay, K., Narayan, A. & Chaitra, K. Evaluation of Nickel and Chromium Ion Release During Fixed Orthodontic Treatment Using Inductively Coupled Plasma-Mass Spectrometer: An In Vivo Study. *J. Int. oral Heal. JIOH* (2015).
30. Enamorado-Báez, S. M., Abril, J. M. & Gómez-Guzmán, J. M. Determination of 25 Trace Element Concentrations in Biological Reference Materials by ICP-MS following Different Microwave-Assisted Acid Digestion Methods Based on Scaling Masses of Digested Samples. *ISRN Anal. Chem.* **2013**, 1–14 (2013).

Osteotransductive Nature of Calcium Phosphate Cement as 'Barrier-Graft' to Treat Human Periodontal Intraosseous Defects

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Abstract. A material should possess properties of osteoconductivity, allow selective cell repopulation and should be resorbable during the healing period to be termed as 'barrier-graft'. The virtues of calcium phosphate cement (CPC) seem to fit the barrier-graft concept. The study aimed to evaluate the regenerative efficacy of calcium phosphate in periodontal intraosseous defects, both clinically, and radiographically. A study was conducted on 15 subjects diagnosed with periodontitis for 2 years where clinico-radiographic parameters were recorded at baseline, third, sixth and ninth month. All surgical sites healed uneventfully after the initial surgery. During follow-up, no clinical signs of inflammation, infection, or swelling were evident, indicating that graft materials appeared to be well tolerated by the periodontal tissues. Mean radiographic defect fill of 64% (2.33±0.5 mm) was observed in nine months. The difference for mean of clinical attachment level (CAL) between baseline and ninth month was 3.47±0.36 mm, and probing pocket depth reduction of 4.21±1.18 mm were recorded. A significant decrease in plaque and gingival index was observed. Soft-tissue measurements were appended by postoperative radiographs. The osteotransductive nature, its commendable properties of barrier-graft and the putty nature of the cement make it a suitable candidate for periodontal intraosseous regeneration

1 Introduction

The reconstruction of the lost periodontium has been a challenge in periodontics but it has been made possible with new treatment modalities. The underlying theories of grafting and guided tissue regeneration imply that a material that amalgamates the properties of an osteoconductive graft and a resorbable barrier (i.e., a "barrier-graft") can significantly improve the periodontal regeneration outcomes. A **barrier-graft** material should have properties of osteoconductivity to promote the growth of new bone, should allow selective cell repopulation and should be resorbable during the healing period. The virtues of calcium phosphate cement (CPC) seem to fit the barrier-graft concept.[1 intra]

CPCs are second generation of hydroxyapatite bone substitutes, developed as a moldable treatment modality that chemically bonds to the host bone, restores contour, and augments the biomechanical properties of the injured or reconstructed region. This is a two-component cement having a powder part containing calcium and phosphorous ingredients, and a liquid part consisting of aqueous solution of phosphates, which produce a self-setting putty or paste. The cement mass undergoes isothermal setting and gets converted to hydroxyapatite [$Ca_{10}(PO_4)_8(OH)_2$], the basic inorganic component of bone and teeth. The moldability of CPCs gives them an edge over hydroxyapatite ceramics in skeletal repair. Excellent bio-compatibility and osteotransductivity (i.e. active resorption at bony sites, facilitates bone remodeling) are its additional advantages.[2] CPC can create a scaffold structure with load capacities suitable for the regeneration of a bone defect.[3]

A notable feature of CPC material is osteotransductivity (i.e., resorption of the cement graft in tune with new bone formation), which is absent in other alloplastic materials.[4,5] The CPC mass consists of submicron-sized hydroxyapatite with weaker interparticle boundaries. It is chemically stable in body fluid, still osteoclast cells can act upon and resorb the hydroxyapatite particles easily. During the resorption progress, the osteoblast cells proceed with forming new bone in the space between host bone and the material. Eventually, this new bone is converted to lamellar bone. This process will continue till the whole material is resorbed, and the defect is repaired completely.[3,4]

The study aimed to evaluate the regenerative efficacy of the calcium phosphate in periodontal intraosseous defects, both clinically and radiographically.

2 Study Method

2.1 Patient Selection

The approval for the study was given by the institutional ethical committee (AME/2012/06/01). 15 systemically healthy subjects diagnosed with periodontitis, between 25-55 years, with radiographic evidence of one or more

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vertical defects (two or three-walled) and pocket depth of 6 mm or more at experimental site were enrolled.

Medical compromised patients, those on therapeutic or antibiotic regimen that could decrease the probability of soft tissue or bone healing, pregnant or lactating women, non-vital or root canal treated teeth, 3rd molars, one walled defects, patients with parafunctional habits i.e. bruxism, and who had periodontal surgery in the last 6 months, allergic to drugs and materials were excluded.

2. 1.1 Clinical Parameters

The graft material was assessed based on the evaluation of selected clinical parameters, soft and hard tissue measurements of the experimental defect. The clinical parameters i.e probing pocket depth (PPD), clinical attachment level (CAL), gingival recession, plaque index, gingival index were recorded by a single investigator just before surgery as baseline data, and then were re-evaluated at third, sixth and ninth months post surgery. In the stent, vertical grooving allowed proper alignment of the probe and ensured reliability and reproducibility for future comparisons. (Fig. 1a).

2.1.2 *Radiographic Parameters*

Depth of intrabony defect was assessed using periapical radiographs with attached X- ray grid, standardized by means of paralleling technique. (Fig. 1b)

Fig. 1a. Clinical parameter parameter recorded

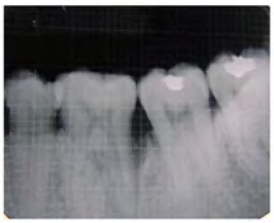

Fig. 1 b Radiological recorded.

2.2 Study Protocol

Following initial examination and treatment planning, all patients received Phase 1 therapy. Adjunctive chemical plaque control (chlorhexidine rinse 0.2%) twice daily was advised. After 2 weeks, all patients underwent re-evaluation examination to assess the level of plaque control, and all patients maintained an acceptable level of plaque control.

2.3 Surgical Protocol

Surgical procedure was performed under local anaesthesia. It included intrasulcular incisions, full -thickness flap elevation, meticulous debridement and root planing, defect filling with CPC, flap repositioning. (Fig. 2-6). Pre-suturing was done before placement of graft material to prevent graft dislodgement by insertion of the suture needle. Overfilling of the defect was avoided to ensure adequate closure of the flap. 3-0 silk sutures was used for suturing. All patients received postoperative instructions. (Fig 2-6)

Fig 2. Incision

Fig 3. Defect after reflection

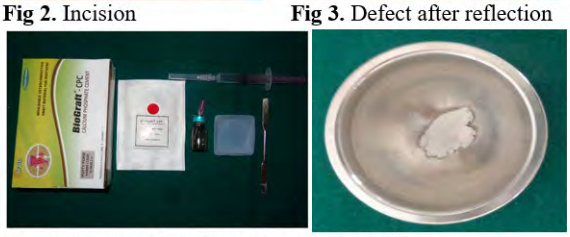

Fig 4. Calcium Phosphate cement in putty form

Fig 5. Graft placed

Fig 6 Sutures placed

Fig. 2-6 Step-by-Step Surgical Procedure

2.4 Statistical Analysis

The statistical analysis was carried out using Statistical Package for Social Sciences version 23 (SPSS ver 23). All quantitative variables were evaluated using measures of central location (mean) and dispersion (standard deviation). For analysing each of the clinical and radiological parameters through the baseline and follow-up period, Kruskal-Wallis Test was used. For intragroup comparison (time-related comparison), Wilcoxon Signed Rank Test was used. Statistically, data was considered significant if the P value was <0.05.

3 Results

The study comprised of 15 subjects (5 males and 10 females) with angular defects, in the age range of 26-52 years with periodontitis. All surgical sites healed uneventfully after initial surgery. During follow-up, no clinical signs of inflammation, infection or swelling were evident, indicating that graft materials appeared to be well tolerated by the periodontal tissues.

The difference between means for the PPD reduction, and the CAL between baseline and ninth month was 4.21±1.18 mm and 3.47±0.36 mm, respectively. Within the group, the intra-group comparisons were done. There was a significant decrease in the probing pocket depth and clinical attachment level at each successive recall visit at 3, 6 and 9 months. (Fig 7, 9, 11) (Table for PPD 1, 2 and table for CAL 3, 4).

There was statistically significant decrease in plaque index and gingival index. No gingival recession was present at the baseline and follow up visits. There was a statistically significant decrease in radiographic infrabony defect from CEJ to the base of the defect in the ninth month when compared to the baseline. The difference for mean between baseline and ninth month was 2.33±0.38 mm, which showed that there was a significant bone fill. (Fig. 8, 10, 12) (Table 5, 6)

Fig.7 PPD-3rd month

Fig 8.Defect fill-3rd month

Fig.9 PPD-6th month

Fig 10.Defect fill- 6th month

Fig.11 PPD-9th month

Fig 12. Defect fill-9th month

Table 1 & 2: Comparison of PPD values - baseline to 9th month & intragroup comparison of PPD

COMPARISON OF PROBING POCKET DEPTH VALUES FROM BASELINE TO 9TH MONTH

Time duration	Min	Max	Mean	SD	Chi-square value	P VALUE*
At baseline	6.33	8	6.33	0.82	44.986	0.000*
At 3rd month	3.53	4	3.53	0.52		
At 6th month	3.07	4	3.07	0.46		
At 9th month	2.8	3	2.80	0.41		

Statistical Analysis: Kruskal-Wallis Test * Statistically significant (if P<0.05)

INTRA GROUP COMPARISON OF THE PROBING POCKET DEPTH AT BASELINE, 3RD MONTH, 6TH MONTH AND 9TH MONTH

Time duration	Mean	SD	Difference Mean±SD	Z value	P value
At baseline	6.33	0.82	2.80±0.30	3.460	0.001*
At 3rd month	3.53	0.52			
At baseline	6.33	0.82	3.26±0.36	3.446	0.001*
At 6th month	3.07	0.46			
At baseline	6.33	0.82	3.53±0.41	3.493	0.000*
At 9th month	2.80	0.41			
At 3rd month	3.53	0.52	0.46±0.06	2.646	0.008*
At 6th month	3.07	0.46			
At 3rd month	3.53	0.52	0.73±0.11	3.317	0.001*
At 9th month	2.80	0.41			
At 6th month	3.07	0.46	0.27±0.05	2.000	0.046*
At 9th month	2.80	0.41			

Statistical Analysis: Wilcoxon Signed Rank Test * Statistically significant (if P<0.05)

Table 3 & 4: Comparison of CAL - baseline to 9th month & intragroup comparison of CAL

COMPARISON OF CLINICAL ATTACHMENT LEVEL FROM BASELINE TO 9TH MONTH

Time duration	Min	Max	Mean	SD	Chi-square value	P VALUE*
At baseline	5.8	8	5.8	1.08	37.986	0.000*
At 3rd month	3.07	4	3.07	0.7		
At 6th month	2.6	4	2.60	0.83		
At 9th month	2.33	3	2.33	0.72		

Statistical Analysis: Kruskal-Wallis Test * Statistically significant (if P<0.05)

INTRA GROUP COMPARISON OF THE CLINICAL ATTACHMENT LEVEL AT BASELINE, 3RD MONTH, 6TH MONTH AND 9TH MONTH

Time duration	Mean	SD	Difference Mean±SD	Z value	P value
At baseline	5.80	1.08	2.73±0.38	3.464	0.001*
At 3rd month	3.07	0.70			
At baseline	5.80	1.08	3.20±0.25	3.443	0.001*
At 6th month	2.60	0.83			
At baseline	5.80	1.08	3.47±0.36	3.508	0.000*
At 9th month	2.33	0.72			
At 3rd month	3.07	0.70	0.47±0.13	2.646	0.008*
At 6th month	2.60	0.83			
At 3rd month	3.07	0.70	0.74±0.02	3.317	0.001*
At 9th month	2.33	0.72			
At 6th month	2.60	0.83	0.27±0.11	2.000	0.046*
At 9th month	2.33	0.72			

Statistical Analysis: Wilcoxon Signed Rank Test * Statistically significant (if P<0.05)

Table 5 &6: Comparison of radiographic defect fill - baseline to ninth month & intragroup comparison.

COMPARISON OF RADIOGRAPHIC INFRABONY DEFECT DEPTH FROM BASE LINE TO 9TH MONTH

Time duration	Min	Max	Mean	SD	Chi-square value	P value*
At baseline	4.00	8.00	5.70	1.19	24.065	0.000*
At 3rd month	2.00	6.00	4.10	1.00		
At 6th month	2.00	5.00	3.73	1.07		
At 9th month	2.00	5.00	3.37	0.95		

Statistical Analysis: Kruskal-Wallis Test * Statistically significant (if P<0.05)

INTRA GROUP COMPARISON OF THE RADIOGRAPHIC INFRABONY DEFECT AT BASELINE AND 9TH MONTH

Time duration	Mean	SD	Difference Mean±SD	Z value	P value*
At baseline	5.70	1.19	2.33±0.24	3.45	0.000*
At 9th month	3.37	0.95			

Statistical Analysis: Wilcoxon Signed Rank Test * Statistically significant (if P<0.05)

4 Discussion

The development of biological-alloplastic osteoconductive bone reconstruction materials aims at bony defect regeneration, not only in physical but also in biological terms.[3] Trombelli advocates the use of specific biomaterials over open flap debridement (OFD) in improving CAL in intraosseous defects.[4]

CPC is emerging as a promising alloplastic material for bone regeneration, with its ability to harden in vivo by a non-exothermic reaction that forms a viscous mouldable paste that chemically bonds to the bone. Hydroxyapatite with a chemical composition same as living bone has been observed at two weeks thereby accelerates the bone healing process.[3,4] Mitogenic events are promoted by increasing mesenchymal cell contact. Resorption of the cement at 3 to 36 months surface parallels bone growth.[5]

Though various methods exist to assess the therapeutic results, the true endpoint can only be assessed by histological examination. However, due to ethical reasons and patient concerns, re-entry procedures and histological analyses are not possible in routine clinical trials. Therefore, **clinical attachment level** has become widely accepted as the primary clinical endpoint of regenerative attempts around natural teeth. **Radiographic methods** accurately reflect changes in bone levels, and this may obviate the need for direct clinical evaluation of bone changes. It has been reported that both the radiographic interpretations and changes in measurement of clinical attachment level over time are reliable in assessing outcomes of infrabony defect treatment.[7]

The present study aimed to evaluate the efficacy of **CPC** in intraosseous periodontal defects. The **lack of adverse reactions** such as allergies, abscesses or rejection of the implanted material indicates that it was well tolerated. These findings were in accordance with studies done by researchers in whose studies, the material did not evoke any inflammatory response, but favoured new bone formation comparable with autologous bone grafting.[8]

A randomised controlled trial showed that there was a significant reduction in the pocket depth in the CPC group of 3.2 ± 1.3mm in the 3rd month to 3.4±1.2 mm in the 12th month and a clinical attachment gain of 1.8 ±1.2 mm in the 3rd month to 2.3±1.0 mm in the 12th month.[9] A study done to evaluate the efficacy of calcium phosphate in periodontal intraosseous defects showed that the pocket depth reduction, and the mean clinical attachment level gain at 12 months are 6.20 ± 1.8 mm and 5.80 ± 2.02 mm, respectively.[1] The present study was in accordance with the above studies which showed CPC had significant gain in clinical attachment with difference in CAL between baseline & ninth month being 3.47±0.36 mm and significant PPD reduction of 4.21±1.18mm. The difference for meanS between baseline and ninth month was 2.33±0.38 mm, which showed that there was a significant bone fill. A previous systematic review and meta-analysis conducted on the chemical polymorph of CPC showed bone regeneration to be superior to that with debridement alone but showed comparable results to other bone graft materials in terms of pocket depth reduction, clinical attachment level gain, and bone fill.[10]

In accordance to previous studies, **handling properties of CPC** make it a better choice. Upon mixing and working, the material forms a mouldable and cohesive putty which facilitates the accuracy of placement.[2, 3]

The results of the present study showed that calcium phosphate cement improved periodontal regeneration when probing pocket depth, clinical attachment level gain and radiographic defect fill were evaluated as parameters.

5 Conclusion

CPC resulted in statistically significant improvements in clinical parameters and radiographic defect measurements with no adverse effects reported at surgical sites as it was tolerated well. Studies with critically enhanced protocols, bigger sample size and histologic evidence as a criteria for periodontal regeneration are further required.

References

1. Rajesh JB, Nandakumar K, Varma HK, Komath M. Calcium phosphate cement as a “barrier-graft” for the treatment of human periodontal intraosseous defects Indian J Dent Res 2009; 20(4): 471-9.
2. Chow LC. Calcium phosphate materials: Reactor response. Adv Dent Res 1988;2:181-4.
3. Hettich G et al. Calcium Phosphate Bone Graft Substitutes with High Mechanical Load Capacity and High Degree of Interconnecting Porosity. Materials (Basel). 2019 Oct 23;12(21):3471.
4. Bayerlein T, Mundt T, Mack F, Bienengräber V, Proff P, Gedrange T. Bone graft substitutes in periodontal and peri-implant bone regeneration. Folia Morphol (Warsz). 2006;65(1):66-9.
5. Dasgupta S. Prospective of Calcium Phosphate Cements forBone Regeneration in Relation to Physicochemical, Mechanical and Biological Properties. SM J Orthop. 2018; 4(1): 1066.
6. Trombelli L, Heitz-Mayfield L, Needleman I, Moles D, Scabbia A. A systematic review of graft materials and biological agents for periodontal intraosseous defects. J Clin Periodontol 2002;29:117–35.
7. Singh MP, Mehta DS. Clinical evaluation of biogran as a graft material in the treatment of periodontal defects. J Indian Soc Periodontol 2000;3(2):69-72.
8. Aral A, Yalcin S, Karabuda ZC, Anil A, Mutlu Z, Jansen JA. Injectable calcium phosphate cement as a graft material for maxillary sinus augmentation: An experimental pilot study. Clin Oral Impl Res 2008;19:612–7.
9. Gauthier O, Boix D, Grimandi G, Aguado E, Bouler JM, Weiss P, et al. A new injectable calcuium phosphate biomaterial for immediate bone filling of extraction sockets. A preliminary study in dogs. J Periodontol 1999;70:375-8.
10. Jasser RA, AlSubaie A, AlShehri F. Effectiveness of beta-tricalcium phosphate in comparison with other materials in treating periodontal infra-bony defects around natural teeth: a systematic review and meta-analysis. BMC Oral Health. 2021 Apr 29;21(1):219.

CONFERENCE ABSTRACTS
POSTGRADUATE

PG1

Dynamic Characterization of Bioactive Restorative Materials: Effect of Environmental pH

**Ong JEX, Yahya NA, Abdul AA, Yap AU*

Objective: To determine the effects of environmental pH on the viscoelastic properties of Bioactive Restorative Materials (BRMs).

Methods: A resin-based composite [Filtek Bulk Fill Posterior (FB)] was used as the control, and four BRMs [Beautifil-Bulk Restorative (BB), Bioactive composite Activa (AB), bulk-fill alkasite Cention N (CN), and resin-reinforced highly viscous glass ionomer cement Riva Light Cure (RV)] were evaluated.

Results: Stainless steel moulds were used to fabricate 40 beam-shaped specimens(12mm x 2mm x 2mm for each material). The specimens were finished, measured, and randomly divided into four groups of 10. Each group was immersed in aqueous solutions of pH 3.0, pH 5.0, pH 6.8, and pH 10.0 at 37°C for seven days. The specimens were then subjected to dynamic mechanical analysis with a 5N load and frequency of 0.1-10.0Hz. Data were analysed using one-way ANOVA/Dunnet T3's post-hoc test (α=0.05). Mean elastic modulus spanned from 2.68±0.17 to 6.49±0.71 GPa, while viscous modulus ranged from 0.43±0.03 to 0.62±0.12 GPa. Loss tangent values fluctuated from 77.30±4.9 to 164.50±9. Results of pH comparisons were (i) Elastic modulus: CN-pH 3.0,5.0,10.0>6.8; AB- pH 3.0,6.8,10.0 >5.0, (ii) Viscous modulus: CN-pH 3.0,5.0,10.0>6.8, and (iii) Loss tangent: AB-pH 5.0>3.0,6.8,10.0 (> indicates significant differences). No significant differences in viscoelastic properties were observed among the various pH for FB, BB, and RV. Differences among the materials were (i) Elastic modulus: pH 3.0 & 10.0- AB>CN>FB,BB,RV; pH 5.0 & 6.8- AB>CN,FB,BB,RV, (ii) Viscous modulus: pH 10.0- AB,CN>FB,BB,RV, (iii) Loss tangent: pH 3.0 & 5.0- RV>FB,BB,CN>AB; pH 6.8 & 10.0- FB,BB,CN,RV>AB.

Conclusion: Significant differences in viscoelastic properties were noted between BRMs. AB presented the lowest elastic modulus for all pH levels. Immersion of all material in pH 6.8 yielded the highest elastic modulus except for AB. The effects of environmental pH were found to be material dependent.

Keywords: Bioactive, Dynamic Mechanical Analysis, pH, Viscoelastic

PG2

Accuracy of Novel Smartphone-based 3D Stereophotogrammetry System for Palatal Defect Rehabilitation using Digital Obturator Prostheses

**Farook TH, Jamayet NB, Asif JA, Din AS, Mahyuddin MN, Alam MK*

Introduction: 3D scanning and digital prosthetic management of surgically mutilated oral cancer patients require proprietary equipment that may not be readily available to the rural outreach.

Objective: To develop and virtually validate the *in-vitro* accuracy of a Smartphone-Integrated 3D Stereophotogrammetry *(SPINS)* workflow in order to digitally fabricate palatal obturator prostheses.

Methods: An electronic microcontroller-driven wireless 3D system was developed to utilize the smartphone's camera for the proposed stereophotogrammetry workflow. 6 smartphones were used to pilot test the workflow. Once deemed reproducible, the workflow was repeated to scan dental casts of 18 palatal defects. *SPINS*-derived outputs were compared against those of the standard laser scanner. Prostheses were then designed from both set of outputs using free and medical-grade software solutions, and results were compared. The parameters for comparison were mesh surface area (MSA), virtual volume (VV), Hausdorff distance (HD) and Dice similarity coefficient (DSC). The standard threshold for HD and DSC were established at <0.5mm and >0.70 respectively.

Results: The pilot test suggested all 6 smartphones produced no significant differences in MSA (χ^2=0.92, *P*=.97) and VV (χ^2=1.23, *P*=.94). There were no significant differences between *SPINS* and laser scanner in terms of MSA (Z=-0.60, *P*=.55) and VV (t=0.35,*P*=.73). HD and DSC thresholds were met on both instances. *SPINS* with free software produced prostheses that demonstrated no significant differences for MSA (F=0.34, *P*=.72) and VV (F=1.18, *P*=.32) when compared to their conventional medical-grade counterparts. HD exceeded threshold by 0.05-0.15mm while DSC threshold was met (0.80-0.82).

Conclusion: *SPINS* was able to create accurate virtual models of palatal defect casts across a range of smartphones. Obturator prostheses designed

virtually from *SPINS* were reasonably accurate and can be improved with further development.

Keywords: Digital dentistry, maxillofacial prosthetics, stereophotogrammetry

PG3

Mechanical, Dimensional, and Structural Property Evaluation of 3D Printable Materials Subjected to Dental Disinfection

**Rashid F, Barman A, Farook TH, Jamayet NB,*

Introduction: Acrylonitrile Butadiene Styrene (ABS) is an extensively used 3D printable material in dentistry that is used for prototyping diagnostic casts, educational models, and specific dentures. However, in a time where disinfection is of the utmost priority, information pertaining to the physical durability of 3D printable ABS material subjected to dental disinfection is still lacking.

Objective: The aim of this in-vitro study was to evaluate physical property changes of 3D printed ABS material when subjected to a range of disinfectants commonly used in dentistry.

Material and Methods: Forty-two ABS hollow cubic specimens were modelled in Computer-Aided Design (CAD), and 3D printed using Fused Deposition Modelling (FDM) technology. 206 Outer and inner linear measurements (OM, IM),Root Mean Square (RMS) error of accuracy, and specimen mass were electronically evaluated.The models were then subjected to the following disinfectants: tap water (Control), 0.12% Chlorhexidine gluconate (CHG), 3% Hydrogen Peroxide (H_2O_2), 5% Sodium Bicarbonate solution ($NaHCO_3$), 0.5% Sodium Hypochlorite (NaOCl) and Polydent for 672 hours, after which compressive stress and infrared spectroscopic analyses were carried out. At every 168-hour interval, OM, IM, RMS and mass were evaluated to establish trends. The findings were statistically correlated and data variances were analyzed.

Results: No significant differences [χ^2=5.47, *P*>.05] were observed for OM and IM. RMS showed an increase for OM and decreasefor IM. A significant correlation (r=0.34, *P*>.05) was observed between mass and immersion time for ABS subjected to CHG. Compressive stress tests revealed no significant differences [F=1.04, *P*>.05]. Infrared spectroscopy suggested uptake in OH peak (3000-3500) and discharge of styrene peak (1300-1500) for CHG and H_2O_2. NaOCl and Polydent demonstrated minimal peak alterations following immersion.

Conclusions: ABS underwent some amount of dimensional distortion but did not significantly affect stress-dependent durability. ABS disinfected in 0.5% NaOCl and Polydent were the most spectroscopically stable.

Keywords: Fused deposition modelling, disinfection, additive manufacturing, material testing

PG4

Shear Bond Strength of Different Adhesive Systems to Silver Diamine Treated Carious Dentine

**Ahmad AA, Yahya NA, Yeoh OT, Yap AUJ*

Objectives: To investigate the shear bond strength (SBS) of different adhesive systems to silverdiamine fluoride (SDF)-treated carious dentine, and to determine failure modes associated with these adhesive systems.

Methods: A total of 75 sound premolars were sectioned and randomlyassigned as follows (n=15); sound dentine with universal adhesive and etchant (Group A), SDF-treated carious dentine with universal adhesive and etchant (Group B), universal adhesivewithout etchant (Group C), glass ionomer (Group D) and alloy (Group E) adhesive systems. Groups B, C, D and E were subjected to pH cycling to form artificial caries. Resin composite cylinders of 4 mm diameter and 2 mm height were bonded to the occlusal surfaces of the treatedteeth. The specimens were stored in distilled water at 37ºC for 24 hours, and thermal cycled at 500 cycles, 5ºC/55ºC. SBS was established using a universal testing machine with shearload of 500N and crosshead speed of 0.5 mm/min. Data for SBS were analyzed using One-wayANOVA and post-hoc Dunnett T3 test. Failure modes were categorized as adhesive, cohesiveor mixed failures, and were evaluated using Pearson Chi-square and post-hoc Z tests.

Results: For SDF-treated carious dentine, Group C presented the highest SBS, followed by Groups B, E, and D. SBS of Group D and E were significantly lower than Groups A, B and C. No significant difference in SBS was found between Groups A, B and C. While Group B had significantly fewer adhesive failures, the proportion of mixed failures was statistically insignificant among the different groups. Resin composite cohesive failures were only observed in Group B.

Conclusions: When bonding resin composite to SDF-treated carious dentine, universal adhesive without etchant is preferred over universal adhesive with etchant, glass ionomer and alloy bonding systems. Failure modes were related to the type of adhesive system utilized.

PG5

Mechanical Characterization of 3D-printable Materials Used in Dentistry following Simulated Dietary Interaction

**Barman A, Rashid F, Farook TH, Jamayet NB,*

Introduction: As additive manufacturing is becoming common place in clinics, 3D-printable materials such as polylactic acid (PLA) and polyethylene Terephthalate Glycol (PETG) have begun seeing wider applications in dentistry. However, reports of dietary influence on the mechanical properties of these materials are still lacking.

Objectives: Current in-vitro study aims toexplore the mechanical characteristics of 3D-printed specimens and compare it to conventionallyused polymethyl methacrylate (PMMA) after subjecting them to dietary liquids.

Methods: 3D printed PLA and PETG specimens were modelled using Computer-aided design (CAD) conforming to ISO 37:2017(*Tens*) and ISO 604:2002(*Flex*) guidelines. 120 specimens were 3D-printed using fused deposition modelling (FDM) technology at layer thickness of 0.1mm and +45/-45 print orientation. 60 PMMA specimens were fabricated on custom silicone moulds. Specimens were randomly divided into groups and subjected to oil, soda, milk, and caffeine solutions for 180 hours while one group was not immersed (control). Mass (g), density, infrared spectroscopy, root mean square (RMS) error of accuracy, plastic deformity (N/mm^2), ultimate tensile stress (N), flexural deformity (N/mm^2) and break force (N) were evaluated. Repeated measures and multifactorial analyses of variances were statistically evaluated.

Results: Significant interactions between material mass and immersion media (*Tens*; P=.185, *Flex*; P<.001) were observed. PMMA demonstrated the lowest RMS (297.68) while PLA demonstrated the lowest density (1.01 ±0.05). Infrared spectroscopy showed absorbance of CH_3 from oil into PMMA and a new peak at 3300-3350 cm^{-1} was observed for PLA subjected to caffeine. Significant differences were observed in plastic deformity (F=156.63, P<.001). Ultimate tensile stress and break force suggested no significant (P>.05) interactions with dietary media while flexural deformity suggested significant interactions (F= 4.98, P<.001).

Conclusion: 3D-printed specimens were of lower mass and comparable in resisting flexural deformity. PETG exhibited better mechanical resilience to dietary liquids than PLA while PMMA demonstrated better overall mechanical characteristics.

Keywords: Additive manufacturing, material testing, dietary liquids, 3D printing.

PG6

Surface Degradation of Bioactive Restorative Materials with Cariogenic Challenge

**Ibrahim H, Abdul AA, Yahya NA, Yap AUJ*

Objective: To examine the influence of cariogenic environments on the surface roughness ofbioactive restorative materials.

Methods: Custom made stainless-steel moulds with holes of 5mm diameter and 2mm height were used to fabricate disc-shaped specimens of the following materials: Activa Bioactive (AV), Beautifil Bulk (BB), Cention N (CN), Filtek Z350 (FZ) (Control). Baseline surface roughness (Ra) measurements were obtained using an optical 3D measurement machine (Alicona Imaging GmbH). The specimens were then randomly divided into 5 subgroups (n=12) and exposed to 10-ml of the following mediums for 1-week at 37°C: distilled water (DW), demineralisation solution (DM), remineralisation solution (RM), pH cycling (PC) and control air (AR). Ra measurements were again recorded. Statistical evaluations were performed with one-way ANOVA/Games Howell and independent samples T-test ($\alpha = 0.05$).

Results: All bioactive restorative materials showed significant differences inRa values after exposure to the aqueous mediums. Mean Ra values ranged from 0.085±0.004 to 0.198±0.001 for the various material-medium combination. For all materials, the smoothestsurfaces were observed with the control (AR) and mean Ra values were significantly lower than the other groups. When the mediums were compared, conditioning in PC resulted in significantly rougher surfaces than DW for AV and BB. For CN and FZ, the roughest surfaces were noted after exposure to DW. No significant differences in roughness were detected between DM, RM and PC for BB and CN. When comparing between materials, AV presented the roughest surfaces for all mediums. BB exhibited the lowest Ra in DW and AR. CN had significantly lower Ra values than BB after conditioning in RM, DM and PC.

Conclusions: All bioactive restorative materials showed an increase in surface roughness after exposure to aqueous mediums. The effect of conditioning/pH cycling on surface roughness of bioactive materials was both material and medium dependent.

Keywords: Bioactive restoratives, surface roughness, pH cycling

PG7

Characterisation of the Linseed Oil as Bio-based Plasticiser in Polymethylmethacrylate (PMMA) Denture-based Material

**Nadiyah AZ, Raja AA, Nik NINK, Hazlina AG*

Objective: This study is part of a bigger project aiming to look at the physical and mechanical properties alleviation effect of Linseed Oil (LO) as a bio-based plasticiser in Polymethylmethacrylate (PMMA) denture base material. This section of the study investigated the characterisation of the experimental PMMA enhanced by linseed oil (PMMA- L) using Fourier-transform infrared spectroscopy (FTIR).
Methods: PMMA-L was fabricated by the addition of 1, 5 and 10 wt.% LO with heat-cured PMMA. LO was added at the initial stage before the polymerisation of PMMA. Sample of PMMA was alsofabricated as a negative control. The polymers were then processed as suggested by manufacturers' guidelines, and were heat cured in water bath at 100^{o}C for 20 minutes. Samples were then characterised using FT-IR over a wavelength range from 400 cm^{-1} to 4000 cm^{-1}.
Results: Based on comparing FTIR spectrum of PMMA-L with the spectrums of Linseed oil and PMMA, there is a presence of Linseed oil in the PMMA compound. Since themolecular compounds of Linseed oil and PMMA were similar, peaks of C-H bending (700 – 780 cm^{-1}), C-O stretching (1085 – 1250 cm-^{1}), C=O stretching (1706 – 1818 cm^{-1}) and C-H stretching (2840 – 3000 cm^{-1}) were detected for both pure Linseed oil and PMMA spectrums. However, two peaks observed at 3876 cm^{-1} and 3656 cm^{-1} were only detected in Linseed oil and PMMA-L spectrums. These two peaks might be corresponding to the O-H stretching vibration originated from triglyceride compounds found in Linseed oil, derived as linoleic acid, alpha-linolenic acid, and oleic acid.
Conclusions: The analysis on the FTIR spectrum verified that linseed oil was successfully integrated into the crosslinked structureof PMMA.

Keywords: Polymethylmethacrylate, PMMA, Linseed Oil, Plasticiser, Denture

PG8

Comparison in Tooth Colour Between Males and Females Using Digital Camera in Standard Lightening Setups

**Hiyat MR, Ab-Ghani Z, W Ahmad WMA, Halim MS, Jamayet N*

Introduction: Tooth colour is one of the factors that affect aesthetics. To improve aesthetic appearance, the differences in tooth color between males and females should be considered.
Objective: The aim of this study was to compare tooth colour between males and females using a new methodology of dental colour measurement.
Methods: 150 participants (75 males/ 75 females) were selected randomly. Digital camera photography was used for each participant to measure tooth colour in the CIELab colour system on the upper central incisor. Tooth photography was done under standard lightening setups, and all photos were calibrated. Data were analyzed using an independent sample t-test. Normality assumption was fulfilled.
Results: Tooth colour using digital camera presented tooth colour in red and yellow regions of colour spaces a and b. There was no present of green or blue colour in tooth colour. Females had lighter teeth in central incisors while males had the most reddish and yellowish teeth (p < 0.01).
Conclusion: By considering this methodology in tooth colour measurement, females had less yellow, less red, and lighter teeth than males.

Keywords: Tooth photography, colour measurement, digital colour measurement.

PG9

Effectiveness of Silver Diamine Fluoride on Molar Incisor Hypomineralization (MIH)- Affected Molar: A Randomised Controlled Trial

**Farah EMS, T Nurfarhana NTH*

Introduction: Over the years, restoration and extraction are options for managing Molar Incisor Hypomineralisation (MIH)-affected molars. Treatment using glass ionomer cements (GIC) in combination with remineralisation and desensitising agents which is in line with the minimally invasive approach has gained attention among clinicians when dealing with the paediatric population.
Objective: This study aimed to determine the effectiveness of Silver Diamine Fluoride (SDF) in the management of MIH-affected molars.
Methods: This study was a single-centre, three-arm, parallel-group randomised controlled trial comparing the clinical effectiveness following the use of SDF in MIH-affected molars of children. Participants aged 5-15 years with MIH-affected molars of post-eruptive breakdown, caries, or unsatisfactory restoration were selected. Based on the tooth as a unit, the samples were randomised

(1:1:1 via blocks) across three arms: Group 1 received High Viscous GIC (HVGIC) restoration; Group 2 was treated with 38% SDF (RivaStar®) solution and restored with HVGIC, and Group 3 received papain-based gel, Papacarie DuoTM followed by 38% SDF application and HVGIC restoration. Carious tissue was removed using the selective caries removal (SCR) technique and the restoration was done using the atraumatic restorative technique. The findings for this study were categorised based on clinical parameters and outcomes at 6 and 12 months follow-up reviews. **Results:** In total, 63 MIH-affected molars were included. After 12 months, using intention-to-treat (ITT) analysis, Group 3 had the highest clinical success (100%), followed by Group 2 (95.2%) and Group 1 (76.2%), with a statistically significant difference were found between intervention groups ($p<.05$). Pairwise comparison showed a significant difference between Group 1 and Group 3 ($p<.05$). The odds of success were 13 times more likely in the SDF-treated molars than non-SDF molars. **Conclusion:** The application of SDF with and without papain-based gel improved the outcome of the HVGIC restoration. SDF negated the association of the restoration quality with clinical success.

Keywords: Silver Diamine Fluoride, Molar Incisor Hypomineralization, First Permanent Molar, Glass Ionomer Cement, Papain-based gel

PG10

Evaluating The Pit and Fissure Sealant Retention Capabilities of Self-Etch and Conventional Acid-Etch Techniques: A Randomized Controlled Trial

**Yazeed A, Sabri M, N Malina M, N Azlida MN*

Introduction: A recently introduced self-etch adhesive system that reduces the number of steps required for treatment has been found to decrease procedure sensitivity and the chair time required in fissure sealant applications.
Objectives: To evaluate and compare the clinical retention capabilities and incidence of caries of the self-etch adhesive system and conventional acid-etch techniques at a 6-months and 24-month follow-up period Comparison was also made on the caries incidence following the sealant dislodgement. **Methods:** Based on the inclusion and exclusion criteria, a total of 47 healthy children aged between 9 and 10 years (mean age 9.7 years) with all erupted permanent first molars, either sound or non-cavitated, were included in the trial. The 188 molars were randomly assigned in split-mouth design, the self-etch mode in the universal adhesive (Single Bond Universal Adhesive Scotchbond™) (intervention) and conventional acid-etch (control). The fissure sealants placed on the molars were evaluated after 6 and 24 months to assess sealant retention using Simonsen's criteria while caries incidence was evaluated using the International Caries Detection and Assessment System (ICDAS) scoring system.
Results: At the 24-month follow-up, the retention rate for the fissure sealant application using conventional acid-etch was significantly higher at 62.1% than for the self-etch mode using the universal adhesive system at 25.8%. A higher level of caries incidence was observed in the self-etch group compared to the control group, though the difference was not statistically significant. **Conclusions:** Within the limitation of this study, it can be concluded that at the 24-month follow up, the conventional acid-etching technique had superior retention rates over the self-etch technique. However, no difference in caries incidence were apparent between the two groups after 24 months follow up.

Keywords: self-etch, fissure sealant, conventional etching

PG11

The Pharmacokinetics of Silver Diamine Fluoride in Children with Dental Caries

**Lim SP, Musa S, Zainal AN, Chik Z*

Introduction: Silver diamine fluoride (SDF) is a medication used topically on carious tooth surfaces to arrest caries progression in both child and adult populations. There were standard pharmacokinetic studies of SDF being performed in adult populations, but not in the paediatric population.
Objectives: This study aimed to determine the pharmacokinetics of SDF in 15 children with dental caries, who received SDF treatment.
Methods: Urine samples were collected at baseline, and at first and second 24 hours after SDF treatment to determine silver and fluoride levels. Hair samples were collected at baseline, and at days 7, 14, 30, 60, 75, and 90 after SDF to assess silver levels. Silver levels were determined by using the Inductively-coupled plasma mass spectrometry, and fluoride levels were determined with the use of fluoride ion selective-electrode.
Results: The median and interquartile range of urinary fluoride at baseline, first and second 24 hours after SDF was 498.33 (381) µg/24-hour, 574.92 (318.87) µg/24-hour, and 474.35 (324.21) µg/24-hour, respectively. The pairwise comparison results indicated that urinary fluoride levels at the

first 24 hours after SDF treatment were significantly higher than those at the baseline. However, the higher urinary fluoride levels are not sufficient to cause fluorosis as SDF is not for daily application. The range of urinary silver levels at baseline, and the first and second 24 hours after SDF were <1 µg/24-hour, 1 – 2 µg/24-hour, and <1 µg/24-hour, respectively.

Conclusions: Although urinary silver levels were higher in the first 24 hours following SDF, the level is considered extremely low, and the statistical analysis was not possible. The hair silver levels in the first (<0.2-0.69 µg/g) and second 24 hours (<0.2-0.63 µg/g) after SDF treatment were found to fluctuate around the baseline level (<0.2-1.7 µg/g). Based on these study results, the use of SDF is safe in children.

Keywords: Silver diamine fluoride, caries teeth, children, pharmacokinetics, safety

PG12

Vickers Hardness and Flexural Strength of Nanohybrid Dental Composite reinforced with Nano-Sized Zirconia and Macro-Sized Alumina

**N Najwa MN, N Huda I, Dasmawati M, M Firdaus Y, Raja AA*

Introduction: An experimental nanohybrid dental composite (NHDC) using silica extracted from rice husk has been developed. However, the NHDC properties are inferior compared to the commercial dental composite.

Objective: This study aims to enhance the NHDC properties using nano-sized zirconia and macro-sized alumina reinforcing fillers, focusing on the NHDC Vickers hardness (VHN) and flexural strength.

Methods: Nanosilica white powder, derived from rice husk, was used as a filler in NHDC. This dental composite was then reinforced with nano-sized zirconia (ZrO_2) and macro-sized alumina reinforcing fillers (Al_2O_3), which were group into three: Group A, Zr (2%) and Al (3%); Group B, Zr (3%) and Al (2%); and Group C, Zr (3%). These experimental NHDCs were then tested for Vickers hardness (VHN) and flexural strength.

Results: The Vickers hardness and flexural strength of zirconia and alumina reinforced NHDC were statistically higher than the control. However, these values are significantly lower than the commercial product.

Conclusion: This study concludes that zirconia and alumina reinforcement improves the hardness and flexural strength of the experimental NHDC.

Keywords: Hardness, flexural, nanohybrid composite

PG13

Capping Agent-Mediated Reduction in Dentine Staining Associated with Silver Diamine Fluoride

**Asghar M, Yahya R, Yap AUJ, Azzahari AD, Omar RA*

Objectives: To investigate effect of tannic acid (TA) and glutathione (G) incorporation on dentine staining reduction and antibacterial properties of silver diamine fluoride (SDF).

Methods: Three concentrations of TA and G (5, 10, 15% w/v) were incorporated in 38% SDF and subsequently applied to 0.5 M EDTA-demineralized bovine dentine specimens (6×6×1 mm^3). Lightness values (L*) were spectrophotometrically recorded at different timepoints (1,3,6,24 hours, and then 2,3,4,7,14,21,28,45,60 and 90-days post-treatment). The antibacterial efficacy of SDF, TA- and G-modified SDF against S *mutans* was measured using the agar disk diffusion test. Data were statistically analyzed using one-way ANOVA and post-hoc Tukey test at $p < 0.05$.

Results: SDF-treated specimens exhibited the lowest L* values compared with TA- and G-modified specimens at all timepoints ($p<0.05$). A directly proportional, concentration-dependent increase in L* was observed for TA- and G-modified SDF-treated specimens. At 90-day, TA15 showed the highest L* (58.98±2.06) while SDF had the lowest L* values (31.61±1.52). Overall, the L* values for the capping agent-modified SDF solutions increased in the following order: SDF>G5>G10>G15>TA5> TA10>TA15 ($p<0.05$) at 90-day. TA incorporation significantly reduced the zones of inhibition (ZOI) in the specimens with increased concentration ($p<0.05$). However, this effect was not visible in G-modified SDF-treated specimens ($p>0.05$). The highest ZOI was exhibited by SDF (16.03±1.11 mm), while deionized water (DI) (6.09±0.04 mm) and TA15 (7.29±0.16 mm) showed the least ZOI. Pairwise comparison revealed a significant difference ($p<0.05$) in the mean ZOI of DI, TA10, and TA15 compared to SDF, statistically non-significant for TA5, G5, G10, and G15 ($p>0.05$). **Conclusions**: Capping agent incorporation significantly reduces SDF-mediated tooth staining, by preventing the aggregation or dark-colored silver compounds formation that cause tooth staining. The stain minimization effect was more pronounced in TA- compared with G-modified SDF; however, this occurred at the cost of its antibacterial efficacy.

Keywords: Silver diamine fluoride, dental caries, tooth staining, color change

PG14

Adhesion of Hydroxyapatite Coated Gutta-Percha to Dentine with Various Sealers Using Push-Out Bond Strength Test

**Fauzi M, Zeti ACAA, Nora SM N, N Hayati A.*

Introduction: To achieve an improved sealing of the root canal systems (Monoblock concept), several coated GP systems i.e., resin, GIC and bioceramic coated GP are available. However, it is only intended to be used with its corresponding sealer. By coating GP with Hydroxyapatite, a component similar to dentine, different sealers available in the market can be used with Hydroxyapatite coated gutta-percha (HAGP) and improve the adhesion at the GP-sealer interface.

Objectives: To identify the mean bond strength of HAGP to root dentine, compared to other conventional GP, and to identify the mode of failure of HAGP to dentine after push- out bond strength test.

Methodology: Eighty single canal teeth were prepared and assigned to experimental groups (n = 20), designated as Group 1: Conventional GP/AH Plus (Control group), Group 2: HAGP/AH Plus, Group 3: HAGP/iRoot SP, Group 4: HAGP/GuttaFlow Bioseal. After obturation, each root was restored with composite resin and stored in Simulated Body Fluid for 30 days at 37°C. Teeth from each group was sectioned to obtain 1 slice of 1 mm thickness and diameter of more than 0.5 mm, which was prepared for push-out assessment using universal testing machine, 30 days post-obturation.

Results: The One-Way ANOVA showed a significant mean difference ($p<.001$) across the 4 groups. Tukey HSD post-hoc test showed significant differences ($p< .001$) between GP/AH Plus compared with HAGP/AH Plus, HAGP/iRoot, and HAGP/GuttaFlow Bioseal with mean differences of 2.53, 2.90, 2.48 respectively. There is no significant mean difference between the experimental groups. Stereomicroscopic examination of 80 samples revealed that 62.5%of the samples showed mixed failure mode., followed by cohesive failure at 37.5% and no adhesive failure seen.

Conclusion: The HAGP showed significantly higher bond strength compared to conventional GP and Ah Plus regardless of type of sealer used i.e., AH Plus, iRoot SP, and GuttaFlow Bioseal.

Keywords: Hydroxyapatite, Gutta-Percha, Endodontics, Push-out test, Bioactive.

PG15

Evaluating Surface Roughness of Enamel After Minimally Invasive Treatment of Proximal White Spot Lesions

**Md Jazam I, Gonzalez MAG, Sukumaran P, Abdul A A*

Objectives: To investigate and compare surface roughness (Ra) of proximal white spot lesions (WSLs) treated with ICON® and Duraphat® after 7 days of pH cycling.

Methods: Sixty extracted sound human premolars were randomly divided into four groups (n=15): Group 1-Sound, Group 2-Demineralised, Group 3-ICON®, and Group 4-Duraphat®. Proximal artificial WSLs were created in Groups 2, 3, and 4 after exposing specimens to initial demineralization in a pH 4.5 solution for seven days. WSLs formations were assessed at pre- and post-demineralization using swept-source optical coherence tomography (SS-OCT). Resin infiltrant (ICON®) and fluoride varnish (Duraphat®) were applied to WSLs in their respective groups. Groups 1 and 2 served as controls. Specimens were then subjected to seven days of pH cycling. Surface roughness (Ra) measurements were taken at pre- (T1, Ra1) and post-pH cycling (T2, Ra2) using a non-contact profilometer (3D Alicona). Mean differences in Ra (ΔRa) were recorded as Ra2–Ra1. Data were analyzed with one-way analysis of variance (ANOVA) and repeated measures ANOVA with significance set at $p<0.05$.

Results: There were statistically significant differences in mean Ra1 and Ra2 in between the groups except for at T1, post-hoc Dunnett's test showed no significant difference in Ra between Group 3 (Ra1 = 0.31μm±0.01) and Group 1 (Ra1 = 0.31μm±0.03). At T2, Group 3 (0.42μm±0.01) were significantly smoother compared to Group 4 (0.58μm±0.01) and control groups 1 and 2. Within the groups, comparisons showed Group 3 exhibiting the least change in Ra value (Ra2–Ra1 = 0.11μm) after 7 days of the acidic challenge.

Conclusions: Within the limitations of this study, results showed WSLs infiltrated with ICON® exhibited similar surface roughness to sound enamel and remained relatively unchanged after an acidic challenge. Duraphat® neither improved nor maintained sound enamel surface smoothness, however, it improved the surface roughness of WSLs.

Keywords: Icon, Resin infiltration, Fluoride varnish, Roughness, White spot lesion

PG16

Resin Dentin Interface of Normal and Eroded Dentin using Universal Adhesive System– *In vitro* study

**Ghayathri K, Padmini H, Ravikanth HJ*

Introduction: There is paucity of evidence that explains the relationship between total-etch and self-etch technique on eroded dentin using universal adhesive system.
Objectives: This study aims to compare the resin-dentin interface of sound and eroded dentin using universal and total-etch adhesive systems.
Methods: Forty caries-free extracted human premolars were collected and the occlusal surfaces were grounded using slow speed diamond disc with copious water supply until a flat superficial dentin was exposed. The test group underwent erosive cycle (n=20) and another group (n=20) were reserved for control group. Erosive protocol consisted of immersion in 1.23% citric acid for one minute every 12 hours and stored in artificial saliva. Both the control and eroded teeth were further subdivided (n=10) for composite restoration using either self- etch or total-etch systems. Then, the tooth samples were sectioned longitudinally and observed under Confocal Laser Scanning Microscope (CLSM) at 10x magnification to evaluate resin tag length and hybrid layer thickness.
Results: The highest mean value of the resin tag length and thickness of hybrid layer was observed with total-etch system in sound dentin group compared with other groups ($p < 0.001$).
Conclusion: The resin-dentin interface of sound dentin was found to be better than eroded dentin using total etch system. The resin-dentin interface of eroded dentin was superior to sound dentin using self-etch adhesive system.

Keywords: confocal laser scanning microscope, resin tag length, hybrid layer, eroded dentin, universal adhesive, total-etch adhesive.

PG17

A 2D Photographic and 3D Digital Dental Model Analysis of Golden Percentage in Maxillary Anterior Teeth

**Naseer A, M Syahrizal H, Zuryati AG, Zafar AK, Maria SA, Nafij J, M Khursheed A*

Objectives: The objective of this study was to evaluate the existence of golden percentage in natural maxillary anterior teeth with the aid of 3D digital dental models and 2D photographs and to propose regional values of golden percentage for restoration of maxillary anterior teeth.
Methods: For this purpose, one hundred and ninety dentate subjects with sound maxillary anterior teeth were selected. Standardized frontal images were captured with DSLR, and the apparent width of maxillary anterior teeth was measured utilizing a software on a personal laptop computer. Once the dimensions were recorded, the calculations were made according to the golden percentage theory (GPT). The data were analyzed by independent and paired T – test. The level of significance was set at $p < 0.05$.
Results: The golden percentage values were not found in this study. The values obtained were 16%, 15%, 20%, 20%, 15%, and 16% moving from the right canine to the left canine teeth. There was no significant gender difference in the golden percentage values.
Conclusions: The golden percentage should not be used solely for the correction of anterior teeth or for determining dental attractiveness. Emphasis should be given to a range of dental proportion on regional basis.

PG18

Salivary IgA Depression in Drug-influenced Gingival Enlargements Among Hypertensive Patients Attending Hospital Universiti Sains Malaysia

**Sabarudin, M.A., M.H., Taib, H., Wan Mohamad, W.M., Zainuddin, S.L.A., Radzwan M., Ghazali W. W.S.*

Introduction: Drug-influenced gingival enlargement (DIGE) among hypertensive patients is commonly associated with the use of calcium channel blockers (CCBs) such as nifedipine and amlodipine. The immune response alteration is one of the mechanisms proposed for DIGE. Immunoglobulin A (IgA) antibodies in saliva which acts as a defense mechanism was shown to be affected in patients with DIGE.

Objective: To determine the association of salivary IgA level with the presence of drug influenced gingival enlargement.

Methods: This is a cross-sectional study which comprised of 47 patients with the mean age of 55.7 (SD 10.0) years old taking anti-hypertensive agents for at least 3 months. There were 21 (44.7%) males and 26 (55.3%) females who agreed to participate in this study. Data was analyzed using SPSS version 26.0 with $p<0.05$ is considered statistically significant.

Results: There were 83% patients taking CCBs and 17% taking non-CCBs, which amlodipine was the most common (55.3%) antihypertensive consumed. About 21 (44.7%) patients presented with DIGE. The

salivary IgA antibody level was significantly reduced (p=0.03) among patients with DIGE [median 4.9 ng/mL (IQR 5.268)] compared to those without DIGE [median 15.3 ng/mL (IQR 32.246)].

Conclusion: This data indicates that the level of salivary IgA was significantly affected in patients with DIGE which may compromise the defense mechanism of saliva.

Keywords: Gingival enlargement, drug-influenced, calcium channel blocker, salivary IgA, anti-hypertensive agent.

PG19

A Study on the Awareness and Self-Perception on Periodontal Disease Among Older Adult Population in Malaysia

**Thomas A., Taib, H., Zainuddin S.L.A., Berahim, Z, Adnan,M.M*

Introduction: Lack of knowledge and awareness among older adults about periodontal disease and its value can result in deferred or neglected oral healthcare. Therefore, it is crucial to carry out this study so that remedial measures can be taken to increase the awareness of periodontal health among them.

Objectives: To study the awareness and self-perception on periodontal disease and oral hygiene practice among older adult population in Malaysia.

Methods: This is a cross sectional study targeted on subjects aged 50 years and above using an online platform via Google forms. Sixty respondents completed the validated questionnaires on the knowledge and their behavioral aspects towards periodontal disease. Data was analysedusing SPSS software Version 24 with p<0.05 at 95% Confident Interval considered as significant. **Results:** Majority of respondents were Indians (66.7%), aged 60 to 69 years old (56.7%) and retirees (45%). There were 32 (53.3%) male and 28 (46.7%) female participants. About 68% chose poor oral hygiene as the most common cause of gum disease, 71.7% answered plaque being a hard deposit stuck on teeth. Around 63% visited a dentist only when necessary, and 38.3% were aware that some illnesses are related with gum disease, with the most commonanswer being diabetes and hypertension. 58.3% of the respondents brushed at least twicedaily whereas the most common additional aid used are toothpicks and dental floss.

Conclusion: This data indicates that level of awareness on periodontal disease among subjects was relatively low with average understanding among participants on the cause of periodontal disease. Hence, education on the importance of periodontal health should be emphasized to prevent oral health burden in the aging population.

Keywords: Periodontal disease, older adults, periodontitis, dental plaque

PG20

Salivary and Urinary Baseline Nickel Level Among Healthy Malay Population

**Sabri M.N.I, Noviaranny IY, Kazi JA*

Introduction: Nickel is one the common trace metal element used in manufacturing industries. It has been documented that even in low amount, long-term exposure to nickel is cytotoxic, genotoxic and carcinogenic. Nickel biomonitoring has been done by various countries to monitor nickel level. However, the nickel level varies significantly within and between populations and geographical regions. As a result, there is limited information on established baseline nickel level in our population which leads to the difficulty for comparison during nickel exposure.

Objective: An objective of this study was to determine the baseline nickel level in saliva and urine samples for healthy Malay population. **Methods**: Fourteen healthy Malay subjects were recruited in this study. Unstimulated saliva and urine samples were collected in the morning and stored at -20 ºC. All the samples were subjected to Inductively Coupled Plasma Optical Mass Spectrometry (ICP-MS) which is widely used, have low detection limit and highly sensitive for detection of nickel level. Statistical analysis was performed using IBM SPSS Version 27.

Results: The results indicate that the nickel level in urine was higher compared to saliva. The baseline nickel level demonstrated in saliva was 4.80 ppb (95% CI: 2.23, 7.38) and in urine was 5.88 ppb (95% CI: 3.49, 8.27).

Conclusion: Our study reports the baseline salivary and urinary nickel level among healthy Malay population and can be applied for further health-related and population-based studies to nickel.

Keywords: baseline nickel level, saliva, urine, Malay population.

PG21

A Comparative Study of Emotional Intelligence and Leadership Among Dental Undergraduates in Kurdistan and Malaysia

**Sara R, Fauzi A, Yazid F, Mahadir A*

Introduction: Leadership, the art of motivating oneself and others towards achieving a common goal, is an inseparable part of dentistry and has been proven essential in all aspects of dentistry where a dentist is obliged to work in an organized medium dealing with different personnel. Leadership level among dental undergraduates may be highly associated with emotional intelligence (EI). **Objectives:** This study was a comparative study that aimed to find Self-leadership (SL) and EI level of dental undergraduates in pre-selected universities in Malaysia and Kurdistan and to find the relationship between EI and Self-leadership. **Methods:** Dental students (N=236) participated in the study each answering two questionnaires; The Schutte-Self Report Emotional Intelligence Test (SSREIT) to measure EI level (33 items) and the Revised-Self Leadership Questionnaire (RSLQ) to measure Self-leadership (35 items).
Results: The results showed that both leadership and EI levels of dental undergraduates were moderate at all the universities involved in the study. There was a statistically significant positive correlation between EI and Self-leadership ($p<0.01$) with 37% of the variation of Self-leadership determined by EI.
Conclusion: Most of the students in all three universities demonstrated moderate levels for Self-leadership, thus intervention in academic curriculum or planning for training that would enhance leadership skills among dental undergraduates can be considered as a better preparation for future dentists with competency in both patient care as well as managing dental services. In line with this, it is important to understand that EI has an essential role in the development of leadership skills among dental undergraduates.

Keywords: Leadership, Self-leadership, Emotional Intelligence, Dental Undergraduates, Dentistry

PG22

Social Inequalities in Children's Oral Health-Related Quality of Life in Pakistan

**Khaliqa TZ, Zamros YMY, Marhazlinda J*

Objectives: The aim of this study was to investigate the social inequalities in oral health-related quality of life (OHRQoL) among 11–12-year-old children in Pakistan.
Methods: A cross-sectional study was conducted among 1161, 11-12-year-old children in Lahore, Pakistan. A structured questionnaire including items on oral health-related behaviors, attitude and knowledge along with Urdu Child-OIDP index was answered by children in class room setting. Parents answered a questionnaire on sociodemographic information. Oral examinations were conducted by a calibrated dentist.
Results: The prevalence of oral impacts on the children's daily performances in the last three months was 68.6% (mean OIDP score = 13.6, SD = 16.0). The performance with the most impact was *eating* (n=583, 50.2%), followed by *cleaning teeth* (n=499, 43.0%). The performance with the least impact was *speaking* (n=168, 14.5%). Main causes of oral impacts were toothache (51.5%) and malaligned teeth (27.1%). While the least common cause of oral impact was cleft lip and palate (1.8%). Bivariate analysis revealed that income, mother's and fathers' education, locality and gender of children were significantly associated with children's OHRQoL. Parents with higher income and who were well educated were associated with children having lower Child-OIDP mean scores ($p<0.001$). Likewise, children of rich and privileged class residing in Cantt tehsil had significantly lower Child-OIDP scores, in comparison to other areas ($p<0.001$). Girls reported having lower OIDP mean score than boys ($p<0.001$). Children with perceived need for dental treatment, less satisfied with their oral health, experienced oral impacts, and suffered from oral diseases reported higher OIDP mean scores ($p<0.001$). Among oral diseases, dental caries, gingivitis and dental aesthetics were significantly associated with Child-OIDP scores ($p<0.001$).
Conclusion: Children Pakistan reported worse OHRQoL than those from high socioeconomic background. Efforts towards oral health inequalities need to address socioeconomic factors among Pakistani children.

Keywords: OHRQoL, oral impacts, Child-OIDP, socioeconomic determinants

PG23

Salivary Aquaporin-5 as a Biomarker for Xerostomia in Patients with Periodontitis

**Saira A, Norsila AW, Sarah G, Ahmad A*

Introduction: Xerostomia is a debilitating condition of oral dryness which is not always associated with a reduced salivary flow rate. Aquaporin (AQP)-5 as a potential salivary protein biomarker for xerostomia in patients with periodontitis has not been established.
Objectives: The objectives of this study were: (i) To compare the concentrations of salivary AQP-5 in periodontitis patients with grade 1 and grade 2 xerostomia, (ii) to investigate the association of Summated Xerostomia Inventory (SXI) score, unstimulated salivary flow rate, and concentration of

salivary AQP-5 in periodontitis patients with xerostomia.

Methodology: A total of 140 healthy participants, 20-55 years old, with Community Periodontal Index (CPI) score ≥ 2 were included through systematic random sampling. SXI was used for subjective assessment of xerostomia. SXI score > 5 was considered xerostomic; score 6-8 as grade 1 and score 9-15 as grade 2 xerostomia. Unstimulated whole saliva was collected between 8-10 am in a 2-hour fasted state for objective assessment of xerostomia followed by storage at -80°C. ELISA was performed for quantification of salivary AQP-5. Data were recorded and analysed using Mann-Whitney U test and Spearman matrix correlation. $P < .05$ was considered statistically significant.

Results: Median salivary AQP-5 concentrations were significantly different among the grade 1 and grade 2 xerostomics, $p = .002$. There was a moderate negative and significant correlation between SXI and salivary AQP-5 concentration ($r = −.25$, $p = .01$). However, the correlations were not significant between salivary AQP-5 concentrations and unstimulated salivary flow rate ($r = −.19$, $p = .053$) and SXI and unstimulated salivary flow rate ($r = .12$, $p = .226$).

Conclusion: Salivary AQP-5 is a suitable biomarker to differentiate grade 1 from grade 2 xerostomia in patients with periodontitis.

Keywords: Biomarker; Hyposalivation; Dry mouth; Periodontitis; Salivary flow rate

PG24

Efficacy Of Air Polishing in Non-Surgical Treatment of Periodontitis and Peri-Implantitis: Systematic Review and Meta-Analysis

**Grewal GK, Nazari NSM, Baharuddin NA, Dom MTN*

Objectives: To determine and compare the clinical and microbiological outcomes of air polishing to mechanical debridement with hand and/or sonic/ultrasonic instruments in the non- surgical treatment of periodontitis and peri-implantitis and to determine if its usage is cost effective.

Methods: Electronic search of selected databases was conducted to identify randomised and non-randomised controlled trials published in English from January 2000 to April 2020. Hand searching of selected journals and reference lists of included articles and relevant published systematic reviews was also performed. Random effect meta-analysis was performed on the clinical outcomes of the adjunctive use of air polishing in the non-surgical treatment of periodontitis. Meta-analysis was not possible for peri-implantitis.

Results: Two studies analysed the adjunctive use of air polishing in the non-surgical treatment of periodontitis while one study analysed the use of air polishing compared to mechanical debridement in the non-surgical treatment of peri-implantitis. Narrative data synthesis identified the adjunctive use of air polishing to be equally efficacious to mechanical debridement in the non-surgical treatment of periodontitis in terms of decrease in probing pocket depth and bleeding on probing (BOP) and gain in clinical attachment level. These results were confirmed by the meta-analysis. A short-term decrease in total bacterial counts and relative expression levels of Porphyromonas gingivalis was observed lasting one month following treatment of periodontitis with adjunctive erythritol powder air polishing. At peri- implantitis sites, a significantly greater reduction in BOP was observed following treatment with air polishing. Cost effectiveness was not reported in any study.

Conclusions: The adjunctive use of air polishing in the non-surgical treatment of periodontitis is as effective as mechanical debridement in influencing clinical changes. In the non-surgical treatment of peri-implantitis, air polishing is more effective than mechanical debridement in reducing BOP. However, complete disease resolution is not achieved.

Keywords: periodontitis, peri-implantitis, non-surgical, air polishing

PG25

'We're Tough, But So Is Quitting'. Barriers to Smoking Cessation: The Royal Malaysian Navy Perspective

**Arham MH, Ikmal HI, Budi AMS*

Objectives: Smoking is the major cause of preventable death and disability. Despite this, there are over 1.1 billion smokers worldwide. Its harmful effects impair daily performance and readiness. As smoking is deeply ingrained in the military culture, as evidenced by the high prevalence, this study aims to identify the barriers to smoking cessation among this specific population.

Method: A study involving two groups of current smokers (officers and other ranks) was conducted using the modified nominal group technique (mNGT), which is a qualitative research method of judgmental decision-making involving four phases: generating ideas, recording them, evaluation and prioritization. The mNGT was used to solicit respondents' barriers to smoking cessation.

Results: The mNGT yielded seven main barriers to smoking cessation; 1) addiction; 2) it is hard to stay focused without a cigarette; 3) it is a part of the

lifestyle and difficult to abandon; 4) environmental influence (cigarette availability and peer influence); 5) coping mechanism for pressure; 6) the long interval period between orders and duty exacerbates the desire to smoke; 7) it has become a habit and become a part of oneself. While nicotine addiction and habit were ranked as the most important barrier, the military working environment and nature of the job exposed them physically and mentally to unfavourable situations, complicating the quitting attempt. Furthermore, the acceptance of smoking in military culture leads to a positive smoker identity, further hindering cessation.
Conclusion: The findings indicate that in addition to barriers affecting the general population, military-specific barriers exist complicating cessation in this population. Hence, any intervention programme should address these barriers in order to achieve positive outcomes.

Keywords: barriers, smoking cessation, military

PG26

Users' Experience on Preventive Module in an Academic Institution Based Electronic Dental Record (EDR)

**Adilah RNRAR, Mazuan NMNMR, Sabri BAM*

Introduction: Electronic Dental Record (EDR) is a valuable tool in dentistry that could improve patient management and increase efficiency in providing clinical services. In dental education, EDR has enhanced the capability in improving the quality of care, education and research. The effectiveness and the usage of EDR are influenced by many factors. Previously, rigorous evaluation was done to ensure EDR would be able to meet the technical and usability standards, but nowadays, user experience (UX) evaluation is also factored in to evaluate technology-oriented field. Thus, it is important to evaluate UX so it could provide an input to the betterment of the system.
Objectives: This study aimed at evaluating users' experience and the associated factors in regards to preventive module in Integrated Dental Record Management System (iDeRMS).
Methods: A cross-sectional survey was conducted using a validated questionnaire short version, User Experience Questionnaire (UEQ-S). Four preventive modules namely the tobacco cessation, caries risk assessment (CRA), plaque score and dietary assessment were assessed based on 8 UEQ- S items measured on 7-point Likert scale. Findings were analysed using independent T-test.
Results: A total of 148 undergraduate students participated giving a response rate of 93.0% where 130(87.8%) were female and 18 (12.2%) were male. The mean UX score for tobacco cessation, caries risk assessment, plaque score monitoring and dietary assessment were 1.20 (±1.02), 1.74(±0.89), 1.73(±0.99), 1.31(±1.22) respectively which indicates an above average UX for tobacco and dietary module and an excellent UX for CRA and plaque score module. No significant difference was found between UX across all modules with gender and level of computer skills.
Conclusion: The preventive modules in iDeRMS provide above average UX for tobacco and dietary modules and excellent UX for CRA and plaque modules. Further study can explore the impact of these modules on
clinical practice.

Keywords: Electronic Dental Record (EDR), Electronic Health Record (EHR), User Experience.

PG27

Efficacy of Air Polishing in Supportive Periodontal Therapy and Implant Maintenance: A Systematic Review

**Tan SL, Baharuddin NA, Nazari MNS, Dom MTN*

Objectives: Patients who had undergone periodontal therapy and implant placement require long-term professional monitoring and periodic subgingival mechanical debridement during recall intervals. This systematic review aims to assess the clinical outcomes, patients' perception and cost effectiveness of repeated periodontal therapy with air polishing devices (APDs) in comparison with hand instruments and/or power-driven instruments in Supportive Periodontal Therapy (SPT) and implant maintenance.
Method: Electronic and hand searches were performed to identify relevant randomised controlled clinical trials with at least 6 months follow-up in SPT or implant maintenance published in English from 01 January 2000 to 30 April 2020.
Results: Repeated interventions using APDs in SPT patients resulted in better clinical outcome for probing pocket depth (PPD) reduction. There was statistically significant more PPD reduction in SPT patients following the use of APDs (weighted mean difference 0.14, 95% confidence interval -0.25 to -0.02, p=0.02, I^2=6%). For reduction of bleeding on probing (BOP) and gain in clinical attachment level (CAL), the results were comparable with hand instruments and/or power-driven instruments. In terms of implant maintenance, APDs resulted in promising clinical outcomes for PPD and BOP reduction whereas CAL gain was comparable to the conventional treatment. Treatment with APDs was

associated with lower pain score based on the Visual Analogue Scale (VAS) and higher patient acceptance in SPT studies. None of the implant maintenance studies recorded patient reported outcome. No studies assessed and reported on economic evaluation of the intervention. **Conclusions:** There is evidence to support that repeated subgingival debridement using APDs in SPT has slight superiority in clinical parameter with reference to PPD reduction and better patients' comfort, when compared to conventional treatments. There is limited evidence to show that repeated application of APDs has higher potential in improving clinical outcomes compared to conventional treatments in implant maintenance patients.

Keywords: air polishing, supportive periodontal therapy, implant maintenance

PG28

Adapting Research Methodology During Covid-19: Insights from a Pilot Study on Cultivating Dental Students' Empathy

**Malhotra V, Syed A, John J, Nazari MNS, Khor HM*

Introduction: Identifying effective pedagogical methods in developing dental students' empathy and communication skills is crucial. However, research in this area normally requires face-to-face communication and ethnographic methods, which are unfeasible during the COVID-19 pandemic. Thus, the aim of this study was to investigate whether adapting these methods to online mode could also improve empathy among dental students. **Objective:** To assess the feasibility of conducting an online communicative study about cultivating empathy among dental undergraduates by interviewing and writing the life stories of older adults. **Methods:** Using an explorative pseudo-experimental design, we conducted a pilot study involving 5 dental undergraduate students at Universiti Malaya and 2 adults aged over 60. The students attended 3 online training and calibration sessions over a 4-week period, during which they conducted life-story interviews via video call with the older adults to create a multi-modal biography. The students completed pre-and-post surveys to measure empathy and other psychometric variables and recorded their reactions in vlogs. A support chat group was also available. **Results:** Research activities were successfully completed with the students creating multi-modal biographies of the 2 older adults. Students' vlogs revealed that the experience improved their communication skills and challenged their perceptions of older adults but analysis of the survey data was limited by the small sample size. Several methodological improvements were indicated: 1) more training is needed to support students in creating meaningful biographies 2) the surveys should be streamlined 3) interview methods must be adapted as the older adults could only use WhatsApp video call, which cannot be video-recorded 4) Online consent taking methods must be formalised, and 5) recruitment approach should be adapted to encourage higher participation. **Conclusions:** Communicative and ethnographic research involving dental students can be conducted online, with adequate support and adjustments to include participants across the digital divide.

Keywords: research methodology, online research, dental students, soft skills.

PG29

Antioxidant Properties of *Psidium Guajava, Nigella Sativa, Azadirachta Indica* and *Averrhoa Bilimbi* Plant Extracts

**Rajkumar NANF, Safii SH, Wan-Ibrahim WI, Razak AF*

Introduction: Antioxidant properties of plants have intrigued significant research interest as many evidence, associates antioxidant activities with wound healing and repair process. By limiting the oxidative stress during the process, wound healing can be accelerated and improved. Plants are well known for their natural anti-inflammatory, antioxidant, and pro-collagen synthesis actions with less/no side effects.
Objectives: This study aims to determine the antioxidant properties of the aqueous extracts of four local plants known to exhibit antioxidant potentials based on their scavenging activity of free radicals, phenolic content, and ferric reducing antioxidant power.
Methods: Aqueous extraction was performed on fresh specimens of four plants; *Psidium guajava* (PG), *Nigella sativa* (NS), *Azadirachta indica* (AI), and *Averrhoa bilimbi* (AB). DPPH scavenging assay, total phenolic content (TPC) assay, and ferric reducing antioxidant power (FRAP) assay were carried out on the extracts. The relationship between the parameters measured were then determined using bivariate correlation analysis.
Results: In DPPH assay, the IC50 of NS, AB, AI, PG, and ascorbic acid (AA) as a positive control were 756.33, 728.14, 42.52, 1.94 and 1.65 ug/mL, respectively. The TPC values of NS, AB, AI, and PG

were 10.99, 20.29, 98.49 and 378.04 mgGAE/g, respectively. The FRAP values of NS, AB, AI, PG, and AA were 99.33, 104.70, 1675.38, 1968.26 and 14138.93 uM/mg, respectively. The correlation values for DPPH/TPC, DPPH/FRAP and TPC/FRAP are -0.988*, -0.766* and 0.995* (*p<0.01), respectively.

Discussion: The antioxidant power of the plant extracts and the positive control was in the following order: AA>PG>AI>AB>NS. However, comparatively PG exhibited the highest ability to inhibit free radicals. The high values of TPC and FRAP may have contributed to the antioxidant potential of PG. This is supported by a strong correlation between all the parameters measured.

Conclusion: The aqueous extract of PG is a potential candidate to promote oral tissue repair.

Keywords: antioxidant; *Psidium guajava; Nigella sativa; Averrhoa bilimbi; Azadirachta indica*

PG30

The Association Between Sweet Taste Perception and Dental Caries Among FELDA Settlers in Kuantan

**Alia NAR, Faisal AI, Ningseh TMD*

Introduction: Frequent sugar consumption has long been recognized as the primary etiological factor for dental caries. In Malaysia, dental caries prevalence is still high and while sugar is widely consumed, the association between sweet taste perception and dental caries is not well established. Equally worrying are the increasing trends of unhealthy dietary behaviour among rural communities leading to chronic diseases like diabetes and obesity.

Objective: This study aims to investigate the association between sweet taste perception and dental caries experience among FELDA settlers in Kuantan.

Methods: A cross-sectional study involving 76 adults, aged between 20-80 years, from FELDA Bukit Sagu 1 and FELDA Bukit Sagu 2&3 was conducted from September to October 2020. Sweet taste perception of the participants was measured by identifying their threshold to ten different concentrations of freshly prepared sucrose solutions ranging from 1.63 gm/L to 821.52gm/L. Participants were then grouped according to their taste threshold (TT), and taste preference (TP), which is the level of sweetness that they prefer in their daily drinks. Dental caries experience was determined using the DMFT index through a clinical examination.

Results: The mean DMFT score was 11.1 (S.D. 5.6) with a high missing teeth component score, MT=7.83 (S.D.5.8). 18 participants were fully edentulous. Majority of the participants had medium TT and TP at 77% and 83.6%, respectively. There is no significant association found between TT and TP with DMFT (Spearman's correlation, P= 0.633 and P=0.062 respectively). Moreover, the DMFT scores between the TP levels were not significantly different (One-way ANOVA, P=0.717).

Conclusion: No association was found between sweet taste perception and dental caries among the FELDA settlers in the study. Nevertheless, the high incidence of missing teeth warrants further investigation into the association between sweet taste perception and dietary sugar intake among older adults.

Keywords: sweet taste perception, dental caries, adults

PG31

Preparedness and Job Satisfaction among Dental Officer in Charge of Clinic in Penang: A Qualitative Study

**Lesa L, Md Bohari NF, Md Sabri BA*

Introduction: Dental officer in charge of the clinic (DOCC), also known as "Pegawai Pergigian Yang Menjaga" (PPYM), is assigned to be in charge of the primary dental clinic in the Ministry of Health. The DOCC plays a dual role as a clinician and a leader in the clinic.

Objective: To explore the preparedness and job satisfaction of DOCCs in Penang.

Methods: A qualitative study using the modified Nominal Group Technique (mNGT) was conducted virtually via GoogleMeet. 28 DOCCs from Penang were recruited and divided into 3 mNGT groups based on their years of service as DOCC. The top 5 responses were chosen by consensus and ranked individually. The reverse score method is applied and multiplied with the personal score for a final score for each response. Responses were ranked based on the average score of all the participants.

Results: The majority of the participants were female (89.2%), and the mean age was 36.14 years (SD=5.05). The mean years in service was 10.5 years (SD = 4.23), ranging from 7 to 28 years in service. The DOCCs' responses to their preparedness for the role were "learning on the go", "no training provided by higher management", "learning from peers", and "mentoring by Senior Dental Officers". "Staff cooperation", "positive feedback from patients", "appreciated", and "respected while performing role" were the responses from the DOCCs when asked about their satisfaction when performing the role. However, DOCCs were dissatisfied when being held accountable beyond their control, with no allowances and the inability to satisfy everyone.

Conclusions: Majority DOCCs have to learn on the

go since they did not receive training from the higher management before becoming the DOCC, and they gained satisfaction when their staff cooperates. In contrast, they feel most dissatisfied when they are being held accountable for matters beyond their control.

Keywords: Clinical leadership, dental officer, preparedness, job satisfaction, mNGT

PG32

Comparison Of MMP-1 and MMP-8 Expression in Rats' Gingival Tissues at Different Time Interval Following Gingivitis Induction

**Fazle K, Badiah B, N Najmi A, N Shaqinah N*

Introduction: MMP-1 and MMP-8 are the member of the matrix metalloproteinase (MMPs) family belongs to the collagenase group and responsible for degradation of collagen type I which is abundant within the extracellular matrix (ECM) component. MMP-1 is usually produced by macrophages, fibroblast and other cells type. MMP-8 also known as neutrophilic collagenase mostly produced by neutrophil.
Objectives: The aim of our study is to compare MMP-1 and MMP-8 expression level in gingival tissues of rats following experimental gingivitis induced by *E. faecalis* inoculation concurrent with orthodontic wire ligation at different time interval.
Materials and methods: Twelve rats were divided equally into 3 groups; 0- day group (control), 7-days and 14-days group (experimental). 0.2mm sterile orthodontic wire was inserted into the interdental space of maxillary right 1^{st} and 2^{nd} molar and 0.5µl of $1.5x10^8$ CFU/ml *Enterococcus faecalis* suspension was injected into the gingival sulcus of rats in experimental groups. The rats were euthanized after the induction period respectively. Gingival tissue samples were collected from all rats for RNA extraction and cDNA conversion. The Real-Time PCR was carried out in 10µl reaction as follows: pre- denaturation at 95°C, 30 sec; denaturation 95°C 10 sec; annealing 60°C 30 sec; 40 cycles for MMP-1 and MMP-8.
Results: Results shows, significant upregulation in mRNA expression levels within the gingival tissue of MMP-1 ($P < 0.05$) and MMP-8 ($P < 0.01$) in 7-days as compared to control group. Moreover, significant upregulation of MMP-1 ($P < 0.05$) and insignificant upregulation of MMP-8 ($P > 0.05$) mRNA expression levels within the gingival tissue in 14-days as compared to control group. However, difference between MMP-1 and MMP-8 mRNA expression levels is not significant ($P > 0.05$).
Conclusion: The study suggests acute inflammatory response within the periodontal tissue following the induction.

Keywords: Gingivitis; gingival tissue; MMP-1; MMP-8; rat

PG33

Oral Health-Related Quality of Life Among Patients Attending Government Visiting Dental Services in Selangor

**Munirah P, N Faezah Md B, Nawwal AMR*

Introduction: Visiting Dental Services (VDS) are provided in selected Health Clinics by the Ministry of Health in Malaysia to increase the accessibility of oral healthcare services to the wider population.
Objective: To investigate the oral health-related quality of life (OHRQoL) among patients attending VDS in Selangor.
Methods: Self- administered questionnaires were distributed to the attendees of the VDS using the validated Malay version of the Short Oral Health Impact Profile (S-OHIP). The S-OHIP score for each participant were calculated using Additive scores (ADD) which is the total sum of all 14-items that range from being the least affected with the score of 0 to the most affected with the score of 56. Participants' satisfaction were also assessed and correlated with the participants' OHRQoL. Statistical analysis was done using t- test and one way ANOVA with the statistical significance set at $p=0.05$.
Result: The data from the 12 VDS in Selangor were collected with 111 participants. Mean age of the participants were 33 years (±9.895). Majority of the participants were female (86.5%) and of Malay ethnicity (85.6%). The total mean S-OHIP score was 10.03±7.56. The highest impact of oral health in the participants' daily life was the domain of "psychological discomfort" under the category of "food stuck" with almost 20% chose "quite often". The total mean S-OHIP score between gender was statistically significant ($p=0.003$). The relationship between the total S-OHIP score and the satisfaction score was found to be insignificant ($r=-0.073$) with the p-value >0.05.
Conclusion: The psychological discomfort domain was shown to give more impact towards the OHRQoL of the VDS attendees. Although with the limited services offered and equipment, the S-OHIP score of the VDS attendees was low and closely similar to the OHRQoL of the adult population in Selangor, indicating that they had good OHRQoL.

Keywords: Visiting Dental Service, Oral Health-Related Quality of Life, Short Oral Health Impact Profile (S-OHIP)

PG34

Internet Use, Online Health-Seeking Behaviour and eHealth Literacy Among Dental Auxiliaries in Pahang, Malaysia

**Zaberi ZS, M Nor NA, M Nazari NS*

Objectives: This study aimed to investigate the internet use, online health-seeking behaviours, eHealth literacy and factors associated with eHealth literacy among dental axillaries in Pahang, Malaysia.
Materials and Methods: This was a cross-sectional study using an online questionnaire involving dental auxiliaries (namely dental surgery assistants, dental technologists and dental therapists) working at government dental clinics in Pahang (n=466). The questionnaire was distributed via Google Form collecting information about socio-demographic, internet use, online health- seeking behaviour, and perceived health status. Data were analysed using descriptive, ANOVA and Kruskall-Wallis tests.
Results: A total of 456 respondents completed the questionnaire (response rate= 97.5%). The majority were female (76.3%) with the mean age of 36.34±7.62. More than half of the respondents were dental surgery assistants (53.5%). About 54.6% spent 1 to 4 hours browsing internet daily. Most of them (55.9%) relied on health personnel for health-related information, while the remaining searched information from social media (23.5%) and search engines such as Google (20.6%). Majority of respondents (95.6%) trusted the information provided on the internet with 80.3% expressed that the information obtained affected their decision. Mean eHealth literacy was 30.53±3.94. High eHealth literacy (eHEALS ≥26) were significantly associated with frequency of health information search ($p<0.001$), perceived having good health status ($p=0.003$) and perceived having good oral health status ($p=0.023$). Respondents with diploma and degree had better eHealth literacy than those with certificate level of education however, the difference was not statistically significant ($p=0.059$).
Conclusions: Most of the dental auxiliaries were active internet users and frequently utilised internet for health information. Frequency of health information search and better self- perceived health status were factors associated with higher eHealth literacy score among studied population. Findings indicated that dental auxiliaries had good eHealth literacy, suggesting an opportunity of integrating digital health into provision of dental services for better oral healthcare delivery.

Keywords: eHealth literacy, eHEALS, internet use, dental auxiliaries.

PG35

Comparative Study of Flaxseed (*Linum Usitatissimum*) Extract; Water and Ethanol, on Human Oral Fibroblast Cell Activity

**Sama NS, Khairani IM, Solachuddin JAI, Basma Ezzat MA*

Objectives: the objective of this comparative study is to extract flaxseed (*linum usitatissimum*) plant using two types of medium using the same extraction method then to determine the main component of each extract and lastly to investigate the effect of two types of flaxseed extract on human oral fibroblast cells.
Method: *L. usitatissimum* is extracted using ethanol and water separately via soxhlet extraction method, then gas chromatography mass spectrum (GC-MS) is used to illustrate the components of *l. usitatissimum* extract. After that 3-(4,5-dimethylthiazol-2- yl)-2,5-diphenyl tetrazolium bromide (MTT) eassay is used to assess the human oral fibroblast cell viability in three different time lines.
Results: the results indicate higher yield of *l. usitatissimum* when extracted with ethanol compared to water, GC-MS illustrate the major component present in *l. usitatissimum* extract such as lionolic acid and olic acid, the effect of ethanol and water flaxseed extract on human oral fibroblasts cell line is demonstrated using MTT assay where the results shows a lot of variations in the numbers between the three time lines used (24-48 and 72 hours) *l. usitatissimum* ethanol extract show higher and faster proliferation effects when compared to *l. usitatissimum* water extract with a *P* value of <0.05 at 95% confidence interval.
Conclusion: In general, based on the results obtained it is safe to say that flaxseed (*l. usitatissimum*) is safe and can promote high cell proliferating effects on human oral fibroblast cell line especially when extracted using ethanol as a medium of extraction.

Keywords: *L. usitatissimum*, GC-MS, MTT

PG36

The Use of Smartphone Image to Identify Gingivitis. Is it Feasible?

** Ismail A, Awang R.A., Abd. Rahman N., Hasan A.*

Introduction: Gingivitis is defined as inflammation of the gingiva that is commonly presented by redness of the gingival margin, which may be associated with swelling and easiness of bleeding. The progression of teledentistry has been in the collateral manner as the extensive growth of

smartphone technology that includes producing a high-quality photo for personal or professional usage. A smartphone image was shown to be used in diagnosing oral diseases such as carious lesions, dentoalveolar trauma and cancerous lesion. **Objective:** To compare the smartphone photo-based method with a clinical oral examination in diagnosing gingivitis.

Methods: This was a cross-sectional study involving 87 secondary schoolchildren with a median age of 14. There were 55 (63.2%) girls and 32 (36.8%) boys who agreed and consented to the guardian to participate in this study. Clinical examination was carried out using a non-invasive procedure called Modified Gingival Index (MGI), followed by smartphone photo-based procedures, which were taken using a standardized protocol. The photos were evaluated for the presence of gingival redness and swelling

Results: Clinically, 31.0% of schoolchildren presented with gingivitis, with more girls (55.6%) than boys (44.4%). The percentage of gingivitis was found to be at 27.6% when evaluated using a smartphone photo-based procedure, which was not significantly different from clinical examination (p=0.674). The smartphone photo-based also showed a significant difference in detecting gingivitis and healthy cases (p=17.483).

Conclusions: This data indicates that the smartphone photo-based method is feasible for identifying gingivitis from healthy gingiva using a perfectly standardized photo.

Keywords: Smartphone photos, teledentistry, gingivitis

PG37

Association between Dental Caries Status and Body Mass Index of Children from High Socioeconomic Families from Two Preschools in Kuantan

M Zaki R, Nina SA, A Faisal I

Introduction: The association between dental caries and body mass index (BMI) in children has been researched extensively. The socioeconomic status of the families plays a significant role in determining the BMI and caries status of preschool children.

Problem Statement: Preschool children's dental caries and BMI statuses are of concern among parents, not excluding those from high socioeconomic families. However, the findings in previous research that relate socioeconomic status with dental caries and BMI have been shown to have contradictory results.

Objective: This study aimed to examine the association between dental caries and the BMI statuses among preschool children in two preschools in Kuantan, with particular attention given to children from families with high socioeconomic backgrounds.

Methods: Socioeconomic data of the children's families sending their preschool children to two preschools in Kuantan were obtained using a questionnaire. Dental caries was evaluated by a paediatric dentist according to the decayed, missing, and filled teeth (dmft) index. Statistical analyses were performed using an online statistical calculator.

Results: A total of 55 Malay preschool children were sampled, and 29 (52.7%) of them were from high socioeconomic families based on Pahang's 2019 mean household income as reported by the Department of Statistics Malaysia. These 29 children ranged from 3 to 6 years old, consisting of 16 (55.2%) male children and 13 (44.8%) female children, with a mean BMI of 15.8 (range = 11.1 – 25.5), mean dmft of 3.72 (range = 0 – 10), and mean families' household income of RM11,913.79 (range = RM8,000 – RM30,000). A Kruskal-Wallis test showed a significant association between dmft, socioeconomic backgrounds, and BMI of the preschool children, H (2) = 76.45, p < 0.00001.

Conclusion: Dental caries and BMI status of preschool children from high socioeconomic families had a significant association with their families' household income.

Keywords: Dental Caries, Body Mass Index, Preschool Children, High Socioeconomic Status

PG38

Comparison of The Tooth Cusp Area Measurement Between 2D and 3D Imaging Methods

**Riaz S., Khamis M.F., Ahmad W.M.A.W., Abdullah J.Y.*

Introduction: Multiple studies have been conducted on cusp area of the teeth using 2D measurement methods while there is lack of 3D data for cusp area measurement.

Objectives: To compare the 2D and 3D imaging methods of tooth cusp area measurement for method validation.

Methods: Forty-eight cusps of maxillary posterior teeth from two dental casts were measured using 2D-Hirox and 3D-Next Engine Laser Scanner. Data were analysed using paired t-test. Significance level was set at 0.05.

Results: 3D area measurements were statistically significantly larger than 2D measurement (p<0.01).

Conclusions: 3D measurements captured the polygon-shaped tooth cusps and the height of the

object true area thus better in term of validity of the method.

Keywords: Cusp area, 2D, 3D, imaging.

PG39

Impact of COVID-19 Pandemic on Malaysian Dental Practitioners and Dental Therapists

**N Baiti B, Norashikin Y, Nawwal AMR, Izyan HB*

Introduction: The unprecedented COVID-19 pandemic has brought significant impact on global healthcare system including oral health services. Oral healthcare workers' relatively close contact with their patients in the clinical setting coupled with aerosol production during most dental procedures have exposed them with an enormous risk of COVID-19 infection.
Objectives: This study aimed to assess the clinical practice and emotional consequences of COVID-19 pandemic on government dental practitioners, private dental practitioners and dental therapists in the Northern Zone of Malaysia.
Methodology: An online validated questionnaire was administered to 456 participants to explore issues regarding the clinical practice during the pandemic, their emotional perception, the supports needed and the perception of future challenges and improvement in the field of dentistry following the pandemic.
Results: A total of 360 respondents (78.9%) consisting of 130 government dentists, 78 private dentists and 152 dental therapists participated in this study. Majority of the respondents, (88.3%) had a good clinical practice adherence during COVID-19 pandemic with (99.2%) of them aware and complied to the relevant guidelines of dental services during the current pandemic. About (68.6%) of the respondents experienced high emotional distress due to this pandemic. Government dentists were less likely to have emotional distress compared to dental therapists (Crude OR=0.52; 95% CI = 0.31-0.86). Private dentists raised concern of having financial problems, losing job and possibility of terminating their employees. Most of the respondents required support from dental associations and financial institutions during this pandemic.
Conclusion: Dental practitioners and dental therapists in the Northern Zone of Malaysia revealed a good clinical practice but majority of them had high emotional distress due to this pandemic. This highlighted the need for relevant changes and possible interventions in coping with emotional distress among oral healthcare workers to enhance safe and quality services to the public.

Keywords: COVID-19, dentists, dental therapists, clinical practice, emotional impact

PG40

Geometric Morphometrics Analysis of Hard and Soft Tissues in Different Skeletal Relations

**Tamana S, Nagham M. AJ, N Hafizan N, Aspalilah A*

Introduction: The traditional measurement of malocclusion relies on cephalometric techniques. Nowadays, the geometric morphometric method is used in biology for shape analysis and could provide better perception and capabilities of measuring the size and shape variations of malocclusion.
Objectives: This study aims to investigate the size and shape variations of the hard and soft tissue patterns in different skeletal relations in adult Malays using the 2-dimensional (2D) geometric morphometrics method from lateral cephalograms.
Method: 188 lateral cephalograms of Malaysian Malay (age18–40) were collected and comprised of Class I, II, and III skeletal relations with 117 females and 71 males were collected for all analyses. A total of 21 2- dimensional hard and soft tissue landmarks were applied on lateral cephalograms using tpsDig2 software. The MorphoJ software was used for the data analysis. The data were further analysed for shape variation according to skeletal relations and gender groups.
Results: Skeletal relations (Class I, II, and III) showed 38 Principal Components (PCs) which indicated that variances existed in 38 different dimensions, while the variability of soft and hard tissue patterns were separately described by 18 PCs and 16 PCs, respectively. Centroid size was significantly different in genders and skeletal relations by Procrustes ANOVA (p<0.01). Canonical variate analysis showed the highest Mahalanobis and Procrustes distances between Class II and III among skeletal relations and between males and females (P< 0.0001). The B-point, Pogonion, menton, Gonion, Condylyion, soft tissue Pogonion, and soft tissue Gnathion showed the most obvious variance from the mean. Wireframe models for the different skeletal relations were created.
Conclusion: The results of our study provided novel wireframe models for soft and hard tissue patterns of Class I, II, and III skeletal relations. Those models of wireframe could be used as a guide in diagnosis and treatment planning by orthodontists and maxillofacial surgeons.

Keywords: Skeletal patterns, Geometric morphometrics method, Soft tissues

PG41

Mandibular Second Molar Distal Caries in The Presence Of An Impacted Mandibular Third Molar: A Retrospective Study

**A Azim AAA, N Sakina MN, N Hayati A, Lim GS*

One of the impacted mandibular third molar (MTM) complications is distal caries in mandibular second molar (MSM) which can eventually lead to early loss of MSM. The objective is to find the correlation of dental caries in MSM with the presence of impacted MTM and to identify its associated risk factor. The patients' dental records with DPT imaging at Faculty of Dentistry, University Malaya were studied retrospectively. Five hundred eighty-three DPT images of MTMs out of 337 patients were evaluated. The presence of MSM distal caries, patient's gender and age, impaction depth and angulation of MTM and the distances between distal MSM and mesial MTM were assessed. Pearson Chi square test was performed on the data set. Out of 337 patients (136 men and 201 women), 71.8% (n=242) were between 25-29 years of age. According to this study result, the overall incidence of caries on distal aspect of MSM was 24.7%. The highest caries incidence observed was in mesioangular impacted MTM, which is 34.1%(n=91). Majority of the caries incidences found were Level A and Class II as per the Pell and Gregory classification, 27.9% and 27.0% respectively. The highest distance percentage between distal MSM and mesial MTM was 0.40-0.69cm (31.9%) of the caries group. Age is statistically significant associated to the distal caries on MSM ($P < .0001$). The highest age group contributed to the caries incidence was between 25-29 years old which was 59.0% (n=85). As the incidence of distal caries in MSM is significantly associated with age group, frequent monitoring, or prophylactic removal of MTM should be proposed when the distance of mesial impacted MTM and distal MSM is around 0.40-0.69cm, and MTM is mesially angulated with Level A and Class II.

Keywords: impacted third molar, dental caries, second mandibular molar, factor

PG42

The Utilization of Innovation as a SULAM Teaching for SCD Training during COVID-19 Pandemic

**Aminda FO, T Yasmin IMS, Mas SA, M Isyrafuddin I, Ilham WM*

Introduction: The concept of SULAM (Service Learning Malaysia-University for Society), which advocates for service/community-based learning, was developed by the Ministry of Higher Education, as one of their High-Impact Educational Practices. This concept was adopted in the teaching and learning of Special Care Dentistry (SCD) at Universiti Teknologi MARA, via the conduct of group innovation project.

Objectives: This study was undertaken to analyse the student's perceptions, and the impact, of SULAM teaching for SCD training during the COVID-19 pandemic.

Methods: All final-year dental students (n=90) were divided into 8 groups to develop innovative products for different categories of SCD patients. At the end of the project, students were invited to answer a validated online feedback survey on their perceptions of the SULAM activity. Quantitative data were analysed using SPSS for frequency, while qualitative data were analysed via thematic analysis.

Results: A total of 82 students (Response rate= 91.1%) responded to the survey. Most students agreed that the activity was interesting (90.2%), improved their understanding of SCD (89.0%), allowed interaction (90.2%), supported sharing of ideas and experience (97.6%), encouraged student-lecturer interaction (95.7%) and enhanced knowledge integration and application (93.9%). Nevertheless, half of them (53.7%) felt neutral about having an increased workload from this activity. Students expressed that the learning activities were beneficial in enhancing creativity and innovation, improving knowledge and understanding of SCD, instilling interest and positive attitude towards learning SCD, and encouraging teamwork. However, a few students noted facing some limitations in completing their projects (technological challenges and reduced physical access to purchase materials). There were differing perceptions in terms of time and financial commitments, as well as supervisors' and patients' involvement during the project development process.

Conclusion: Students perceived that the SULAM-based innovative project was beneficial in multiple aspects of SCD training during the COVID-19 pandemic.

Keywords: SULAM, special care dentistry, pandemic

PG43

Impact of Innovative Online Peer Learning Approach to Special Care Dentistry Training during COVID-19 Pandemic

**T Yasmin IM S, Aminda FO, Ilham WM, Aida NAAR, Mas SA*

Introduction: Restrictions of face-to-face learning in dentistry due to COVID-19 pandemic indicates the need for development of an innovative educational intervention, including in the teaching of Special Care Dentistry (SCD).

Objectives: This study was undertaken to analyse the impact, and students' perceptions, of online peer learning (OPL) in SCD training during the COVID-19 pandemic.

Methods: A descriptive cross-sectional quantitative and qualitative study employing a vetted online pre- and post- intervention quiz involving all final year undergraduate dental students from Universiti Teknologi MARA was done as well as a validated feedback survey of the OPL activity following a seminar conducted by two SCD postgraduate students. Quantitative data were analyzed via paired t-test using SPSS (significance level, $p<0.05$). Qualitative data were analysed via thematic analysis.

Results: A total of 68 (Response rate= 75.6%) and 81 (Response rate= 90.0%) students completed the quiz and the feedback survey respectively. There was a significant difference in the students' total mean scores, and mean scores of 7 individual items (out of 10) from the quiz following the OPL session. Most students (86.5% to 97.5%) indicated positive reviews in multiple aspects of the OPL session, while only some students rated feeling discouraged to ask questions (1.2%) and noted punctuality issues (3.7%). Students perceived that the OPL session was useful in terms of its 1) comprehensive content (supplement revision), 2) preparation process experience (enhance creativity, encourage teamwork), 3) technology used in teaching (promote interactivity, stimulate interest) and 4) involvement of lecturers in giving feedback (improve knowledge, allow critical thinking).

Conclusion: Students responded positively to OPL as an innovative approach to SCD training during the COVID-19 pandemic.

Keywords: peer learning, special care dentistry, training, pandemic

PG44

Exploring the Usability of MySmile App as an Oral Health Education Tool Among Adolescents: A Qualitative Study

**Ab Mumin N, Yusof ZYM, Marhazlinda J, Obaidellah U*

Introduction: Health-related smartphone application (app) is gaining popularity as one of the ways to assist patients in managing their health. Realising the potential benefit of smartphone apps in promoting oral health, the MySmile app was developed by the Faculty of Dentistry, Universiti Malaya to help adolescents gain oral health knowledge while improving their oral health behaviours. However, developing an app without considering its usability may risk the target users' expectations, hence could affect the app's performance and efficacy.

Objective: This study aims to explore the usability of the MySmile app (beta version) as an oral health education tool among adolescents in Selangor, Malaysia.

Methods: Thirty students (Form Two (14-year-old) and Form Four (16-year-old)) from two secondary schools in the Petaling district, Selangor were recruited to use the beta version of MySmile app for 14 days. After this period, four online focus group discussions were conducted via Google meet using a semi-structured topic guide developed based on the Technology Acceptance Model (TAM). Data were coded in the NVivo software and analysed using the framework method analysis.

Results: Two main themes were developed based on the constructs of TAM, 1) perceived ease of use and 2) perceived usefulness. The students find the MySmile app as easy to use, however preferring it to be bilingual. Three additional themes that emerged are 3) information receptivity, 4) intention to use, and 5) suggestions from users.

Conclusions: To develop an acceptable, usable, and appropriate app for the target user, assessing the usability of MySmile app as an oral health education tool is critical during an app development phase. Identifying the users' satisfaction would increase the chances of app being installed and used, reflecting an increased conversion rate. Findings gained from this study will be used to refine the present version of the MySmile app.

Keywords: adolescents' oral health, oral health education, smartphone application, mHealth intervention.

PG45

A Comparative Study on Mandibular Premolar Root Canal Morphology Employing CBCT and Micro-CT Imaging.

**Khor CP, Phrabhakaran N, Kacharaju KR*

Introduction: The present study was to investigate the root canal morphology of mandibular premolars in the Malaysian population using CBCT and micro-CT scanned images.
Methods: Sixty selected mandibular premolars were evaluated in-vitro and the root canal morphologies of the samples were categorized based on Vertucci's classification. The position of apical foramen, presence, and location of the lateral canal, as well as the prevalence of apical delta, were also determined.
Results: Invariably Type I variety (Vertucci's classification) was the most frequent root canal morphology followed by Type V, Type III, based on micro-CT imaging. CBCT investigation also revealed Type I as the most numerous, however, the second most common configuration was Type III followed closely by others. There was a moderate agreement in Vertucci's classification of root canal configuration and also the prevalence of apical delta (kappa 0.516 and 0.550, respectively). However, only a fair agreement (kappa 0.289) was observed between CBCT and micro-CT on the prevalence of the lateral canal.
Conclusion: CBCT should be cautiously used in determining root canal configuration as deficiencies were evident and revealed by Micro-CT imaging.

Keywords: CBCT, micro-CT, root canal, morphology, lateral canal, apical delta.

PG46

Comparative Evaluation of the Dentinal Thickness Using Different Retreatment Techniques: A Cone-Beam Computed Tomography Study

**Subramanian P, Ibrahim M, Giriyapura D, Nambiar P*

Introduction: There are numerous studies available on the comparison of efficiency in retreatment between hand and rotary files. However, the data regarding the difference in dentinal thickness before and after retreatment using different instrumentation is insufficient. Therefore, the purpose of this study is to evaluate the remaining dentin thickness after performing different retreatment techniques.
Methods: Twenty maxillary central incisors were cleaned and shaped with the ProTaper Next and obturated. The dentinal thickness was measured from the axial views in the CBCT images at 0mm,5mm,10mm, and 13mm from the radiographic root apex. The teeth were then randomly placed into four groups, employing different systems to remove the gutta-percha. The systems that were used were Hedstrom file without xylene, Hedstrom file with xylene, ProTaper Universal Retreatment files without xylene, and ProTaper Universal Retreatment files with xylene. The images for post retreatment samples were captured again using CBCT and dentin thickness was measured at the respective distance from buccal, palatal, mesial, and distal from the center of the canal at each side. Wilcoxon Signed-Rank test and Kruskal-Wallis test with the significance level set at, p=0.05 was used for statistical analysis.
Results: Group 1 showed a significant difference in the dentinal thickness pre and post-retreatment at 0 and 5mm ($p < 0.05$). Group 2 and 4 which were the groups with xylene showed a significant difference in the dentinal thickness at 5 and 13mm. Group 3 only showed a significant difference at 0mm. However, the overall changes in the dentinal thickness for all four groups appeared to be insignificant.
Conclusion: H-files and ProTaper Universal Retreatment files, with or without xylene were effective in the removal of the obturating material in root canal retreatment. ProTaper Universal Retreatment system without xylene, when comparing pre- and post-retreatment, showed the least amount of changes in dentinal thickness.

Keywords: Root canal retreatment, dentinal thickness, CBCT

PG47

Quantification and Correlation of Trabecular Bone Microstructure Parameters in Cone Beam Computed Tomography for Bone Age Estimation - A Preliminary Study

**Arishiya TF, M Yusmiaidil PMY, N Hidayah R*

Introduction: Studies pertaining to age-related changes in the jawbones in humans are limited and very little is known about their intrinsic strength determinators. Emphasis is laid on the Trabecular Bone Microarchitecture (TBM), because studies have proved that the complexity of the TBM imparts more strength than other determinants. Quantitative methods prove to be far superior because they rely on geometry and architecture. Hence quantifying the TBM by non-invasive imaging would be the method of choice. Previous studies have focused on the quality of bone, but the paradigm has shifted and demands assessment of each case individually for quantitative analysis by Cone Beam Computed

Tomography (CBCT). Hence this study has been designed to assess the TBM parameters viz. trabecular number (Tb.N), trabecular thickness (Tb.Th), trabecular separation (Tb.Sp), and bone volume fraction (BV/TV (%)).
Objective: To correlate each of the TBM parameters (Tb.N, Tb.Th, Tb.Sp, and BV/TV) to an individual's chronological age and gender.
Methods: 20 CBCT scans were retrospectively collected from a database of adult patients age 22 to 43 years old attending the dental clinic. The DICOM images of CBCT scans were post-processed, transformed, segmented via a novel semi-automatic threshold-guided approach and reconstructed using the AnalyzeDirect 14.0 software and subjected to bone microarchitecture assessment. Further, TBM parameters were derived and statistical analysis was done using a 2-tailed Pearson correlation test.
Results: In the current pilot study, all parameters showed no significant correlation (p>0.05) with chronological age and gender, respectively. However, a statistical significant negative correlation (r = -0.489) was observed between Tb.N and chronological age (p< 0.029).
Conclusions: In the current study, only Tb.N showed negative correlation with chronological age. However, it was conducted to analyze the sample size, intra- observer variability and to evaluate the feasibility of methodology. To derive definite conclusions, a stratified sample based on each age interval is intended.

Keywords: Cone-Beam Computed Tomography; trabecular bone; microstructure parameters; chronological age

PG48

Assessment of Root Volume, Three-Dimensional Airway Volume and Quality of Life of Obstructive Sleep Apnea Patients Following Monoblock Treatment

**Z Adnan MAM, M Razi R, Ibrahim N, M Yusof ZY, Abu BMZ*

Objectives: This study assessed the changes in root and oropharyngeal airway volume using CBCT images and evaluated the Quality of Life (QoL) changes in patients diagnosed with mild to moderate obstructive sleep apnea after treatment with mandibular advancement appliance (MAA).
Methods: Ten mild to moderate OSA patients were recruited from a previous study which had been diagnosed with polysomnography (PSG). Patients were given a monoblock MAA with 60% of maximal mandibular protrusion and 5mm anterior vertical opening between upper and lower incisors, to be worn every night during sleep. Cone beam computed tomography (CBCT) were taken before starting treatment, at 6-month, 12-month, and 18-month without wearing the MAA. Root and oropharyngeal airway volumes were analysed and calculated using Materialise Interactive Medical Imaging Control System (MIMICS). Quality of life changes were measured using validated Malay translated Sleep Apnea Quality of Life Index (SAQLI) questionnaire at pre-treatment, 6-month, 9-month, 12-month and 18-month intervals. All study parameters were analysed using repeated measures analysis of variance (ANOVA) test in SPSS 26 with statistical significance level set at $p < .05$.
Results: Ten patients were initially recruited. By the end of the observation period, only six patients remained with eight subjects dropped out. There were no significant changes to the volumes of the roots and oropharyngeal airway ($p > .05$). There was significant improvement in the mean QoL score when the MAA was actively worn which was mainly contributed by SAQLI Domain A (daily functioning) ($p < .05$). The intra- and inter-correlation coefficient for root and airway volume measurements were excellent (ICC >0.80).
Conclusion: MAA does not change the oropharyngeal and root volumes in mild to moderate obstructive sleep apnea patients. Oral appliance treatment can improve the QoL of sleep apnea patients.

Keyword: Obstructive Sleep Apnea, mandibular advancement device, airway volume, root volume, Sleep Apnea Quality Of Life Index.

PG49

Student's Performance on Innovative Online Learning Through Peers in Orthodontics

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Introduction: Learning Through Peers (LTP) was designed to be a value-added session to enhance student's competence in clinical management, while instilling teamwork among peers. During the COVID-19 'Movement Control Order' period, the online LTP program has been developed as an innovative pedagogy to provide students with continuous learning in clinical patient care as an alternative of face-to-face learning.
Objectives: This study was undertaken to investigate the academic performance of undergraduate students in orthodontics, following LTP.
Methods: A peer learning session consisted of two webinars and case discussions entitled 'removable

appliance' (topic 1) and 'examination and diagnosis' (topic 2) were conducted by postgraduate students enrolled in Master of Science in Dentistry to the year 3 and year 4 undergraduate dental students respectively. A quiz related to the topic given was administered post-intervention after one week to the students attended the webinars and to the other clinical students from Universiti Teknologi MARA who did not attend the webinars. Descriptive analysis was done with one way ANOVA with Tukey's post hoc test using SPSS version 28.0 (significance level was set at $p<0.05$).

Results: A total of 130 students sat for the quiz for topic 1 and topic 2. It was found that the intervention groups for topic 1; year3 performed better than the year4 in the quiz with significant difference of (p=0.013) and mean score of 82.9%, 72.9% respectively, but not significant with year5 (p=0.065) with mean score of 75.3%. For topic 2, intervention group (year4) performed better with highly significant difference compared to the year3 (p=0.00); mean score of 77.7%, 54.3% respectively but not significant with the year5 (p=0.221) with mean score of 83.3%.

Conclusion: Online peer learning is an effective novel pedagogy to boost student's performance of clinical knowledge during the COVID-19 pandemic to supplement clinical teaching in dentistry.

Keywords: peer learning, orthodontics, performance, pedagogy, COVID-19

PG50

Mapping The Distribution of Reticulated Water Fluoride and Caries Trends Among Children in Pahang

**Arif BM, Bohari NF, Hassan EH, Sharif S*

Objectives: The aims of this study were to identify the spatial pattern of the fluoridated public water supply and the effect on the caries trends of the 6-year-old children in Pahang, to test the hypothesis that diminished level of fluoride to suboptimal range in water supply increases the caries experience among the children.

Methods: Fluoride level readings in the water supply from each water treatment plant from 2015 to 2019 of all the xx districts in Pahang were collected from the Pahang State Health Department. Caries data of the 6-year-old children from 2015 to 2019 in Pahang were obtained from the government school dental services. The coordinate of each water treatment plant (WTP) was obtained from Google Maps. All the data were imported to the Quantum GIS (QGIS) software to be integrated and finally extracted to Microsoft Excel and SPSS for data analysis.

Results: The distribution of all WTPs with fluoride feeders were scattered throughout all districts of Pahang centrally and all the WTPs had suboptimal fluoride range (0.4 ppm) since the year of 2018. The least fluoridated area with 0 ppm of fluoride in the water supply were in the district of Kuantan, Bera, Rompin and Cameron Highlands. The caries prevalence of the 6-year-old children in Pahang from 2015 to 2019 were increased from 42.1% to 42.9%. In 2019, the caries prevalence of the permanent dentition of the 6-year-old children was 97.39% with the mean dmft of 2.45 (SD=±1.29). The district of Rompin had the highest mean dmft index among the 6-year-old children in 2019 (3.74) compared to the mean dmft of Pahang (2.45).

Conclusion: All WTPs in Pahang has diminished fluoride level to suboptimal range and may contribute to the increase of caries experience in the primary and permanent dentition of the preschool children.

Keywords: water treatment plant, Quantum GIS.

PG51

Accuracy of Dental Age Estimation Methods in Children with The Chromosomal Syndrome: A Systematic Review and Meta-Analysis

**Ismail N, Mokhtar IW, Yusof MYPM*

Introduction: The influences for timing and sequence of dental eruption may occur due to localized dental conditions, specific systemic conditions, and genetic predisposing.

Objectives: The study aims to systematically examine how accurate the application of different dental age estimation methods on children with chromosomal syndromes and evaluate its performance based on various populations and regions.

Methods: A systematic search of the literature applying the PRISMA-NMA-compliant method was conducted using the databases PubMed, Web of Science, Science Direct, Google Scholar, and Scopus between 1981 to 2020; that estimate dental development of children with chromosomal syndrome based on populations, interventions, comparisons and outcomes (PICO) search strategy identified. The literature quality was assessed using MINORS. A network meta-analysis was performed to compare the effects of different dental age estimation methods on the accuracy of estimated dental age. Standardized mean differences were calculated for the difference of dental age to chronological age by using the random-effects model.

Results: From 60 titles retrieved utilizing standardized search strategy, 45 titles met the qualitative analysis criteria, and 29 titles qualified the quantitative analysis requirements. Twenty-four comparative studies and twenty-one non-comparative studies suggested five DAE methods within this population used in combination or alone namely Demirjian, Willems, Nolla, Haavikko, and London Atlas. Down's syndrome is the highest contributing literature relating the DAE and chromosomal syndrome.

Conclusions: Current literature does not demonstrate which of the DAE method that is most accurate as the majority of the included articles utilized Demirjian's method in their studies. The differences in the means between chronological age and dental age are statistically significant for the Demirjian method.

Keywords: dental age, dental maturity, chronological age, children, chromosomal syndromes

PG52

Validation of Deep Neural Network for Age Estimation in Malay Children Using Digital Panoramic Dental Imaging

**Norhasmira M, Anuar MM, Rohana A, M Yusmiaidil PMY*

Introduction: The influx of irregular migrants entering Malaysia has been worrying, especially during this pandemic era. The chronological age of an individual is one of the critical pieces of evidence required by the authorities when sentencing criminals. Estimating the age of the deceased bodies at the forensic scene is also essential in some instances. Demirjian's technique is one of the most frequently used method to establish an individual's age. The technique requires professionals to manually rate all seven permanent mandibular teeth using panoramic dental imaging in accordance with the designated atlas. However, the existing technique can be a complicated procedure for a large-scale incident requiring a greater number of forensic identifications, particularly during mass disasters and the continuing Covid-19 pandemic. As a result, the existing technique entails a large number of specialists, which increases workloads and lengthens the identification process. The present practice is also arguably biased toward subjective grading, as dental age assessment is performed manually by forensic odontologists using a scoring system.

Objectives: This study aims to perform the automated dental staging system based on the Malay children population and used a brain-inspired learning algorithm termed deep learning.

Methods: The methodology is comprised of four steps: image preprocessing, which adheres to the inclusion criteria for panoramic dental radiographs, segmentation and classification of mandibular premolars according to Demirjian's staging system using the Dynamic Programming-Active Contour (DP- AC) method and Deep Neural Network (DNN), respectively, and statistical analysis.

Results: The DNN approach outperformed the standard age estimate method with comparatively low mean error (ME) values and introduced additional sub-stages of stages D_1, D_2, D_3, D_4, and D_5.

Conclusion: The automated system based on the machine learning application imply exact reproducibility. Also, the overall performance of the presented automated technique to stage mandibular premolars development was similar to staging by human observers.

Keywords*:* Forensic odontology; Dental age estimation; Demirjian's method; Premolars; Deep learning

CONFERENCE ABSTRACTS
RESEARCHER

R1

Gonial Angle and Its Association with Mandibular Residual Ridge Resorption in Implant-Overdenture Patients

**Dr. PL. Ranganayakidevi S. Palaniappan, Prof. Dr. Norsiah Y, Associate Prof. Dr. Norliza I, Dr. Siti FA*

Introduction: The demand to treat edentulous patients who are having problems wearing conventional complete dentures using implant-retained overdenture is increasing. Even though implant-supported overdenture patient encounters lesser bone resorption compared to conventional dentures, the event of contraction still occurs. To assess the amount of predictable bone resorption, the gonial angle may serve as a guide in clinical evaluation.

Objectives: To investigate various methods of gonial angle measurements and to determine the association between gonial angle and residual bone resorption in edentulous patients provided with implants overdenture.

Methods: Twenty-three patients wearing maxillary complete dentures opposing mandibular implant overdenture prosthesis were recruited. The posterior ridge resorption was measured using the proportional area index method, whereby the dentopantomograph (DPT) of pre- and 4 years post-implant placement of these patients were compared. Mandibular gonial angle measurements were done on 5 out of the 23 patients using four measurement methods: (i) Two different vertical line tracing points on DPT (exterior border points and mid-condylar points), (ii) Manual measurement on 3D printed mandibular model using goniometer, (iii) Lateral cephalometric view of CBCT using Mimics software. The results from each measurement method were then compared.

Results: Strong association between CBCT measurements and both DPT measurement methods (R2 = 0.927, 0.829), but weak association between CBCT and the manual measurement on the 3D printed models (R2 = 0.098). The posterior ridge resorption in implant overdenture patients showed no correlation with gonial angle ($r < 0.3$, $p>0.05$) as measured on DPT images.

Conclusion: No significant difference between the different gonial angle measurement methods was observed in this study. No correlation between the mandibular gonial angle and posterior mandibular bone resorption was found.

Keywords: Overdenture, Bone resorption, Dentopantomograph, Gonial angle

R2

Perception of Smile Attractiveness Among Patients

**Lau XL, Betsy ST*

Introduction: The perception of smile attractiveness is very subjective and is dependent on one's personal preference or acceptance. The disagreement reported in the literature between the smile esthetic perception of a layperson and the opinion of a professional has made the clinician focus more towards the patient's preferences and perception in order to increase patient satisfaction.

Objective: To understand the concepts of smile attractiveness in different ethnic and age groups among patients visiting MAHSA University student clinic.

Methods: Ideal smile created using Adobe Photoshop was altered in various increments using variables in relation to incisal edge position, maxillary gingival display, black triangle in between maxillary central incisors, midline diastema, vertical lip thickness of the upper lip and crown width of maxillary central incisors to produce 6 sets of smiles with 6 photos in each set. All photos were distributed randomly to 252 participants of different age and ethnic groups who fulfilled the inclusion criteria to score the attractiveness of each smile using a 5-point visual analogue scale. A Chi-square test was used to analyze the responses of patients in each ethnic and age groups.

Results: Significant difference was noted in the perception of smile attractiveness among all the three ethnic groups evaluated on the maxillary gingival display, the black triangle between maxillary central incisors and midline diastema, with no difference in age groups.

Conclusion: Obtaining a beautiful smile is always the main objective of any aesthetic dental treatment. The difference in the perception of smile attractiveness among the different ethnic groups emphasizes that the concept of beauty might not be congruent among all the patients. Hence the success of any aesthetic treatment depends on identifying patients' perceptions of the need, expectations and preferences.

Keywords: perception, smile, esthetics

R3

Platelet Rich Fibrin in The Treatment of Infrabony Defects. A Randomized Control Trial

Betsy Thomas

Introduction: Platelet rich fibrin (PRF) described by Choukroun is a second-generation platelet concentrate enriched with platelets and growth factors and has shown to stimulate proliferation of osteoblasts and periodontal ligament cells. These actions of PRF on specific cells may be harnessed for periodontal regeneration. The promising results reported in sinus floor augmentation and healing of extraction sockets prompted the use of PRF in regeneration of periodontal tissue in infra bony defects.

Objectives: The present study aimed to investigate the effectiveness of PRF in the treatment of infrabony defects in comparison with open flap debridement.

Material and methods: A single centered double-blinded and spilt mouth study design was conducted. 28 patients with 56 bilateral defects (28 per group) were randomized as PRF (Test group) or Open flap debridement alone (control group) in the management of infrabony defects. Evaluation of soft tissue and hard tissue parameters like pocket depth, clinical attachment level and bone defect were recorded preoperative and 6 months postoperative. Paired t-test was used to compare means between base line and 6 months in each group. Independent t-test was used for intergroup comparison of means at base line and after 6 months. A p value of 0.05 was statistically significant.

Results: The PRF group showed significant improvement in clinical parameters and radiographic assessment over control group at the end of 6 months.

Conclusion: From the clinical and radiographic point of view at 6 months after surgery, it can be stated that the use of PRF as the sole grafting material seems to be an effective modality of regenerative treatment for periodontal infrabony defects.

Keywords: Platelet rich fibrin (PRF), intrabony defects, growth factors, wound healing

R4

Orthodontics on Sale: Fixed Appliances on E-commerce Platforms

**Ong VX, Zakaria NN, Kamarudin Y*

Introduction: Orthodontic material, considered as medical device, must have its sales regulated to protect consumers. The sale of such product on e-commerce platforms, however, may go unchecked and compromise consumer safety.

Objective: This study aimed to investigate the sale of fixed orthodontic appliances on a local and global e-commerce platform.

Materials and methods: A cross-sectional analysis of orthodontic materials sold on Shopee and Amazon.com was done by conducting specific keyword searches for brackets, archwires and ligatures. The top 50 products for each keyword search were analysed, deleting duplicates and irrelevant search results, product name, type of product, seller, cost, star rating, number of reviews, number of sales, shipping location and brand identification were recorded. Brand registration with medical device regulatory bodies was checked. Data was tabulated in Google sheet and SPSS was used to generate descriptive statistics with frequency tables.

Results: A total of 800 search results were screened. 348 relevant search results were identified, with approximately two-thirds of the findings originating from Shopee. Ligatures resulted in the highest search results for both Shopee (39%) and Amazon.com (80%). Fixed orthodontic material sold on Shopee saw a larger number of reviews, higher star ratings and lower cost per item compared to those of Amazon.com. Products on Amazon.com were more likely to have brand identification (97%) compared to Shopee (5%). None of the identifiable brands on Shopee had registered with regulatory bodies, whereas eight products on Amazon had. A large portion of shipping locations originated from China for both e-commerce platforms.

Conclusions: Orthodontic brackets, archwires and ligatures are more readily available on Shopee compared to Amazon.com. The quality and safety of these products cannot be assured as most of the products were either not clearly labelled or their registration was not identified under regulatory bodies of medical devices.

Keywords: e-commerce, Shopee, Amazon.com, orthodontic material, fixed appliances

R5

Rheumatoid Arthritis Subjects are Associated with Subgingival Microbial Dysbiosis

Cheah CW, Al-Maleki AR, Vadivelu J, Vaithilingam RD

Introduction: Rheumatoid arthritis (RA) is an autoimmune condition characterized by synovial inflammation and destruction of the cartilage and

bone. Its aetiology is unclear, but bacterial dysbiosis at mucosal sites (i.e. oral, lung and gut) have been suggested to play a role in the production of autoantigens.
Objective: The objective of this study is to profile the subgingival microbiota of RA subjects using 16s rRNA next generation sequencing technology.
Methodology: RA subjects were recruited, and their periodontal conditions were examined. They were further grouped into periodontitis (PD), gingivitis (G) and periodontally-healthy (H). Their subgingival plaque samples were collected. Plaque DNA was extracted and subjected to amplification and sequenced on Illumina MiSeq targeting the V3-V4 region. The data obtained was processed and analysed on CLC genomic workbench. Bacteria composition for each RA subgroup was examined. Co-occurrence of bacteria in the community was explored qualitatively and presented as networks. Associations between bacterial genera with disease parameters were explored qualitatively using canonical correlation analysis.
Results: The bacteria community across groups were different in relative abundance. In the control group, NRA-H, the bacteria network was dominated by periodontal health-associated taxa; while for RA-H, RA-G and RA-PD, the network key genera consisted of both health-and disease-associated genera. Subgingival bacteria from RA-PD group presented as high inter-generic network. A clear pattern of correlation was observed in NRA-H, but mixed correlations were noted in the rest of the groups.
Conclusion: The presence of both health and disease-associated genera as network key-genera, and loss of clear correlation pattern with disease parameters in all RA subjects indicated subgingival microbial dysbiosis. The concurrent presence of both RA and PD conditions has multiplicative effects on the subgingival microbial community. Whether this may contribute to exacerbation of RA can only be confirmed with long term follow up of RA subjects.

Keyword: rheumatoid arthritis, subgingival microbiota, network, dysbiosis, periodontal

R6

Enhanced Virulence and Survival Abilities of Oral Microbiota are Dependent on The Oral Microbiome Shift in Periodontitis with Type 2 Diabetic Patients

**Anis RAM, Rathna DV, Jamuna V, Chia WC, W Harun HA*

Introduction: Type 2 diabetes (T2D) is an important and progressively widespread disease in the population. Moreover, T2D is associated with the rise in the occurrence and development of periodontitis. Complete analysis of the microbiome linked with periodontitis in T2D is seldom investigated, causing a marked gap in the role of the periodontal microbiome in diabetics.
Objective: This study aimed to investigate the global biodiversity of the human oral microbiota to characterize taxonomic composition and functional shifts of microbiomes.
Methods: Shotgun metagenomics will be used to investigate the microbiome of oral subgingival plaque of nine Malaysian adults with periodontal disease and T2D using the Illumina HiSeq platform. CLC Genomics Workbench software was used for clustering, taxonomic profiling and functional analysis.
Results: Consistent with many previous reports, the most common genus of the human oral microbiome are *Veillonella, Prevotella, Streptococcus, Leptotrichia, Actinomyces, Corynebacterium, Neisseria, Porphyromonas, Selenomonas* and *Fusobacterium*. It is interesting to note that while *Veillonella, Prevotella* and *Streptococcus* were the predominant family in patients with periodontal disease and T2D, the proportion of *Veillonella* and *Leptospira* to other major genus was more evenly distributed in patients with periodontally diseased and healthy T2D. In addition, *Capnocytophaga*, an opportunistic Gram-negative periodontal pathogen, was also found in the oral bacteria of these patients. Moreover, several genes implicated significantly in pathogenesis, virulence or pathways playing roles in disease were identified in periodontally diseased and healthy T2D compared to healthy controls.
Conclusion: This study highlights the potential complexity of the human oral microbiome comprising of various prokaryotes, as well as different viruses. Findings from this study will serves as a basis for future studies to investigate the interaction between oral microbiota, viruses, and diseases.

Keyword: Type 2 diabetes, periodontitis, shotgun metagenomics, sequencing, dysbiosis

R7

Influence of Technical Quality and Coronal Restoration on the Outcome of Root Canal Treatment

**Norazlina M, Faizah AF, Aws Hashim AAK, Azlan J, Siti HO, Aimi AA, A Azim AAAziz*

Introduction: Root canal treatment (RCT) and its coronal restoration need to be regularly assessed to ensure a successful treatment outcome.
Aim: To evaluate the technical quality of root canal fillings, coronal restoration (CR) and to determine the outcome of the RCT.
Methodology: 143 root treated teeth from 136 patients were evaluated through clinical examinations and periapical radiograph. The types and quality of coronal restoration were recorded. The technical quality of the root canal filling was assessed based on two variables: length and density. The frequencies and percentages of quality of RCT, CR and their association with apical periodontitis (AP) were also recorded. The data were evaluated using descriptive statistics and Chi-square test ($p<0.05$).
Results: The mean follow up period was 2.4 (SD=1.59) years. Acceptable root fillings and coronal restorations were found in 84.9% and 72.5% respectively. The dental crown procedure (50.7%) was the most placed post- endodontic restoration procedure done followed by composite (23.9%). 63.8% of the teeth were both adequately filled and restored. 64% of the teeth was classified as healthy with significant reduction of apical periodontitis from 70.3% pre-operatively to 36% ($p<0.001$). 92.1% of root fillings were of acceptable length, 5% underfilled and 2.9% overfilled. Teeth with acceptable length were five times less likely associated with AP than the inadequately filled ones. Teeth restored with intracoronal restorations had 50% more chance of developing AP. Inadequately restored teeth and teeth with poor obturation quality were associated with three times more likely AP occurrence. The quality of endodontic treatment and coronal restoration significantly influenced the RCT outcome ($p<0.001$).
Conclusion: The technical quality and coronal restorations of the root canal treatments performed by the Malaysian undergraduate students was acceptable in 63.8% cases with 64% favourable outcome. The quality of root canal filling and coronal restoration both had significant influence on RCT outcome.

Keywords: Root canal treatment, technical quality, coronal restoration, apical periodontitis, outcome

R8

Effect of Different Flask Cooling Methods on Dimensional Accuracy and Colour Stability of Fast Heat-Curing Acrylic Resin

**Lee WM, Lim GS, J John, SF Ahmad, ZZ Abidin, N Ibrahim*

Objectives: The present study aimed to investigate the dimensional accuracy and colour stability of fast heat curing acrylic resins when subject to different flask cooling methods.
Methods: Dimensional accuracy and colour stability of a Fast Heat Curing (FHC) acrylic resin using different flask cooling methods (F1, F2, F3, F4) were compared with ISO certified Acron Express Acrylic resin (A1). For dimensional accuracy test, forty maxillary edentulous denture bases were fabricated and divided into five groups (n=8) exposed to different cooling methods. Intaglio surface of each denture bases was scanned with a 3Shape E1 laboratory scanner and superimposed over a scanned image of a master cast using Materialize 3-matic software. Numeric distance (mm) generated from each superimposition was used to compare the dimensional accuracy between each groups ($\alpha=0.5$). For the colour stability test, seventy-five round discs specimens were produced for the same five groups. The colour was measured using a spectrophotometer at baseline, after 500, 1000 and 1500 thermocycling cycles, respectively. The colour changes (ΔE) between groups was analyzed using the Independent Sample t-Test at a significance level of 0.05, The colour change means were qualitatively analyzed according to the National Bureau of Standards system.
Results: There was no statistically significant difference ($p>0.05$) in dimensional accuracy and colour stability among all five groups. The most colour-stable FHC acrylic resin after 1500 thermocycling cycles was Fast Heat Curing using the manufacturer's flask cooling method (F1).
Conclusions: Dimensional accuracy of FHC with different cooling methods are comparable to ISO certified Acron Express. All groups have acceptable colour stability after 1500 thermocycling cycles. Although bench cooling is advocated in conventional denture processing, rapid cooling is a viable alternative, especially when a shorter processing time is necessary.

Keywords: Dimensional Accuracy, Colour Stability, Fast Heat-Cure, Flask Cooling.

R9

A Cross-Sectional Study on Knowledge of Disease Characteristics and Management of COVID-19 Among Dental Students

**Jamaludin M, M Nazari NS, Baharuddin NA, Safii SH, Abd Rahman ANA, Ramlan NA*

Introduction: Knowledge is one of the factors influencing adherence to disease control measures, particularly during the COVID-19 pandemic.

Objectives: This study aimed to assess the knowledge related to the COVID-19 pandemic among dental students at the Universiti Malaya and University Teknologi MARA, as well as the factors associated with it. This study focused on the knowledge of (i) signs and symptoms, (ii) disease transmission, (iii) risk factors, and (iv) management or treatment of COVID-19.
Methods: This study was conducted between 2 July and 8 September 2020, involving 359 of Year 1 until Year 4 dental students. The assessment of knowledge was done via a 10–15-minute online questionnaire, with 'True', 'False', and 'Not Sure' answer options. The percentage of correct answers and mean knowledge scores were measured and analyzed.
Results: Across the four knowledge domains, 73.7% of questions were answered correctly. Almost all participants (90%) knew about the most common symptoms of COVID-19. For disease transmission, the correct answer rates ranged from 75.5% to 99.2%, giving an overall correct answer rate of 85.4%. Besides, 99.2% of participants knew that the elderly and people with chronic illnesses are at higher risk of developing serious illnesses but there was substantial uncertainty about the risk among children. In addition, the study found a high overall correct answer rate (83.2%) for knowledge of management and treatment of COVID-19, with more than 90% of the participants knew about the absence and presence of effective cure and supportive treatment. No significant difference between groups was noted in the correct answer rate for all questions addressing COVID-19 transmission but a significant difference was seen for risk factors, management, and treatment.
Conclusions: Dental students at the two universities exhibited good knowledge about COVID-19 in terms of disease characteristics and management.

Keywords: COVID-19, dental students, knowledge, management

R10

A Cross-Sectional Study on Knowledge Towards COVID-19 Prevention and Control Among Dental Students

**M Nazari NS, Jamaludin M, Baharuddin NA, Safii SH, Abd Rahman ANA, Ramlan NA*

Introduction: In light of the COVID-19 pandemic and the risk of disease transmission by the causal virus particularly in dental settings, knowledge about its prevention and control is essential.
Objectives: This study aimed to assess the knowledge on the COVID-19 pandemic in terms of (i) prevention and control and (ii) personal protective equipment (PPE) among dental students at two public universities in Klang Valley. Factor associated with these knowledge domains were also investigated.
Methods: A total of 359 dental students (Year 1 until Year 4) at the Universiti Malaya and Universiti Teknologi MARA participated in this study. The assessment of knowledge was performed using an online self-administered questionnaire, with 'Yes' and 'No' answer options. The period of assessment was done between 2 July and 8 September 2020. A correct or wrong answer was scored 1 or 0 points, respectively. The results were then analyzed.
Results: The participants were comprised of pre-clinical students (55.4%) and clinical students (44.6%). Across all questions about prevention and control of COVID-19 as well as on PPE, 71.2% were answered correctly. Almost all participants (98.6%) knew about avoiding crowded places to maintain physical distancing. Besides, a high majority of the participants were also accurate about other effective preventive measures including practicing good respiratory hygiene. Regarding PPE, more than three-quarters of the participants knew about the aerosol-generating procedures and the appropriate PPE for these procedures. However, less than 20% of the participants knew about the recommended treatment duration and decontamination of treatment surfaces.
Conclusion: In general, dental students at the two public universities showed good knowledge about COVID-19 in terms of prevention and control of COVID-19 but more emphasis on knowledge of PPE would be required.

Keywords: COVID-19, dental students, knowledge, personal protective equipment, prevention

R11

Osteo-Transductive Nature of Calcium Phosphate Cement Used as A 'Barrier-Graft' to Treat Human Periodontal Intraosseous Defects

**Manickam P, Aspalli S, Guttiganur N, Gaddale R*

Introduction: The basic theories of grafting and guided tissue regeneration imply that a material that combines the properties of osteoconductive graft and resorbable barrier ("barrier-graft") can significantly improve the regeneration outcomes. Such material should possess osteoconductivity to promote the growth of new bone, should allow selective cell repopulation, and should be resorbable during the healing period. The virtues of Calcium phosphate cement (CPC) seem to fit the barrier-graft concept. A notable feature of CPC is osteo-

transductivity (resorption of cement graft is in tune with the new bone formation). Objective The aim is to evaluate the regenerative efficacy of the CPC in periodontal intraosseous defects, by evaluating the clinical and radiographic parameters.

Methodology: A clinico-radiographic study was designed and conducted in 15 subjects diagnosed with chronic periodontitis, for 2 years, in which each subject was assessed for 9 months where clinico-radiographic parameters were recorded at baseline, 3, 6, and 9 months.

Results: All surgical sites healed uneventfully after the initial surgery. At 3rd, 6th, and 9th month follow up, no clinical signs of inflammation, infection or swelling were evident, indicating that graft materials appeared to be well tolerated by the periodontal tissues. A probing pocket depth reduction of 4.21±1.18 mm and relative gain in the clinical attachment of 2.71±1.13 mm was recorded at the end of the study. A significant decrease in mobility and gingival index was observed. Soft-tissue measurements were appended by postoperative radiographs. A mean radiographic defect fill of 64% (2.33±0.5 mm) was observed in 9 months, which was statistically significant.

Conclusion: CPC in putty form is a novel and good candidate for periodontal treatment by its biocompatibility, osteoconductivity, moldability, and high compressive strength.

Keywords: Intrabony defects; Periodontitis; Regeneration.

R12

Comparative Evaluation of The Preventive and Remineralizing Effects of Two Toothpastes on Enamel Erosion: An In-Vitro Study

**Santhosh K, Oon J.M.E., Ng K.L.*

Introduction: Dental erosion has been characterized as the chemical dissolution of the dental hard tissues by acids that are not produced by bacteria. Toothpastes, both herbal and non-herbal, have been popularly used to prevent this. However, there are only a few studies done to evaluate the effectiveness of herbal based toothpastes against dental erosion.

Objective: The objective of this study is to evaluate and compare the preventive and remineralizing effects of Colgate Sensitive Pro Relief (A) and Himalaya Herbals Sensitive Toothpaste (B) on enamel erosion. Materials and

Materials and methods: 60 enamel specimens were assigned to 6 groups of 10 specimens each. Group 1 was control, Group 2 was subjected to demineralization by immersing in soft drink, Group 3 and 4 were first treated with toothpastes A and B respectively followed by immersion in soft drink. Group 5 and 6 were first immersed in soft drink and followed by treatment with toothpastes A and B respectively. Surface of each specimen were imaged by Atomic Force Microscopy (AFM). Surface roughness was obtained from the images and differences in averaged values among the groups were analyzed by Kruskal Walls test ($p=0.05$).

Results: Both toothpastes A and toothpaste B show similar but insignificant preventive effect against dental erosion ($p>0.05$). However, there is a statistically significant difference between groups 5 and 6 suggesting that toothpaste A show more pronounced remineralizing effect against dental erosion.

Keywords: Erosion, Miswak, Remineralization, Toothpastes, AFM

R13

Attachments in Single Implant Mandibular Overdentures: A Systematic Review of Randomized Controlled Trials

**Nimbalkar S, Patil PG, Seow LL, Kweh TJ*

Objectives: To compare results of the randomized controlled trials (RCTs) evaluating peri- implant tissue changes and patient reported outcome measures (PROMs) using different attachments in single implant retained mandibular overdentures (SIMO).

Methods: A literature search were conducted in the Cochrane Central Register of Controlled Trials (CENTRAL) and PubMed MEDLINE and databases. Only RCTs done on SIMO measuring peri-implant tissue outcomes and PROMs were selected. Total 115 studies were identified in initial search and 14 full texts evaluated in detail and only 4 studies (2 cross-over studies, 2 parallel 2-arm studies) were included for systematic review. The risk of bias was evaluated using new Cochrane Risk of Bias Tool 2.0 (RoB 2.0).

Results: All 4 studies were found to have low risk of bias. Total 27 patients received ball attachments (in 3-studies), 34 received Locator attachments (in 3-studies), 16 received Equator attachments (in 1-study), 12 received magnets (in 1-study) and 12 received large ball attachments (in 1-study). All four studies used standard-sized implants with different manufacturers. Single study compared crestal bone level changes between ball and Locator attachment, and another compared large ball, standard ball, and Locator attachments and both studies revealed no differences. Single 2-arm-RCT compared the ball and Locator attachments and revealed similar results. Two cross-over studies compared patient preference between (Locator and magnet) and (ball and Equator)

and reveled no preference between ball and Equator while the patient preferred Locator attachments over magnets. Single study compared masticatory efficiency between the Locator and magnet attachment and another between ball and Equator attachments and both revealed comparable results. **Conclusions:** Crestal bone level changes and masticatory efficiency were not influenced by any of the overdenture attachments system in SIMO. No difference between ball and Locator in patient satisfaction. Patient preferred Locator attachments over magnets.

Keywords: Edentulism, Complete Denture, Implant Overdenture

R14

Effectiveness of Station Rotation Model among Dental Students to Acquire Periodontal Knowledge and Skills.

**Padmini H, Su YL, Eddy FF, Jia YO*

Introduction: In dentistry, the knowledge required to implement skill-oriented procedures is acquired routinely using traditional didactic teaching. There are only a few studies that reported application of blended learning in improving practical knowledge and skills in medical education.
Objectives: 1. To assess the effectiveness of blended learning using station rotation model compared to online didactic learning in teaching periodontal examination procedures.
2. To evaluate students' perceptions and learning experience through blended learning and online didactic learning.
Methods: A total of 85 year-4 dental students were recruited for this prospective cross-sectional study. The students were divided into 2 groups: control group underwent online didactic learning; test group underwent blended learning (BL) with station rotation model (SRM). A pre-assessment test was given to the groups prior to the learning session. For the test group, learning materials were given 4 weeks prior to conduction of SRM. Three stations (1) procedural videos and podcasts, (2) live demo and interaction with instructor, and (3) hands-on-models with peer discussion were arranged during the SRM. For the control group, online didactic teaching was conducted on the same topic. Post-assessment test was conducted after the respective learning. **Results:** Intra- and inter-group differences in the pre- and post-assessment scores were analyzed. Students' perception of the learning experiences was recorded using feedback questionnaires and analyzed. The difference in the pre- and post-assessment scores within each group were significant (Paired T-test: $p<0.001$ and $p=0.037$ respectively). Test group showed a significantly greater improvement in post-assessment (Independent T-test: $p=0.002$). Positive feedback was obtained for blended learning with station rotation model.
Conclusion: Students' perception showed positive responses towards BL with SRM. BL with SRM was shown to be a more effective tool compared to traditional learning for teaching procedural knowledge in Periodontics.

Keywords: blended learning, station rotation model, periodontal examination, periodontal charting, dental education.

R15

Comparison of Effectiveness of Propolis Mouthwash with Chlorhexidine Mouthwash on Gingivitis- Randomized Controlled Clinical Study

**Gunjal S, Pateel DGS*

Objectives: To assess and compare the effectiveness of propolis mouthwash with chlorhexidine mouthwash in the reduction of plaque and gingivitis.
Methods: A single centre, latin-square cross-over, double masked, randomized controlled clinical trial was conducted on 45 chronic generalized gingivitis subjects who were chosen from dental clinic of MAHSA University, Malaysia. A total of 45 subjects were randomly assigned into one of the three different groups (n=15 each) using computer generated random allocation sequence: Group A Propolis mouthwash; Group B Chlorhexidine mouthwash; and Group C Placebo mouthwash. Supragingival plaque and gingival inflammation were assessed by full mouth Plaque index (PI) and gingival index (GI) at baseline and after 21 days. The study was divided into three phases, each phase lasted for 21 days separated by a washout period of 15 days in between them. Groups A, B and C were treated with 0.2% Propolis, Chlorhexidine, and Placebo mouthwash respectively in the phase I. The study subjects were instructed to use the assigned mouthwash twice daily for 1 min for 21 days. On day 22nd, the subjects were recalled for measurement of PI and GI. After phase I, mouthwashes were crossed over as dictated by the Latin square design in phase II and III.
Results: At baseline, intergroup comparison revealed no statistically significant difference between Groups A, B and C ($p>0.05$). On day 21, one-way ANOVA revealed statistically significant difference between the three groups for PI ($p<0.001$)

and GI (p<0.001). Bonferroni Post-hoc test showed statistically significant difference between Propolis and Chlorhexidine mouthwash (P<0.001), with higher reduction in the mean plaque and gingival scores in propolis group compared to chlorhexidine and placebo groups.

Conclusions: Propolis mouthwash demonstrated significant improvement in gingival health and plaque reduction. Thus, it could be used as an effective herbal mouthwash alternative to chlorhexidine mouthwash.

Keywords: propolis, chlorhexidine, mouthwash, gingivitis, plaque control.

R16

Estimating Temperature Exposure of Burnt Teeth Using Spectrophotometric and XRD Analyses

**Rabiah AR, Melissa AH, Jeremy JA, Adrian MTL, Peter GSelf*

Introduction: The temperature of cases requiring a forensic investigation, such as house fires, motor-vehicle explosions, and forest fires exceed 1000°C. The resilient structure of teeth to withstand high temperature means that teeth are often recovered from forensic fire scenes. Heat can affect the colour and hydroxyapatite (HA) crystal size of burned teeth due to the gradual alteration of its mineral-organic contents.

Objectives: The objective of this study was to evaluate the potential of spectrophotometric and XRD analyses of burned teeth to estimate temperature of fire.

Methods: Eighty-one teeth were incinerated at 300°C – 1000°C for 15 min and then measured using a spectrophotometer and an x-ray diffractometer. Response variables used were lightness, L*, and chromaticity a* and b* and luminance (whiteness and yellowness) for colour, and crystal size for crystallinity. Through an analysis of variance (ANOVA), colorimetric and crystal size variables demonstrated the ability to predict incineration temperature. Tukey HSD post-hoc analysis was performed to compare the significant differences of means between temperature groups were for each response.

Results: L, a*, WI, YI and CS were able to significantly discriminate the temperature groups of 27°C, 300°C, 600°C, 800°C and 1000°C.

Conclusion: This study suggests that spectrophotometric and x-ray diffraction analyses of burnt teeth can potentially aid to accurately estimate the temperature teeth are exposed to.

Keywords: teeth, temperature estimation, heat-induced change, colourimetry, X-ray diffraction.

R17

Clinical And Cytological Findings in Oral Cavity of Young Shisha Smokers and Non-Smokers - A Comparative Study

**Ramamurthy P, Fernandes B*

Introduction: Shisha, a form of smoking tobacco is known to be detrimental to oral health. Yet, the effects of shisha on oral health is not well documented. Hence, this study was undertaken to compare the clinical and cytological findings in oral cavity of young shisha smokers as compared to non-smokers.

Methodology: A cross-sectional analytical study was undertaken among 60 subjects including 30 young shisha smokers and 30 non-smokers. Clinical examination was carried out to record gingival status, periodontal status, oral hygiene and dental caries experience. Exfoliative cytology was used to study the cytological changes of buccal mucosal cells. Data was analysed using SPSS version 22.Student's t-test, Fisher's exact test and odd's ratio were used for comparison. p<0.05 was considered statistically significant.

Results: No significant differences were found between the groups with respect to proportion of subjects with gingivitis (p=0.071), erosion (p=0.085) and dental caries experience (p=0.329). However, shisha smokers had poorer oral hygiene and more severe gingival inflammation as compared to non-smokers with p=0.026 and p=0.007 respectively. The odds of having dysplastic cells in oral mucosa among shisha smokers was 3.76 times higher than the non-smokers.

Discussion: Though all our study participants exhibited clinically normal oral mucosa, exfoliative cytology showed notable changes in oral mucosal cells, with more atypical cells indicating initial dysplastic changes among shisha smokers as compared to non-smokers. The changes were mainly in the form of hyperchromatic nuclei, multi-lobed nuclei and elongated nuclei.

Conclusion: Our study shows that shisha smoking can be a potential factor in inducing dysplastic changes in oral mucosa in young shisha smokers.

Keywords: Shisha, Water pipe, Tobacco, Oral health, Cytology

CONFERENCE ABSTRACTS
UNDERGRADUATE

UG1

Assessment of Gamified Biochemistry Module for Undergraduate Dental Students in Universiti Sains Malaysia

**N Aimilia HAS, Norhayati Y, Khairul BAAN, S Aishah Z, Azlina A*

Introduction: Gamified learning activities in higher education has gained significant interest in recent years. Despite less evidence on the effectiveness, gamification of basic science subjects is suggested to benefit both educators and students as opposed to the conventional learning method.
Objectives: This study aimed to investigate students' perception towards gamification of biochemistry module, as well as to evaluate student's engagement, and to identify potential issues in achieving the learning outcome from the gamified session.
Methods: This cross-sectional study was conducted between January to December 2020, involving 52 dental undergraduates in School of Dental Sciences, Universiti Sains Malaysia. The self-administered online questionnaires were distributed after the gamified biochemistry session.
Results: Respondents demonstrated positive responses toward gamified lessons. Students perceive gamification to improve understanding on topics (86.5%) and ease the learning process (84.6%). Gamified learning experiences encouraged students to participate in discussions (92.3%) and further stimulate their learning capacity (90.4%) via appropriate variety of methods used (90.4%). A significant association was recorded between an effectively designed module and stimulation of learning environment (p-value=0.008). A mean score of 72.0% (n=6) in metabolism-related topics was recorded in the final examination, which reflected the effectiveness of gamified biochemistry module. The students were highly motivated to improve their personal growth and learning development. A well-planned and organised gamified learning module may assist the students for a better understanding on the subjects. The present study also has identified few issues to be addressed in future module delivery, which includes timing, execution, facilities and improvement on the reward system to maintain intrinsic motivation among students.
Conclusion: The students viewed gamification as having a positive effect on their learning progress and interpersonal skills. Gamified modules were proven effective in delivering the course content and possess huge potential for applications in higher education.

Keywords: Gamification, Biochemistry, Higher Education, Attitude, Perceptions

UG2

Flexural Strength and Scanning Electron Microscope Analysis of High Strength Flowable Resin Composites

**Ooi QER, Chow ZYS, Yeoh OT, Lim GS*

Introduction: Both conventional paste and flowable resin composites are used in restoring teeth in different areas depending on their characteristics.
Objectives: This study aimed to determine and compare the flexural strength and the filler pattern of highly filled flowable resin composites to that of conventional paste resin composite.
Methods: Ten rectangular bar specimens of each of nine brands of commercially available resin composites were prepared. One conventional paste resin composite (control) and eight flowable resin composites (experimental) in cuboidal form (25mm length x 2mm width x 2mm height) were prepared according to International Organisation for Standardisation (ISO). A three-point bending test was performed to determine the flexural strength using the Universal Testing Machine (Instron, USA). One specimen from each brand was randomly chosen and observed under the scanning electron microscope (SEM) for the filler particles' size and distribution pattern. The data were statistically analysed using one-way analysis of variance (ANOVA) and Tukey's Honestly Significant Difference (HSD) test with $p < 0.05$.
Results: The highest flexural strength value was observed in ParaCore which was 126.41 ± 8.57 MPa while Aura Easyflow had the lowest value among the flowable resin composites which was 78.50 ± 12.50 MPa. However, Aura Easy (control) had the lowest value among all, which was 61.86 ± 10.82 MPa. All resin composites showed a hybrid of smaller and larger filler participles under SEM with either even or uneven distribution of the particles.
Conclusion: The flexural strength of flowable resin composites varied depending on the filler loading and distribution of the filler particles. Higher filler loading with even filler particles distribution resulted

in high flexural strength of flowable resin composites. High-strength flowable resin composite may be indicated for class II restoration and build-up of worn dentition.

Keywords: Flowable Resin Composite; Flexural Strength; SEM Analysis; Filler Size; Filler Particles Distribution.

UG3

Observational Study of Implant Screws from Dental Implant Systems

**Ang H, Choo YE, Yeoh OT, Lim D*

Objectives: To study and compare the design and surface characteristics of implant screws from different implant systems and of genuine and non-genuine implant screws.
Methods: Eight groups of two implant screws per group were examined under a low power stereomicroscope at magnifications x1.25, x2.5 and x4.0. One sample from group 1, 6, 7 and 8 were then evaluated under scanning electron microscopy at magnifications x30 and x1000. Parameters evaluated were total screw length, threaded portion length, major and minor diameter, pitch, depth of thread, number of thread, screw head design, thread root design and surface finishing. Dimension of the screws were calculated based on the average of two screws from each group.
Results: Implant screws of different systems exist in varying dimensions, designs and surface characteristics. Genuine and non-genuine abutment screw used in this study possess almost the same design but different screw geometry and surface characteristics.
Conclusion: Each abutment and prosthetic screws are unique in terms of design, dimension and surface characteristics. Due to the differences unexpected adverse outcome in clinical situations can happen with the use of third party non-genuine components. The use of genuine implant components are highly recommended in order to ensure an optimal outcome.

Keywords: Dental implant; Preload; Screw loosening; Settling effect.

UG4

Dental Students' Usage and Satisfaction with E-Portal as a Learning Tool

**Ho SPJ, Liew AYY, Loh JY, Chan ZJ, A/P Dr. Chakravarthy PVK, Dr. Nerali J*

Introduction: E-learning portals have been crucial enablers in educational systems. E-learning is fast catching on and its use is getting more prevalent with the passage of time. In times of crisis, like the N-CoV 19 pandemic of 2020, an efficient E-learning system would be indispensable for the continued education of students.
Objectives: The aim of the study was to evaluate the perception of dental students on Information quality, System quality and Service quality of E-portal**.**
Methods: A validated online structured questionnaire was emailed to year 3, 4 and 5 dental students (n=177). The questionnaire consisted of three sections related to information quality, system quality and service quality of e-portal. Additionally, a focus group discussion was conducted. The data collected from the questionnaire was analysed using the SPSS statistical software package version 22.0 and descriptive analysis was performed.
Results: The response rate was 85.3%. Students' perception towards information, system and service quality were satisfactory with scores of 83.9%, 79.7% and 83.5% respectively. The usage of dental students on PIDC's e-portal as a medium for communication & collaboration among students & lecturers was found to be satisfactory (64.8%). The themes that emerged during the focus group discussion are "Good features, Challenges and Improvement".
Conclusions: Overall the students were satisfied with the information, system and service quality of PIDC E- Learning portal and their constructive feedback will further help to improve the E-portal learning tool for the benefit of the students as well the teachers during this pandemic period.

Keywords: E-learning portal, education, dental students, information quality, service quality, system quality

UG5

UiTM Dental Students' Perspective on Novel Educational Kit

**Aziz N.S.A., Ikmalhisam N.K, Mah M.C., Jamaluddin T.I.B.T., Wahab H.A., Mohamad M.S.F., Tan S.K.*

Introduction: Post-extraction complications commonly happen in the patient after dental extraction procedure. Patient education and compliance after tooth extraction can reduce morbidity and improve patient's quality of life. Proper explanation to the patient regarding post-operative care instructions and potential complications can help to improve satisfaction with the treatment received.
Objectives: To assess UiTM dental students' perspective on a novel patient educational kit in assisting them to deliver post-dental extraction care instruction.

Materials and methods: All undergraduate clinical year's dental students of Faculty of Dentistry, Universiti Teknologi MARA were recruited for this cross-sectional study. An 8- minutes introductory video of Post-Dental Extraction Care kit (PDEC-kit) was played while simultaneously showcasing the tools in the kit to the participants. The participants then answered a set of validated online self-administered questionnaire on their perception and suggestions for improvement of the PDEC-kit, which comprised of twenty items that were rated by a 7-points Likert scale and six open-ended questions.
Results: A total of 216 students participated voluntarily in this study. A vast majority of the participants agreed that the PDEC- kit is useful (99.1%), easy to use (98.7%) and can improve patient's understanding regarding the post-dental extraction care instructions (99.1%). The information provided in the kit was also found to be appropriate for the patients (97.2%). Interestingly, the students who have clinical experience in performing dental extractions have rated significantly higher scores in half of the questions ($p<0.05$). Moreover, all but two participants (99.1%) think that PDEC-kit will assist them in providing better post-dental extraction instructions to patients compared to providing verbal instructions only. Most of the participants (93.5%) also agreed that the kit could improve the communication or rapport between patients and them.
Conclusion: UiTM dental students agreed that PDEC-kit is beneficial and can help them deliver more effective post-dental extraction care instructions to their patients.

Keywords: patient education, post-extraction care, tooth extraction, dental students, dental education

UG6

Tunnel Approach Versus Coronally Advanced Flap in Treating Gingival Recessions: A Systematic Review

**Japri JF, Shahrizad MM, Safii SH, M Nazari NS*

Introduction: The tunnel technique (TUN) in periodontal plastic surgery has gained traction since it has been touted to have superior clinical and aesthetic outcomes. However, limited literature has been published with the aim of comparing the clinical and aesthetic outcomes of TUN and coronally advanced flap (CAF).
Objective: The aim of this systematic review was to compare the clinical and aesthetic outcomes between TUN and CAF in treating gingival recession.
Methodology: Electronic literature search was conducted on PubMed, MEDLINE Complete, Cochrane Library and SCOPUS from 2010 to 2020 to obtain the relevant randomised controlled clinical trials investigating TUN as root coverage procedure in treating gingival recessions. Hand-searching of renowned Periodontology journals was also performed. Meta- analysis comparing the outcomes of TUN and CAF was performed.
Results: 331 sites in 176 patients from 6 articles were included in the systematic review. The mean root coverage (mRC) of CAF and TUN were 90.91% and 86.81%, respectively after 6 months follow-up. TUN and CAF demonstrated no difference in mRC and complete root coverage ($p> 0.05$) after 12 months. TUN exhibited better keratinised tissue thickness by a mean difference of 0.42mm after 12 months ($p< 0.05$). Meta-analysis could not be done for the aesthetic outcomes due to insufficient data. Statistical significances were seen in some of the parameters under investigation, but no clinical significances in terms of clinical and aesthetic outcomes.
Conclusion: TUN serves as an equally reliable alternative to CAF. This provides clinicians with more options to treat gingival recession cases.

Keywords: Periodontics, gingival recession, systematic review

UG7

Comparative Evaluation of The Microhardness of A Novel Zirconia Reinforced Rice Husk Nanohybrid Composite And Nanofilled Composite When Using Three Different Curing Modes

**Yue MN, Yuetqi L, Yong YC, Kiran S, Galvin SSL, N Huda I, N Rozainah NAG*

Objectives: To compare the microhardness of a new zirconia reinforced nanohybrid composite derived from rice husk (Zr-Hybrid) with a commercialized nanofilled composite (Filtek-Z350-XT) after polymerized with three different light curing modes.
Methods: Sixty standardized cylindrical disc samples (10 mm diameter, 2 mm thickness) were prepared and divided into two resin composite groups, each with thirty samples: Group A (Filtek-Z350-XT) and Group B (Zr-Hybrid). Based on the curing modes, each group was then subdivided into three subgroups of ten samples: Subgroup 1 (Normal cure), Subgroup 2 (Ramp cure), and Subgroup 3 (Pulse cure). After polymerization, the microhardness of each composite sample was tested using a Vickers hardness machine with a load of 5kgf for 14s and examined under a digital

microscope to determine the hardness value. Subsequently, data was analysed using Two-way ANOVA complemented with Sidak's multiple comparison test. Significance value was set at P=0.05.

Results: Zr-Hybrid demonstrated the highest microhardness value (P<0.05) than Filtek-Z350- XT regardless of the light curing mode. Besides, the normal cure technique resulted in a significantly higher microhardness value (P<0.05) for both Filtek-Z350-XT and Zr-Hybrid, followed by ramp cure and pulse cure, respectively.

Conclusions: New zirconia reinforced rice husk nanohybrid composite (Zr-Hybrid) demonstrated higher microhardness value to commercialized nanofilled composite (Filtek-Z- 350-XT) irrespective of type of curing mode. In addition, normal cure showed the highest microhardness value.

Keywords: Microhardness, Nanofilled, Zirconia-reinforced rice husk composite

UG8

Effect of Ginger Rhizome Extract Combined with Demethylating Agent on Salivary Flow in C57BL/6 Mice

**Yee Ziyin, David CKT, Frederick S, Abhishek P*

Introduction: Xerostomia remains a debilitating condition for many individuals especially the elderly. Its current treatment includes masticatory, gustatory, pharmacological stimulants, and replacement therapies. Animal studies have shown that hyposalivation could be age related and highlighted the possibility of certain compounds such as ginger rhizome and a demethylating agent named decitabine in increasing the salivary flow that can help in reversing age-related hyposalivation.

Objectives: This study aimed to evaluate the effects of ginger rhizome extract (GRE), decitabine, and their combination on the salivary flow observed in C57BL/6 mice.

Methods: The GRE was prepared by maceration using DMSO as a solvent. GRE and decitabine were then resuspended in normal saline. Twenty-eight C57BL/6 fifteen-week-old mice were randomly divided into four groups (n = 7) based on the treatment intervention: Group I saline (placebo), Group II GRE, Group III decitabine, and Group IV GRE + decitabine. The baseline salivary flow was measured at week 15 and then each mouse based on the group intervention was treated by intraperitoneal injection thrice a week between week 16 to 18. At the end of each week, salivary flow was estimated for comparison with the baseline salivary flow. Data was analysed using the Mann-Whitney U test (SPSS V.25) (P<0.05).

Results: Group II (2.76mg/g), Group III (2.40mg/g), and Group IV (2.77mg/kg) showed significant increase in salivary flow rate when compared to control Group I (1.77mg/g) (P<0.05). Group IV produced the highest increase in salivary flow rate, however, the differences among the three intervention groups were not statistically significant (P>0.05).

Conclusions: GRE, decitabine, and GRE + decitabine were able to increase the salivary flow rate in C57BL/6 mice that can help in reversing the age-related hyposalivation. However, there was no evident synergistic effect of GRE + decitabine in increasing the salivary flow when compared to GRE and decitabine used alone.

Keywords: Ginger; Extract; Decitabine; Xerostomia; Salivation

UG9

Comparison of Cleaning Efficacy of Two Different Disinfectant Solutions on Used Dental Burs

**Jacqueline C, Ng WC, Chew MX*

Objective: To evaluate and compare the efficacies of two disinfectant solutions (ID 220 and ID 213) in removing the debris from the dental burs used for cavity preparation.

Methodology: This was a comparative study. A total of 60 burs mounted to a high-speed handpiece were used without water to prepare cavities on the teeth with minimum of ICDAS code 3 for maximal adhesion of debris. The burs with the adhered debris were divided into 4 groups of 15 burs each. ID 220 was used to disinfect 15 burs manually and 15 burs using ultrasonic water bath. ID213 was used to disinfect for the remaining burs 15 using manual method and 15 using ultrasonic water bath. The ultrasonic groups were taken as positive control. The debris percentage represented before and after disinfection was calculated using a standardized grid size of 4 x 10 squares on the images obtained using VistaCamiX with magnification of 120x. The total percentage of debris reduction was then calculated from these values.

Results: In the manual method, ID220 disinfectant solution showed 57% (p=0.00064) of total debris reduction while ID 213 disinfectant solution showed 41.8% (p=0.00064) of total debris reduction. Our study showed that ID 220 disinfectant solution was significantly more effective in removing debris compared to ID213 disinfectant solution. There was a statistically significant reduction in the debris after disinfection (P=0.00262).

Conclusion: Both ID220 and ID213 were effective in removing the debris manually however ID220 performed better.

Keywords: debris, dental burs, disinfectant, Duerr Dental

UG10

In Vitro Antimicrobial and Antibiofilm Activities of Basil Leaves Essential Oil (BLEO) Against Oral Microorganisms.

**Nordin FA, M Amin N, Mahmud J, M Zain N, M Amin I*

Introduction: *Streptococcus mutans (S.mutans) and Candida albicans (C.albicans)* are oral microorganisms reported causing caries, denture stomatitis and polymicrobial infection.
Objectives: This study aims to determine the antimicrobial and antibiofilm activities of BLEO against *S.mutans and C.albicans*.
Methods: The antimicrobial activities were evaluated using disc diffusion, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) and minimum fungicidal concentration (MFC) methods. Commercial chlorhexidine (CHX 0.12%) and nystatin 100,000 IU/mL were used as positive controls. Three formulations of BLEO (microemulsion, emulsion, water) were tested for biofilm dispersion on 48 hours preformed biofilm followed by scanning electron microscope (SEM) analysis to observe the changes in biofilm morphology. The data were analyzed using SPSS version 27. A Kruskal-Wallis test followed by a Post-hoc Mann-Whitney U test was applied, and the level of significance was set at $P < 0.05$.
Results: All formulations of BLEO show antimicrobial activities against tested microorganisms with MIC ranges from 6.25%-1.25%. Exposure of 2.5% microemulsion for 2 minutes on preformed biofilm exhibited 42.56% and 42.27% ($p<0.001$) of biofilm eradication for *S.mutans and C.albicans*, respectively. The biofilm eradication percentages were 26.97% and 14.89% for CHX and nystatin, respectively. The SEM micrographs revealed that exposure to BLEO microemulsion altered the biofilm morphologies of treated groups compared to the negative controls.
Conclusions: The results of this in-vitro study suggest a possible utilization of BLEO in managing *S.mutans* and *C.albicans* biofilm-associated infection in the oral cavity.

Keywords: Basil leaves essential oil (BLEO), *Candida albicans*, *Streptococcus mutans*, antibiofilm

UG11

Potential Antifungal Activity of *Ocimum Basilicum* Against *Candida Albicans*

**Amran NA, M Azmi NHE, Rajali A, M Zain N*

Objectives: Plant-derived remedies are one of the alternatives being explored as antifungal agents. Thus, this study aimed to evaluate the antifungal activity of *Ocimum basilicum* essential oil when incorporated into tissue conditioner against *Candida albicans* and the effect on the properties.
Methods: The antifungal activities of *Ocimum basilicum* essential oil were determined using disc diffusion, minimum inhibitory concentration (MIC), and minimum fungicidal concentration (MFC) method. Then, the evaluation of color difference and surface roughness were made with different concentrations after one day with a spectrophotometer and profilometer.
Results: Disc diffusion presented the zone of inhibition was larger compared to nystatin and there was no zone of inhibition of deionized water ($p<0.001$). *Ocimum basilicum* essential oil exhibited significantly better antifungal activity against *Candida albicans* as compared to nystatin and deionized water. Incorporated into tissue conditioner exhibit no significant difference of color changes in the light-dark character (L*) and no significant difference in surface roughness (Ra) seen when two concentrations compared to the control group ($p>0.05$).
Conclusion: Incorporation of *Ocimum basilicum* essential oil into tissue conditioner is an alternative of antifungal agents against colonization and inhibition of *Candida albicans*.

Keywords: Antifungal, *Candida albicans*, *Ocimum basilicum*

UG12

Peer-Assisted Learning Via Virtual OSCE: An Innovative Learning Model Amidst Covid – 19 Pandemic and Beyond

**Ng LY, Seow LL, Elvan YYS, Tee YY, Ooi YX, Mandakini M*

Introduction: Objective Structured Clinical Examination (OSCE) via e-learning platform is an emerging trend amidst the COVID-19 pandemic. A student-led virtual OSCE study group was implemented to inculcate innovative peer-assisted-learning (PAL) for dental undergraduates in Malaysia.
Objectives: This study aims to evaluate perceptions of peer tutors and tutees towards the conduct and

benefits of this innovative educational initiative and also to assess the impact on the performance for virtual OSCE.

Materials and methods: A study group involving thirteen Malaysian dental schools was formed and recruited as peer tutors (15) and simulated patients (9). Fifty-nine undergraduates from various dental schools participated in three mock-OSCE sessions, using the Zoom video conferencing platform. Their feedback was evaluated using a self-administered questionnaire. Descriptive statistics were generated using Excel. Paired t-test was conducted to compare the pre- and post- test scores of the participants based on domains of clinical management and patient-dentist communication abilities.

Results: Fifteen peer tutors and fifty-five tutees completed the survey. Tutees reported the virtual OSCE was well-conducted (96.4%). This allowed them to better prepare (98.2%) in actual OSCE. The feedback sessions helped tutees to understand the approaches (96.4%). Tutors reported perceived improvements in their communication skills (100%), knowledge gain was perceived by tutors after they reflected on their knowledge gaps (93.3%). This initiative was perceived as useful for learning among tutors (93.4%) and tutees (81.8%). Overall, there were statistically significant improvements in the domains of clinical management ($p=0.016$), patient-dentist communication ability ($p=0.018$).

Discussion: This novel learning model encourages student leadership, promotes borderless education, and provides valuable learning opportunities. Future studies could focus on empowering students to assume more formal roles in assessments and conduct of virtual OSCE.

Conclusion: There were perceived benefits among tutors and tutees towards this learning model. Significant improvements in both domains were evident in the pre- and post-test scores among tutees.

Keywords: OSCE, dental students, peer-assisted learning, online learning, innovation

UG13

Tissue Changes Following Orthodontic Treatment of Bimaxillary Proclination with A Fixed Appliances: A Retrospective Study

**Ehsan SN, M Azahar MFR, M Tahir NN, Sivarajan S*

Introduction: Treatment aims for bimaxillary proclination patients usually includes correcting the proclined incisors to average population norm. However, a large degree of changes in the incisor inclination during fixed appliance treatment may affect the stability (Mills, 1967). Hence, the changes that occur following treatment should be investigated to aid clinicians in anticipating treatment success, stability, and planning suitable retention regimes.

Objectives: (1)To analyse soft and dental tissue cephalometric changes following orthodontic treatment of bimaxillary proclination patients treated with a fixed appliances; (2)To compare the cephalometric changes of patients with different pre-treatment crowding and different extraction protocols; and (3) To compare the post-treatment cephalometric values with the population norms.

Methods: This retrospective study was conducted at the Orthodontic Specialist Clinic, Faculty of Dentistry, University Malaya. Pre- and post-treatment clinical records including lateral cephalograms of 16 conveniently selected samples were assessed for the soft and dental tissue parameters. The data were then analysed using paired t-test and one sample t-test.

Results: Pre- and post-treatment cephalogram comparison showed statistically significant changes in nasolabial angle, lower lip to E-line distance and on most of the dental tissue parameters. The first premolar extraction and mild pre-treatment crowding arch resulted in more significant changes of the parameters. For soft tissue parameters, the post-treatment cephalometric values were similar to the Chinese and Malay norms. However, only the Malay samples achieved close to their population norm value for dental tissue parameters.

Conclusions: Bimaxillary proclination patients treated with the fixed appliances showed more significant dental tissue changes as compared to soft tissue changes. Pre- treatment conditions such as crowding and choice of extraction pattern can affect the treatment outcomes. Favourable treatment outcomes for bimaxillary proclination patients was evident as the post- treatment cephalometric values were corrected to the population norms.

Keywords: Bimaxillary proclination, Cephalometry changes, Soft tissue changes, Dental tissue changes, Treatment outcomes

UG14

Testing The Accuracy of Foti's Method in Age Estimation of Malaysian Population

**Ringut FA, Chee WL, Azizi NZ, Wafa SWW*

Introduction: Age determination is vital in many disciplines including anthropology, forensic, paediatric dentistry and orthodontics. Dental age estimation was proven to be reliable because it was least influenced by the environmental factors compared to skeletal. Foti et al.(2003) proposed 4 mathematical calculation formulas to aid in age

estimation, based on the eruption of teeth and the presence of the first sign of calcification in the radiograph (Stage A tooth development based on Demirjian, 1973).

Objective: The aim of this study was to compare all four Foti's models against the chronological age and to determine the accuracy of each model.

Materials and methods This is a retrospective cross-sectional study. A total of 44 radiographs (DPT) of healthy Malaysian children aged 6-16 years old (21 males and 23 females) were selected and assessed. All radiographs were taken at the Department of Oral and Maxillofacial Imaging, Faculty of Dentistry, University of Malaya. The age estimation was calculated using all four Foti's methods by calibrated examiners.

Result: Method 2 and Method 3 ($p>0.05$) showed their reliability in estimating the chronological age of Malaysian population compared to Method 1 and Method 4 ($p<0.05$). Method 3 showed the highest accuracy by overestimating the chronological age by only 0.34 years.

Conclusion: Method 3 is the most accurate & reliable to estimate the chronological age among the study population.

Keywords: Orthodontics, Paediatric Dentistry, Odontogenesis, Tooth eruption, Calcification

UG15

Virtual Reality and Pain Management in Temporomandibular Disorder: A Pilot Study

**N Sabrina NA, N Atikah G, Siti FA, Lim GS*

Introduction: Temporomandibular Disorder (TMD) is a common disorder which often associated with chronic facial pain originated from the joint or muscles of mastication. Virtual reality (VR) is the state-of-art technology which was believed to be able to 'deceive' the brain to release endorphins which will relieve the pain.

Objectives: This study aims to determine the need of utilising virtual reality as an adjunctive treatment for patients with TMD pain, as well as analysing the participants' perception or awareness regarding the use of this technology as a non-pharmacologic treatment option for TMD.

Methods: This is a cross-sectional pilot study conducted via online survey method (Google form). Subjects who fulfilled the inclusion and exclusion criteria were given the self-administered questionnaire. A total of 70 questionnaires were distributed; only 60 participants responded.

Results: 28 participants (50.9%) are familiar with the sign and symptoms of TMD, and 27 participants (49.1%) think they know about TMD. There is no significant association between the years of practice and familiarity with sign and symptoms of TMD ($p=0.331$). With regards to the level of knowledge of conventional treatment for TMD, 33 participants (60%) showed a fair level of knowledge. Only 2 participants (3.6%) agreed that VR is useful as a non-pharmacologic adjunct to the conventional treatment for TMD.

Conclusions: Private dental practitioners have a reasonable level of knowledge of TMD; however, only a fraction of them had a positive perception in incorporating VR as a non-pharmacological treatment option in the management of TMD.

Keywords: general dental practitioner; Temporomandibular Disorders; virtual reality; perception; pain management; awareness.

UG16

Perceptions of Geriatric Patient Care and Training among Universiti Teknologi MARA Clinical Healthcare Students

**Mohd Sofri NN, M Sokri SNS, Ahmad MS*

Introduction: The increasing number of geriatric individuals worldwide indicates the increasing needs and demands for healthcare services among this population group, justifying the importance of training in this area of patient care.

Objectives: This study was undertaken to investigate the perceptions of managing geriatric patients among Universiti Teknologi MARA clinical healthcare students, and its correlation with educational experience.

Methods: A self-administered online survey, utilising a content- and face-validated questionnaire adopted from previous studies, was conducted on all final year medical (n=216, Response rate=80%), dental (n=86, Response rate=100%), pharmacy (n=166, Response rate=61%), physiotherapy (n=62, Response rate=73%), occupational therapy (n=75, Response rate=72%), nursing (n=48, Response rate=94%), medical lab technology (n=54, Response rate=98%), medical imaging (n=61, Response rate=87%), optometry (n=34, Response rate=82%) and nutrition/dietetics (n=35, Response rate=100%) students. Quantitative data was analysed via Chi-Square and Fischer's exact tests (significance value $p<0.01$).

Results: The majority of students of all programs have been exposed to treating geriatric patients, with more than 65% of them reported having a positive experience. Most dental (86.9%), physiotherapy (84.4%) and occupational therapy (88.9%) students also reported that they felt comfortable in managing geriatric patients ($p<0.01$).

Comfort in this area of patient care was significantly noted among students who have been exposed to managing geriatric individuals during their undergraduate years. In terms of education, most dental, physiotherapy, occupational therapy and nursing students perceived that their training in managing geriatric patients was adequate ($p<0.01$). Those who perceived their training as adequate also rated positive experience ($p<0.01$) and comfort ($p<0.01$) in managing these patients.
Conclusion: Educational experience is important in preparing clinical healthcare students for managing geriatric patients during their future professional practice.

Keywords: geriatrics, gerontology, education

UG17

Operculitis – The MAHSA Epidemiology

** Yasmine LKW, Marcus CWS, Noorun-nisaa RS*

Introduction: Operculitis is defined as the inflammation of soft tissue around the crown of a partially erupted tooth. This is usually resulted from accumulation of food debris, plaque and bacteria between the tooth and overlying flap. Common manifestations of operculitis include pain and swelling of the area, radiating pain to the ipsilateral ear and temporomandibular joint, dysphagia, and trismus.
Objectives: MAHSA dental clinic was visited with patients complaining of pain in relation to the lower third molar, most of which were diagnosed with operculitis. Therefore, this study aims to predict the chances of experiencing pericoronitis according to age, gender, race, associated third molars, angulation of impaction, and the presence of opposing third molar.
Methods: A 4-year (2018-2021) retrospective study was done on patients who reported to MAHSA Dental Clinic with symptoms of pericoronitis. Records and orthopantomograms of 108 eligible patients were collected. The data was analysed to determine the correlation of operculitis with age, gender, race, associated third molar, angulation of impaction, and presence of opposing third molar.
Results: Operculitis was appreciated most in individuals who are from the 18-27 age group (60.58%), and predominant in female patients (54.81%). It also showed prevalence among the Chinese (53.85%). Besides that, pericoronitis is more frequently seen in the third quadrant (56.73%). The opposing 3rd molar was present in most of the cases (78.58%) and operculitis was prevalent in mesioangularly-impacted lower third molars (50.96%).
Conclusion: Our study analyzed the epidemiology of operculitis among MAHSA Dental Clinic patients over a 4-year period. A comparison of these statistics with similar studies might go a long way in predicting the likely incidence and prophylactic measures to be taken.

Keywords: Operculitis, Impaction, Inflammation, Epidemiology, Angulation

UG18

Standardisation of Record Keeping in Paediatric Dentistry using Consensus-based Delphi Method

**Chung SS, Gan MX, Pau KH, Priya E*

Introduction: A patient record is an important medico-legal document. Good practice of record keeping is essential to ensure quality oral health care delivery and effective communication amongst healthcare professionals. Objective: This study set out to identify and standardise the core set of record keeping items for new and recall patients in Paediatric Dentistry using the Delphi method.
Methodology: Paediatric dentists were invited to participate in a Delphi process which involved a systematic and multi-stage survey to rate the clarity (using a dichotomous scale) and relevance (using a 9-point Likert scale) of the record keeping items. Items that scored ≥ 7 by at least 70% of the participants were included in the final list whereas items that scored ≤ 3 by at least 70% of the participants were excluded. In any other condition, the items were revised and included in the second Delphi round. The items were further discussed in an online face-to-face meeting until a consensus was reached.
Results: Fourteen experts participated in the Delphi process. In total, there were 175 items for new patients and 9 items for recall patients. For new patients, the items were categorised into General – for all age groups (151 items), 0 – 6-year-old (16 items), 7 – 12-year-old (0 items), and 13 – 18-year-old (8 items). The items were further classified into essential (n=135), desirable (n=19), and conditional on presentation (n=30).
Discussion: The Delphi method was used to explore the perceptions of experts and achieve consensual guidance on the best practice of record keeping for the different age groups in Paediatric Dentistry.
Conclusion: This study has identified a core set of record keeping items and this standard can be used as a tool to help with enforcement and standardisation in paediatric dental record keeping in the Malaysian dental setting.

Keywords: Dental records, Paediatric Dentistry, Delphi technique, Consensus

UG19

Standardisation of Record Keeping for Refugee Patients in Paediatric Dentistry Using Consensus-Based Delphi Method

**Gan MX, Chung SS, Pau KH, Priya E*

Introduction: Good record keeping practices are fundamental for delivering competent and high-quality oral health care and ensures effective communication between healthcare professionals. Lack of standardization and inadequate information taken during record keeping for undocumented refugees, and language barriers between the refugee and the healthcare provider becomes increasingly essential to overcome through good record keeping.
Objective: To identify and standardise the core set of items of patient records for refugee patients in Paediatric Dentistry using the consensus-based Delphi method.
Methods: Fourteen experts participated in online Delphi exercise. Eleven items were assessed on a 9-point Likert scale. An item was considered essential to include if at least 70% of the participants awarded a score of 7 and above. Items achieving a score of 3 and less by at least 70 % of members was excluded from the final list of the core items. In addition, each item was evaluated for its clarity using a dichotomous scale: yes or no. Items receiving any other scores were subjected to the second round of Delphi. Items were rated until a consensus was reached. Following the online Delphi rounds, a set of items were agreed for further analysis in a face-to-face meeting.
Results: Eleven items were identified for refugee patients. One item reached a consensus of 54.55% which was further discussed in the face-to-face meeting. Seven items were classified as essential, two items were classified as desirable, and two items were classified as conditional on presentation.
Discussion: This study is the first in examining the record keeping of refugee children in Dentistry. Delphi technique was successful in delivering consensus on standardizing the core set of items for refugee patients in Paediatric Dentistry.
Conclusions: This study serves as a foundation for the enforcement and standardisation in dental record keeping of the vulnerable groups of refugee children in the Malaysian dental setting.

Keywords: Dental records, Paediatric Dentistry, refugees, Delphi technique, consensus

UG20

Clinical Audit of Fixed Partial Dentures by Undergraduate Students: Improving Patient Care and Enhancing Curriculum

**Nishyantini RA, Seow LL*

Objectives: Dental students should be equipped with knowledge and clinical skills in prosthodontics to optimise patient care and obtain good clinical outcomes in the provision of fixed partial dentures (FPDs) treatment. It has been shown that the practice of clinical audits results in improvements in care provided by medical and dental practitioners. The objectives of this audit include to evaluate the compliance on record keeping for fixed partial dentures treatment and to identify difficulties/complications faced in the provision of FPDs by undergraduate students.
Methods: Records of patients who received FPDs at the International Medical University from 2015 to 2019 were retrieved. A total of 150 FPDs records were included in this audit. Detailed audit checklist was formulated and calibrated ($\kappa \geq 0.8$). Students' compliance with record keeping and complications faced by students during the FPD treatment were identified.
Results: More than two thirds of the FPDs provided by dental students were fixed-fixed design (69%), followed by cantilever (14%), resin bonded (14%) and compound FPD design (3%). Majority of the prosthesis replaced posterior teeth (70%). High compliance was noted for recording of medical history (98%), treatment plan (95.3%), taking preoperative radiograph (98%), but unsatisfactory compliance noted for recording of consent (60%), pulp sensibility tests (64.7%), preoperative radiographic reporting (54%). Almost one third of the cases had difficulties before cementation of the prosthesis i.e poor fit or aesthetics of the final prosthesis. 8% of the total FPDs provided by dental students developed complications post cementation, with the highest complication being debonding of prosthesis (58%).
Conclusions: Within the limitations of this audit, there is room for improvement in record keeping and need to be emphasis in the curriculum. It was noted that proper management of difficulties prior to cementation have greatly reduced the overall incidence of complications arising after issuing of prosthesis.

Keywords: fixed partial dentures, record keeping, complications

UG21

Perceived Experiences of Oral Health Care Practice for Parents Raising Children with Down Syndrome

**Bawawi SN, Roselan WN, Baharuddin. IH, IW Mokhtar*

Introduction: Dental anomalies in children with Down syndrome (DS) include abnormalities in the structure, number, and eruption of teeth, highlighting the importance of regular oral health treatment at home and in the dental office. However, several challenges encountered by their parents limited their ability to provide reliable dental care at home and promote their children's optimal oral health. **Objectives:** The study aims to assess parents' oral health care experiences and practices for their children with Down syndrome and investigate the correlation between the child's teeth and gum condition to parents' oral health practices.
Methods: This is a cross-sectional study of parents raising children with DS aged 0-16 years. The recruitment was through a family support group and professional associates of Malaysia's various DS associations. A 14-item bilingual questionnaire on children's oral health status (domains; practices, experiences, and snacking) was distributed via a google form. The data was analyzed using SPSS version 25. A Pearson correlation test was performed to determine the association between each domain.
Results: A total of seventy-five parents of 38 girls and 37 boys were recruited with the children's mean age being 7.25. Most parents rated their child's teeth and gingival health as good, 72% and 76%, respectively. Between experiences and practices scores, a significant negative correlation was discovered (r = -0.057). Additionally, there is a significant correlation between practices score and the child's gum condition (r = 0.031) but no correlation to the child's teeth (r = -0.001). There were no statistically significant differences in practices score between parents' educational backgrounds (p=0.26).
Conclusion: Parent's oral health care experiences and practices are considered sufficient for their children with DS. The discovery suggests a comprehensive oral health care advocacy program tailored specifically for parents caring for children with DS, thus removing all the barriers and challenges.

Keywords: Down syndrome children, oral health care practice, parents' perception

UG22

Perceptions and Awareness About E-Professionalism on Social Media Among Dental Students in Malaysia and Indonesia

**Suriani ANH, Libamin AC, M Nor NA, Kamarudin Y, Bramantoro T, Ramadhani A*

Objectives: This study aimed to compare perceptions and awareness on e-professionalism while using social media among dental students in Universiti Malaya (UM), Malaysia and Airlangga University (AU), Indonesia.
Materials and methods: This was a cross sectional study involving undergraduate dental students at UM, (Year 3 to Year 5, n=150) and AU (Year 4 to Year 5.5, n=150). A questionnaire was developed based on literature and an expert group discussion. The pre-tested questionnaire was distributed to participants using Google Form through the students' WhatsApp group network. Data were analysed with SPSS software using descriptive statistics and Chi-square test.
Results: All invited participants responded (n=300) with a 100% response rate. Most of the students in UM (55.3%) and AU students were Malay (90.7%) females (UM:77.3%, AU: 84%). No statistical significant difference was observed in relation to UM and AU students' perceptions towards online professionalism behaviour statements. Majority reported concerns over unprofessional posts on social media. More than half were aware that uploading clinical records (UM:63.3%, UA:86.0%) and posting videos of patients (UM:60.7%, UA:80.0%) were unprofessional behaviours. A small proportion of UM and AU students, however, reported that they were not aware about posting anonymised dental procedures (UM:20.7%); AU:25.3%), posting statuses (UM: 7.3%, AU: 5.3) or comments referring to patients (UM:8.7%, AU:10.0%), and discussing patient cases (UM: 10.05, AU:22.0%) on social media could potentially breach the dentist code of professional conduct.
Conclusion: Students in both Universities had positive perceptions towards online professionalism behaviours. However, there is lack of awareness on certain aspects related to posting on social media that may put them at risk of breaching the dental code of professional conduct. This suggests the need to have clear guidelines on professional social media use and appropriate training in undergraduate curriculum to instil e-professionalism values.

Keywords: dental students, e-professionalism, professional behaviours, social media

UG23

Depression, Stress and Anxiety Amongst Undergraduate Dental Students during COVID-19 Pandemic

** Jafridin A.A, Azhar A.A, Md Dasor M., Md Sabri B.A*

Introduction: Depression, anxiety and stress (DAS) levels are important indicators of mental health. **Objectives**: To measure the occurrence and levels of DAS among undergraduate dental students during COVID-19 pandemic and identify key contributing factors of the dental environment to DAS among undergraduate dental students.
Methods: A multi-centre, cross-sectional study was conducted among Universiti Teknologi MARA, International Medical University, MAHSA University and Universiti Kebangsaan Malaysia undergraduate dental students. The study utilised an online self-administered questionnaire consisting of the validated Depression Anxiety Stress Scale (DASS), Dental Environment Stress (DES), and a final section comprising of 10 statements assessing potential stressor factors dental students may have faced during COVID-19 pandemic.
Results: 720 students participated giving a response rate ranging from 40% to 85% across t 4 universities. Abnormal levels of depression, stress and anxiety were identified in 60.6%, 66.8% and 42.6% of the study participants respectively. “Pressure of performance”, Faculty administration” and “Self-efficacy belief” were the highest rated stressors. Regarding COVID-19 related factors, the main stressor was concerning on-time graduation.
Conclusion: The levels of DAS during COVID-19 pandemic in this population is high and can be attributed to pressures in performance, faculty administration, self-efficacy and on-time graduation.

Keywords: depression, anxiety, stress, COVID-19, dentistry.

UG24

The Perception of Using Miswak in Oral Hygiene Care among Dental Patients

** Siti AJ, Nor-Asmara, Shahida MS, Atika A, Tanti IR*

Introduction: Miswak or chewing stick is commonly utilized for tooth cleaning especially in the Middle East countries. It also delivers mechanical and chemical properties that benefit the users when it is used correctly. In Malaysia, Miswak is still not widely used and known by the population as an adjunct to oral hygiene routine.
Objectives: This cross-sectional study aimed to evaluate the knowledge and perception of adult patients in Kuala Lumpur, regarding the use of miswak in oral health care.
Methods: This study was conducted through an online questionnaire survey among dental patients aged 18 years and above. Respondents were required to complete a set of questionnaires pertaining to knowledge, attitude and perception towards Miswak and oral health care. A total of 174 adults participated in the study.
Results: About 43.1% of them have used miswak for at least once in their lifetime. Majority of them (73.0%) agreed that Miswak can assist in oral hygiene care, but more than half (61.5%) have limited knowledge regarding the scientific information of chewing stick. About 65.5% respondents agreed that Miswak is suitable to be practiced in this modern era.
Conclusion: This study shows that respondents have good perception on the usage of Miswak in oral care. It may suggest that Miswak has a high potential as an adjunct to oral hygiene care especially in the local setting.

Keywords: Miswak, chewing stick, oral hygiene.

UG25

The Level of Confidence of Dental Students in Malaysian Private Universities in Performing Dental Extraction

**Raashvin S., Nurshakila A., Shariffah S.A.S.*

Introduction: Dental extractions can be defined as the removal of a tooth from its bony socket via the use of specialised instruments, along with proper knowledge and techniques. It is a technique sensitive procedure, and requires good knowledge, confidence, and dexterity to perform. This study was done to assess the levels of confidence of dental students in Malaysian Private Universities in performing dental extractions, and thus inherently gauge the readiness of these subjects in performing dental extractions, along with their knowledge level on dental extractions, and general consensus regarding the study of oral surgery.
Methodology: Total of 133 fourth and fifth year dental students from 7 private universities in Malaysia participated in this study. Among them, a questionnaire was distributed, with a list of questions pertaining to various aspects of dental extractions such as knowledge and confidence as well as a section regarding interest towards oral surgery as a practice. Consent was taken beforehand and the participants anonymity is guarded. Data was collected, recorded, analysed by using SPSS (Statistical Package for Social Science).

Result: Total of 133 students were involved, fourth and fifth year dental students from the 7 private dental universities. In regards to knowledge, a total of 56% of respondents answered favourably indicating an above average level of knowledge in regards to dental extractions. In terms of confidence, 53 % of respondents answered positively, indicating an above than average positive response towards being confident in performing extractions. Lastly, a total of 70% respondents answered positively towards having interest towards oral surgery as a practice, indicating a majority of the students of having a interest towards the subject.
Discussion: In conclusion, the general knowledge and confidence levels among dental students in Malaysian private universities is slightly above average, with a majority showing an interest in oral surgery.

Keywords: dental student, tooth extraction

UG26

Knowledge, Attitudes and Product Promotion Role of Pharmacy Students on Oral Healthcare and Hygiene Products

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Introduction: Community pharmacists have served as the medication expert and due to their knowledge and accessibility, are frequently approached by the public to answer health-related questions. This study was conducted in order to identify the knowledge, attitudes and product promotion role of pharmacy students on oral healthcare and hygiene products.
Objective: To assess pharmacy students' oral health care knowledge, attitudes and their product promotion role on oral health care and oral hygiene products
Methodology: A google online questionnaire with questions in three domains namely knowledge (11 questions), attitudes (13 questions) and promotion role (10 questions), previously validated and pretested, were distributed to pharmacy students in 5 institutions between February 2021 until April 2021 after administrative consent was given. Participation was voluntary and individual consent was automatically achieved when students responded to the online survey. In all, 159 respondents participated. The data collected was analysed using SPSS version 25.
Result: Of the 159 participants who responded, 66% of the participant showed to have knowledge on oral healthcare,71.1% respondents indicated they practice good oral hygiene while 56.6% respondent showed they know the importance of their role in having to promote oral healthcare product.
Discussion: Knowledge, attitudes and product promotion role of oral healthcare and hygiene products are important attributes to be realized especially among new generation pharmacy students.

Keywords: pharmacy student, oral hygiene

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