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#### Compendium of Oral Science Volume 8/2021 Original Article

### Preparedness of Undergraduate Dental Students: A National Study

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#### ABSTRACT

**Objectives:** To evaluate the self-perceived preparedness of final year undergraduate dental students in Malaysia and to compare the difference of preparedness level of final undergraduate student in public and private universities. Material and Methods: A cross-sectional questionnaire study was conducted using a validated questionnaire, Dental Undergraduates Preparedness Assessment Scale (DU-PAS) and no samplings were involved. The questionnaire was distributed via University presentative of each university from MDSA in the form of online and written questionnaire. The data were analysed using SPSS version 23. Results: 239 students responded to this study. Responses revealed that student felt adequately prepared to carry out simple clinical procedures such as taking consent (88.3%), tooth-coloured fillings (87.4%), non-surgical periodontal treatment (86.6%), do proper history taking (85.8%), bitewing radiograph (84.1%) and communication skills (69.9%). However, low levels of scores were reported on ability to do an amalgam restoration (12.1%), endodontics treatment especially multi-rooted tooth (9.6%), crowns (9.2%), referral for suspected oral cancer (31.8%), research skills (15.1%) and raising concerns regarding inappropriate behaviour of colleagues (7.9%). There was significant difference between the level of preparedness of final undergraduate student in public and private universities. Conclusions: This is the first study of self-perceived preparedness of final year undergraduate students in Malaysia. The results showed that the self-perceived preparedness of final year student was satisfactory for a range of clinical and effective skills. However, several areas of weaknesses were identified which underscore the need for additional training and consolidation.

Key words: Self-perceived preparedness, Undergraduate students, Malaysia.

#### INTRODUCTION

Learning and innovation in dentistry keep on developing at a fast pace, and due to scientific advances, Malaysian dental education has been faced with challenges to keep up with the quality inside the profession (Ministry of Higher Education, 2010). The number of dental students has been increasing in Malaysia. Malaysian Dental Council reported that the local dental undergraduates in Malaysia had a threefold increase in number throughout the years, from 186 graduates in 2009 to 660 graduates in 2017 (Malaysian Dental Council, 2017).



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Dental training is a unique pedagogical experience with distinctive challenges. There are 13 dental universities in the nation, of which six are public universities. Therefore, to be qualified as a dental expert, an undergraduate must pass all the professional examinations and complete all minimum clinical requirements in an accredited educational environment of 5 years (Ministry of Higher Education, 2010). In dentistry, the clinical requirements include performing irreversible operative procedures on patients under the supervision of experienced clinicians.

Preparedness is defined by as the state of being prepared for a particular situation (McIntosh, 2013). Preparedness of undergraduate students may be influenced by a variety of factors including: curriculum design, teaching methods, educational environment and clinical training models, and assessment methods (Honey et al., 2011; Ali et al., 2018; Lynch et al., 2010; Divaris et al., 2008; Ali et al., 2017). A prepared graduate should have the ability to carry out patient assessment and treatment planning, perform routine and straightforward dental procedures safely, provide holistic care, communicate effectively, demonstrate professionalism and to have teamworking skills as well as recognise the limits and know when to seek help (Ali et al., 2017). Therefore, dental students preparedness has a very close relationship with their skills and knowledge in delivering treatment to the patient.

Previous studies reported that there were two procedures that rated the highest in overall confidence by the students in School of Dentistry at Cardiff University which were carrying out a simple scaling and fissure sealant with the highest possible mean score of 5.00 (Gillmour et al., 2016). Yiu et al. also reported that 99% (n=157) had felt prepared in placing crowns yet 28% (n=44) felt poorly prepared for multi-rooted endodontics, which was due to lack of exposure and experience in handling endodontic treatment especially molar teeth (Hayes et al., 2001). The study concluded that practicing multiple times and encountering the same event would increase once confidence in that particular area. Similar conclusion was found in a previous report which stated that high proportion of students in Pakistan Institutions (81.5%) perceived themselves to be prepared in tooth extractions and this is because most dental institutions in Pakistan require each undergraduate student to perform approximately 100 extractions prior to graduation (Ali et al., 2018).

Dental education today must ensure that students are equipped to deal with the challenges of tomorrow, and in an increasingly globalized scenario, how skilful and well-prepared of our future dental officers will decide the future of oral health in our country. In Malaysia, limited data expressing a range of dental students clinical training, skills and preparedness are available.

Verification of the preparedness of dental undergraduate in Malaysia would be necessary to increased patient safety, reduction of dental errors, and the provision of high-quality healthcare services. The objective of this research was to report on the self-perceived preparedness of Year 5 dental undergraduate students in Malaysia toward dental practice upon graduation.

#### MATERIALS AND METHODS

This study was a cross-sectional study using a validated questionnaire, Dental Undergraduate Preparedness Assessment Scale (DU-PAS) (Ali et al., 2017). The questionnaire was given to access the self-perceived preparedness of final year undergraduate dental students in Malaysia.

Prior to commencement of the study, ethical approval was granted by The Research Ethics Committee of Universiti Teknologi MARA, REC/88/19. A disclaimer was attached to the first page of the questionnaire to explain the purpose of the study and to ensure respondent confidentiality. Anyone who has inquiries pertaining to the survey has been invited to email the authors through the contact address provided in the questionnaire.

The questionnaire was divided into two sections, section A to investigate the preparedness in clinical procedure; and section B to investigate the preparedness in relation to cognition, communication, and professional skills. Section A involved 24 questions using the scale from 0 to 2, with 0 being no experience, 1 being with help of colleague and 2 being independently prepared. For section B, there were 26 questions to be answered. The questions were using the scale from 0 to 2, with 0 being mostly and 2 being always prepare.

Dental undergraduate students in their final year from all Malaysia Dental Schools were invited to participate in the study by online questionnaire or written questionnaire. A total of 239 students responded to this study, where the minimum sample size was 198 students. Epi Info Software was used for sample calculation. A convenient sampling was used to include all the students from various dental school in Malaysia.

The descriptive and quantitative data were analysed using Statistical Package for Social Sciences (SPSS) software 23 (IBM Corporation, Armonk, NY, USA). Further analysis was undertaken using the T-test to evaluate the overall preparedness level of final undergraduate students in public and private universities.

#### RESULTS

In a total of 239 students responded to the questionnaires, 174 (72.8%) were respondents from public universities while 65 (27.2%) respondents were from private universities. All of the participants are from the range age group of 22-27 years old. Among all of the respondents, 182 (76.2%) were female respondents and 57 (23.8%) were male respondents.

Table 1 shows the levels of students' preparedness in performing clinical procedures. The data depict that the majority of students have high levels of preparedness in receiving valid consent from patient prior to performing any dental treatment as 88.3% (mean=1.88) of the students were able to obtain the consent by their own, however, some of them still felt that they need help from their colleagues or supervisors. Most of the students has higher than 60% level of preparedness on performing appropriate tooth-coloured restoration (87.4%, mean=1.87), obtaining patient's medical history (85.5%, mean=1.86), removing dental caries effectively (82.8%, mean=1.83) and taking periapical radiograph (79.9%, mean=1.80). Low levels of preparedness were associated with performing a proper amalgam restoration 12.1% (mean=1.62) as some of the students have never done any amalgam restoration before. There were also low levels of preparedness among the students in performing endodontic treatment on multi-rooted teeth. The statistical data of the study also showed that 9.5% (mean=1.35) of students had no experience in performing the endodontic treatment in multi-rooted teeth. Low levels of preparedness were also reported by the respondents in providing crowns using the principle of tooth preservation as 9.2% (mean=1.35) of students had no experience and the majority of them still need guidance and help from colleagues or supervisors.

ltems	Questions	No experience (%)	With verbal or practical input from colleague (%)	On my own (%)
A18	I am able to restore teeth with amalgam fillings appropriately	12.1	29.3	58.6
A20	I am able to perform endodontic treatment on multi rooted teeth appropriately	9.6	59.8	30.5
A21	I am able to provide crowns using principles of tooth preservation	9.2	46.9	43.9
A19	I am able to perform endodontic treatment on single rooted teeth appropriately	2.5	33.1	64.4
A13	I am able to prescribe drugs to my patients appropriately	1.7	61.9	36.4
A7	I am able to assess the treatment needs of patients requiring orthodontics	1.3	54.0	44.8
A22	I am able to provide mechanically sound partial dentures	1.3	46.9	51.9
A5	I am able to undertake bitewing radiographs	0.8	15.1	84.1
A8	I am able to formulate a comprehensive treatment plan which addresses all treatment needs of my patients	0.4	35.6	64.0
A10	I am able to explain the merits and demerits of various treatment options to my patients	0.4	33.5	66.1
A15	l am able to perform non-surgical periodontal treatment using appropriate methods	0.4	13.0	86.6
A23	I am able to provide mechanically sound full dentures	0.4	38.1	61.5
A24	I am able to undertake non-surgical tooth extractions appropriately	0.4	28.9	70.7
A1	I am able to obtain a complete medical history from my patients.	0.0	14.2	85.8
A2	I am able to undertake a comprehensive, clinical oral examination	0.0	21.8	78.2
A3	I am able to prescribe appropriate dental radiographs	0.0	20.9	79.1
A4	I am able to undertake periapical radiographs	0.0	20.1	79.9
A6	I am able to interpret common findings on dental radiographs	0.0	31.0	69.0
A9	I am able to provide a range of treatment options to my patients based on their individual circumstances	0.0	29.3	70.7
A11	I am able to obtain a valid consent from my patients prior to undertaking any treatment.	0.0	11.7	88.3

#### Table 1: The student's level of preparedness in performing clinical procedures

A12	I am able to carry out patients' treatment sessions in an appropriate order	0.0	25.1	74.9
A14	I am able to administer inferior dental nerve blocks effectively	0.0	22.2	77.8
A16	I am able to remove dental caries effectively	0.0	17.2	82.8
A17	I am able to restore teeth with tooth coloured fillings appropriately	0.0	12.6	87.4

\*Items are ordered by the 'No experience' column in descending order.

Table 2 shows the levels of students preparedness in relation to cognitive, communication and professionalism skills. Overall the student had the highest level of confidence and preparedness to communicate appropriately with their colleagues as 69.9% (mean=1.59) of the students always felt confident when communicating with their colleagues. Students also had more than 50% level of confidence in seeking help from supervisors or colleagues (66.8%, mean=1.57), in providing opportunities for the patients to express their expectations from the dental treatment (64%, mean=1.54) and in case they recognize their own personal limitations in clinical practice (59.8%, mean=1.50). However, some of the students still had a low level of confidence on referring patients with suspected oral cancer as 31.8% (mean=1.00) of the students had no experience of encountering such type of patients. This study also revealed that 16.7% (mean=1.02) of the students had low levels of confidence to evaluate new dental materials and products using an evidence-based approach as well as 15.1% (mean=1.08) of the students were associated with low confidence levels to interpret the results of research which may influence their practice.

Items	Questions	No experience (%)	Mostly (%)	Always (%)
B6	I feel confident referring patients with suspected oral cancer	31.8	36.4	31.8
B9	I am confident to evaluate new dental materials and products using an evidence-based approach	16.7	64.9	18.4
B10	I am confident to interpret the results of research which may influence my practice	15.1	61.5	23.4
B25	I feel able to raise concerns about inappropriate behaviour of my colleagues	7.9	54.8	37.2
B11	l use an evidence-informed approach in my clinical practice.	5.9	59.4	34.7
B17	I feel confident managing anxious patients with appropriate behavioural techniques	3.8	59.8	36.4
B8	I have sufficient knowledge of scientific principles which underpin my dental practice	2.1	72.0	25.9
B18	I am able to manage the behaviour of children to enable appropriate dental treatment	2.1	64.9	33.1
B14	I feel confident to address barriers to effective communication with patients appropriately	1.7	51.9	64.4

## Table 2: The student's level of preparedness regarding their cognitive,communication and professionalism skills

B5	I am able to refer patients with complex treatment needs appropriately	1.3	43.5	55.2
B20	I maintain accurate records of my clinical notes	1.3	50.2	48.5
B16	I feel confident to communicate appropriately with my colleagues	0.8	29.3	69.9
B22	I take responsibility for my continuing professional development	0.8	40.6	58.6
B7	I reflect on my clinical practice in order to address my learning needs	0.4	46.0	53.6
B12	I feel I can manage to communicate effectively with my patients	0.4	41.0	58.6
B15	I feel confident to communicate potential risks of operative procedures to patients	0.4	41.8	57.7
B19	I am able to fulfil my responsibilities as an effective member of the dental team	0.4	46.4	53.1
B23	l am aware of my legal responsibilities as a dental professional	0.4	33.5	66.1
B24	I restrict my relations with my patients to a professional level	0.4	35,6	64.0
B26	I take appropriate measures to protect patient confidentiality	0.4	42.3	57.3
B1	I feel I can manage peoples' expectations of their treatment	0.0	71.1	28.9
B2	I feel able to motivate my patients to encourage self- care for their dental needs	0.0	51.5	48.5
B3	I recognise my personal limitations in clinical practice	0.0	40.2	59.8
B4	I feel comfortable asking for help from supervisor or colleague if needed	0.0	33.2	66.8
B13	I provide opportunities for my patients to express their expectations from dental treatment	0.0	36.0	64.0
B21	I am able to work within the constraints of clinical appointment schedules	0.0	60.3	39.7

\*Items are ordered by the 'No experience' column in descending order.

For the overall levels of preparedness between the private and public universities, the study revealed that the final year students in public universities (mean=78.52) have higher levels of preparedness compared to private universities (mean=70.51), and the differences were significant (p = 0.001). Table 3 shows the overall differences between both universities in terms of their level of preparedness.

Variables	Public Universities Mean (SD)	Private Universities Mean (SD)	Mean difference (95% Cl)	t statistic (df)	p value
Preparedness	78.52	70.51	8.02	4.767	0.001
level	(11.44)	(11.91)	(4.70, 11.33)	(237)	

#### Table 3: Differences level of preparedness between students in private and public universities

#### DISCUSSION

This is the first study done in Malaysia to investigate the overall level of preparedness of final year undergraduates' dental students. The study revealed large differences in the distribution of the samples between male and female correspondents is due to huge gap inequality in certain sectors of the Malaysian higher education. Women outnumber men in seven out of the eight fields of study, including areas in which women are traditionally underrepresented such as mathematics and science. Previous study reported that 13 out of 20 of Malaysian public universities fall under UNESCO's classification of 'far from gender parity', with a GPI higher than 1.5 which mean extreme fewer men enrolled. For the discipline of dentistry, which was included in the Health & Welfare field of study, women consist about 64% and even more pronounced in Malaysian public universities (71%) compare to men. As such, the resultant percentages in the current study are just reflecting the numbers of male and female on the ground of reality and hence lead to the large difference in the number between male and female and private universities, this was probably due to the difficulty in distributing the written questionnaire to the private universities. It was also due to the private universities routine and geographical barriers as some of the private universities are in other states in Malaysia far from Selangor, which resulted in less number of respondents from private as compared to public universities.

Based on the survey, the current study found that a number of students were still perceived unprepared to perform certain clinical procedures independently. This is because some of them felt that they need a help/guidance from their supervisors or colleges to perform the treatment without any problem. According to the survey, majority of the students were found to have a high level of confidence and preparedness in doing clinical procedures such as receiving valid consent from the patient prior to performing the dental treatment, performing the appropriate tooth-coloured restoration, obtaining patient's medical history, removing dental caries effectively and taking periapical radiographs. These findings are relatively compatible with previous studies done on dental students from European universities. According to the research done in the United Kingdom, it stated that students were found to have low level of confidence in performing amalgam restoration, endodontic treatment on multi-rooted teeth and providing crowns using the principle of tooth preservation. According to a study done in Pakistan, most of the student had a low level of preparedness in undertaking bitewing radiograph, performing endodontic treatment on multirooted teeth, providing partial dentures and providing crown to patients due to the lack of training and skill in treating these kinds of patients (Ali et al., 2018).

The current study findings highlighted the final year student's level of preparedness regarding their cognitive, communication and professionalism skills. Many students found that it was easy to communicate appropriately with their colleagues, providing opportunities for the patients to express their expectations from the dental treatment and recognizing their own personal limitations in clinical practice. The current study found that many students always seek help from their supervisors or colleagues. This in turn increased the confidence level of students as well as made them feel safer in providing treatment. Previous study stated that some students tend to rely on their supervisors and became anxious whenever they are working independently in certain occasions.

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It also stated that the transition from supervised to unsupervised practice is difficult but also an important step because it is essential for an independent and confident practice in the future (Gilmour et al., 2016). Moreover, the current survey showed that a high number of students had agreed that they have a low level of confidence when referring patients with suspected oral cancer. These findings are similar to a previous study results of a dental institute in the United Kingdom. Based on the study, it was reported that the majority of students had a low level of confidence in the ability to refer suspected oral cancer due to their lack of knowledge and skills to detect and recognized oral cancer or potentially oral cancer must be rectified as it plays a crucial role in the sub-optimal prevention and referral for oral cancer management.

The majority of students felt unprepared with regard of using an evidence-based approach in evaluating new dental materials, in their clinical practices, and interpreting the results of the research. In previous studies, it was highlighted that undergraduate dental students lacked the confidence in their knowledge and skills in evidence-based dentistry (Nieminen et al., 2017; Straub-Morarend et al., 2016). Therefore, it is advisable that the dental education should emphasize on developing the skills of students to search and analyse evidence-based practice in the age of rapid technological advancement.

The current study found that there is a difference in the students' level of preparedness between public and private universities. It showed that public universities students has higher level of confidence and preparedness as compared to private universities. The differences may be influenced by many factors such as curriculum design, clinical training, and assessment methods . However, this study has some limitation as it did not include the components of the curriculum and percentage of teaching and clinical hours the student has undertaken. Although the Malaysian Qualifications Agency (MQA) is monitoring and accrediting the curriculum of the dental faculties in Malaysia based on certain requirements and legislations, there are a relative differences in the curriculum contents and clinical requirement between the public and private universities that may have consequences on the students clinical experience, attitude, behaviour and ultimately preparedness.

Although the Malaysian final year undergraduate students were satisfied about their level of preparedness in relation to certain clinical skills, however, several areas of weaknesses were also identified. The areas of skills that should be promoted, enhanced, updated and critically monitored include performing amalgam restoration, endodontic treatment on multi-rooted teeth, providing crowns and recognizing oral cancer. The results of the study would help the dental educators in Malaysia to recognise and avoid the expected shortcomings in the clinical training of their students and provide extra support, reassurance, and when necessary, a further clear training.

#### CONCLUSION

The present study results showed that the self-perceived preparedness of final year students was satisfactory for a range of clinical and effective skills. However, several areas of weaknesses were identified which underscore the need for additional training and consolidation. Further detailed studies are required to be carried out to evaluate the reasons behind the students' level of preparedness; in order to reveal the collateral factors that influence the students' level of preparedness before entering the working environment. It is also recommended that future national studies on undergraduate students should involve a representative from each dental school to help to spread the information about prospective studies more widely with the aim to achieve a higher response rate. Few areas of dental students clinical training and skills need further attention from the lecturers/ supervisors to undertake their utmost experience in training their students.

#### **CONFLICT OF INTEREST**

The authors would like to declare that there is no conflict of interest.

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### Social & Behavioral Risk Factors and Early Childhood Caries – A Cross-Sectional Study on Preschool Children in Shah Alam

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#### ABSTRACT

**Introduction:** Early childhood caries (ECC) remains a major challenge among the 5-6 year olds in Malaysia with a caries prevalence of 71.3% as indicated in the last survey of preschool children in 2015. Studies have shown that behavior and income status can influence development of ECC. **Objectives**: The aim of this study was to measure the caries prevalence among 2 - 5 years old preschool children and to study the association of parents' socio behavioral factors on ECC. **Materials and methods**: 140 preschool children participated in this study. Parents were given a set of structured questionnaires and oral examination was conducted on their children after receiving consent. **Results:** Findings showed prevalence of dental caries was 50.1% with mean dft score of 2.51. There was significant association between dental caries and children drinking formula milk and sweet drinks in their bottles: (p<0.05). Children from lower income family and lower education level have significantly higher caries prevalence compared to those from more privileged family. **Conclusions:** Drinking pattern, family income and education level appear to be contributing factors towards development of ECC among this group of children. It is recommended that health promotion interventions be targeted towards the lower income group with emphasis on drinking pattern of the children.

Keywords: Early childhood caries, drinking pattern, preschool children.

#### INTRODUCTION

Early childhood caries (ECC) in Malaysia is a major challenge as indicated by epidemiological surveys. Caries prevalence among the 6-year-olds have remained high with only a slight decline from 80.9% in 1997 to 74.5% in 2007 (NOHSS 2007). The National Oral Health Survey of Preschool Children 2015 (NOHPS 2015) showed a decreasing trend in caries prevalence (dft $\neq$ 0, DMFT $\neq$ 0) compared to previous survey – 87.1% in 1995, 76.2% in 2005 and 71.3% in 2015 (NOHPS 2015). Even though it shows a decreasing trend, the prevalence is still high as the reduction in caries severity is rather slow with a mean decayed component of 4.55 and almost two-thirds of the children (65%) required treatment for dental caries in the deciduous dentition (NOHPS 2015). ECC has been defined as the presence of 1 or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger (AA Pediatric Dentistry,



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2020). A variety of terms have been used besides Early Childhood Caries such as nursing caries, nursing bottle syndrome and baby bottle tooth (AA Pediatric Dentistry, 2020). Early Childhood Caries is a multi-factorial disease. Development of caries is not only the result of a time-specific interaction of microorganisms with sugars on a tooth surface, which is Streptococcus Mutans (Hallet & Rouke, 2003, Kumar et al, 2014, Poh et al, 2012) but other factors also influence the carious process. Studies have shown that social, demographic and behavioral factors such as ethnicity, family income, maternal education level, family status, tooth brushing habits and parental knowledge and beliefs are scientifically associated with the development of ECC (Kumar et al 2014, Poh B.K et al 2012, Ruhaya H et al 2012).

A number of studies have demonstrated a clear correlation between social and behavioral factors and the prevalence of early childhood caries among preschool children (Hallet et al 2003, Kumar et al 2014, Poh B. K et al 2012, Nahed AA 2013, Naidu et al 2013). There is strong evidence on the influence of behavioral factors towards development of early childhood caries. The primary factor was said to be a pattern of sugar consumption that has been established early in life of the child (Annerosa et al 2010). According to Campus et al., (2004), children with high frequency of sweet food consumption and those who use pacifiers at night are at a higher risk of getting caries (Campus, G., et al 2004). This prolonged and improper feeding habits also contributed to the development of early childhood caries (Hallet et al 2003, Ruhaya H 2012, Widowati Witjaksono et al 2006, Prakasha Shrutha et al 2013). In addition, preschool children who did not practice tooth brushing at all and frequently took sweet foods are at higher risk of getting dental caries (Kumar et al 2014, Ruhaya H et al 2012, Nahed A 2013, Naidu R 2013, Annerosa Borutta et al 2010).

There was also a significant increase in ECC risk caused by infant feeding behaviors such as not breast feeding up to 12 months of age, sleeping with the bottle, and children who continuously sipped from the bottle (Hallet et al 2003).

Parental knowledge and oral health awareness play an important role in minimizing the occurrence of nursing bottle caries among young children. Families with better family income experienced improved dental health as compared to low family income (Hallet et al 2003, Poh et al 2012, Ruhaya H et a; 2012, Naidu et al 2013, Peltzer et al 2014).

The aim of this study was to measure the caries prevalence among 2-5 years old preschool children and to investigate the association of parents' socio-behavioral factors on ECC in preschool children in a local urban area in Shah Alam, Malaysia.

#### MATERIALS AND METHODS

A cross-sectional study was conducted among a randomly selected group of pre-school children aged 2-5 years old living within the area of Shah Alam, Selangor. A total of 142 preschool children participated in this study. The exclusion criteria included children who were not given consent by their parents, special needs children or children with medical history and difficult children who refused to be examined. Ethics approval was obtained from Universiti Teknologi MARA (UiTM) Research Ethics Committee. A set of questionnaires on parents' demography and behavioral factors were given to the selected sample of preschool children and will be completed by their parents. The questionnaire was adapted from a previous study on social and behavioral determinants of early childhood caries (Hallet et al 2003). Only parents who have given consent for their children to undergo oral examination and answered the questionnaire were included in the study. Even though parents of 142 children responded, not all the questionnaires were fully answered by the parents. Oral examination was carried out at the childcare premises using portable equipment. Caries experience was recorded using WHO survey method. The oral examination was conducted in the class or in the kindergarten premises in the presence of their teachers and caregivers.

Data obtained from the questionnaire and oral examination were computed and analyzed using the SPSS (Statistical Programme for Social Science, Raleigh, North Carolina, USA) (V.21). Parents' social and behavioral factors were then grouped into demography and oral health behavior.

#### RESULTS

#### Demography and dental caries prevalence

Table 1 shows caries prevalence and oral health behavioral variables of the children in the study. The difference in caries prevalence between the boys and girls were not statistically significant (P>0.05). However, the association between education level and income level with caries prevalence was statistically significant (P=0.005 and P=0.003). More than 50% of children whose parents' have education level up to secondary level have higher caries prevalence (62.5%) compared to those with university education (30.5%). In the income group, children from households whose earnings were less than RM5000 have higher caries prevalence (31.9%) compared to those from the higher income bracket (8.5%).

		Caries			Chi-sq test
Variables	Absent Prese		sent	p-value	
	Ν	%	Ν	%	
GENDER					0.973
Boys	43	30.3	29	20.4	
Girls	42	29.6	28	19.7	
EDUCATION LEVEL					0.005
Primary& secondary level	9	37.5	15	62.5	
Pre-university& vocational	9	45.0	11	55.0	
University	66	69.5	29	30.5	
HOUSEHOLD INCOME					0.003
<rm3000< td=""><td>18</td><td>12.8</td><td>23</td><td>16.3</td><td></td></rm3000<>	18	12.8	23	16.3	
Rm3001- rm5000	21	14.9	22	15.6	
Rm5001-rm8000	20	14.2	7	5.0	
>rm8000	25	17.7	5	3.5	
DURATION OF BREAST FEEDING					0.761
< 6 months	21	16.9	19	15.3	
6 months- 12 months	15	12.1	19	15.3	
Between 12- 24 months	15	12.1	12	9.7	
More than 24 months	13	10.5	10	8.1	
AGE TO START BOTTLE FEEDING					0.757
Not on bottle feeding at all	3	2.4	5	4.0	
< 6 months	27	21.8	21	16.9	
6-12 months	21	16.9	18	14.5	
At age between 12-24 months	7	5.6	10	8.1	

#### Table 1: Socio - behavioral factors and caries prevalence

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After 2 years old	6	4.8	6	4.8	
CONTENT OF DAILY BOTTLE					
Infant formula	57	46.0	44	35.5	0.024
Plain water	29	23.4	28	22.6	0.880
Cordial fruit juice	12	9.7	12	9.7	0.860
Sweet drink	12	9.7	24	19.4	0.009
SLEEP WITH BOTTLE					0.409
Yes	15	12.1	18	26.6	
No	49	35.9	42	33.9	
USAGE OF SWEETENED DUMMY					0.079
Yes	1	0.8	5	4.0	
No	63	50.8	44.4	55	
AGE STARTED TOOTH BRUSHING					0.937
<6 months	7	5.6	8	6.5	
Between 6-12 months	23	18.5	21	16.9	
Between 12-24 months or more	27	21.8	23	18.5	
More than 2 years old	7	5.6	8	6.5	

#### Socio behavioral Factors and dental caries prevalence

Children who consumed infant formula or sweet drinks in the bottle daily had significantly higher caries prevalence (p=0.024) and (p=0.009) respectively. As for duration of breast feeding and other socio behavioral factors, even though they were not significant, there is an increasing trend of dental caries in children who were breastfed for a shorter duration (30.6%) compared to those who were breastfed for more than a year's duration (17.8%). Those who started bottle-feeding earlier before the age of 1 year showed higher caries prevalence (31.4%) compared to those who started bottle-feeding after twelve months (12.9%). However this study showed that children who did not sleep with the bottle seemed to have higher caries prevalence (33.9%) compared to those who slept with the bottle. Sweetened dummies also did not have much effect towards caries formation.

#### Socio-behavior factors and mean dft scores

The association between social and behavioral factors and the mean decay and filled deciduous teeth (dft) scores is shown in Table 2. Children from families with lower education background have higher mean dft (3.16) compared to those children whose parents have achieved university education (mean dft = 2.03). Children with lower income parents also have higher mean dft of 3.17 compared to those parents who have higher income (mean dft = 1.45). Children who consumed fruit juice or sweet drinks in their bottles or use a sweetened dummy have higher mean dft (3.58, 3.83, 5.00 respectively) compared to children who drink plain water in their bottle (mean dft=2.74) and children who do not use the sweetened dummy (mean dft=2.38). Even though there was no statistical difference between children who slept with the bottle and those who did not sleep with the bottle, it still poses a risk in caries formation as shown by the mean dft (3.42) compared to those who did not sleep with the bottle (mean dft=2.18).

Variables		df	t
		Mean	Sd
GENDER	male	2.90	3.790
	Female	2.13	3.670
EDUCATION LEVEL			
Primary & secondary		3.16	3.837
Pre-university & vocational		3.75	4.667
university		2.03	3.395
HOUSEHOLD INCOME			
<rm 3000<="" td=""><td></td><td>3.17</td><td>3.390</td></rm>		3.17	3.390
RM 3001-RM 5000		2.36	3.681
RM 5001-RM 8000		2.71	4.101
>RM 8000			
		1.45	3.019
DURATION OF BREAST F	EEDING		
< 6 months		2.15	3.199
6 months- 12 months		2.65	3.992
Between 12- 24 months		2.37	3.814
More than 24 months			
		3.09	4.231
AGE TO START BOTTLE I	FEEDING		
Not on bottle feeding at all		3.38	1.523
< 6 months		1.81	0.414
6-12 months		2.59	0.640
At age between 12-24 mont	ths	3.94	1.174
After 2 years old			
		2.42	1.055
CONTENT OF DAILY BOT	TLE		
Infant formula		2.04	3.307
Plain water		2.74	4.099
Cordial fruit juice		3.58	4.818
Sweet drink			
		3.83	4.507
SLEEP WITH BOTTLE			
Yes		3.42	4.528
No			
		2.18	3.362
USAGE OF SWEETENED	DUMMY		
Yes		5.00	4.817

#### Table 2: Socio – behavioral factors and mean dft score

No	2.38	3.647
AGE STARTED TOOTH BRUSHING		
<6 months	2.15	3.199
Between 6-12 months	2.65	3.992
Between 12-24 months or more	2.37	3.814
More than 2 years	3.09	4.231

Children who started solid food as early as less than 12 months have a higher risk of caries (mean dft=2.76) compared to those who started solid food after 18 months (mean dft=1) and children who started brushing after 2 years of age also have higher dft (mean dft=3.0) compared to those who started brushing as early as 6 months (mean dft=2.15).

Overall, the mean dft score for our study population in Shah Alam was 2.51 (SD 3.730) with 59.9% of children having caries free deciduous dentition and 50.01% of them with caries experience. Of these, 19.3% of the children presented with dft score of 6 and more.

#### DISCUSSION

Dental caries is one of the most common public health problem that can affect deciduous and permanent teeth. Managing dental caries in young children, especially those with rapid progression, can indeed be challenging for dental professionals.

According to the guideline of European Academy of Paediatric Dentistry (EAPD) on the prevention of early childhood caries, ECC presents a public health problem with biological, social, and behavioral determinants among some of its associated factors (EAPD Policy Doc 2008). A comprehensive review of literature showed that the prevalence of ECC varies across the world with it being between 1-12% in developed countries and up to 70% in developing countries (Colak et al 2013). The highest prevalence of dental caries is found in Africa and South East Asia (Milnes 1996) while in European countries (England, Sweden and Finland) the prevalence of ECC is estimated to range from 1% to 32% while in Eastern Europe it is reported to be as high as 56% (Szatko F et al 2004). As mentioned earlier, ECC is still a major challenge in Malaysia despite efforts taken to provide early oral healthcare to children from as young as infancy (Early Childhood Caries, OHD, MOH 2008).

The prevalence of ECC in this study population was quite high (50.1%) with a mean dft of 2.51 which is still below the national findings (NOHPS 2015, dft = 4.83). This could be attributed to the fact that the study area was conducted in an urban area. Despite pockets of urban poverty, access to oral health care is good and efforts are continuously being carried out to promote oral health and to provide oral health care specially to target groups of the population including the pre- school and school children.

The risk factors for ECC include a number of social and behavioral determinants (Annerosa Borutta et al 2010). Our study showed that socioeconomic status and education level remain significant risk factors for the development of ECC in preschool children. This could be attributed to low awareness, lower perceived needs and lower utilization of oral health care services. Parents in the low socioeconomic group are more concerned about providing the essential needs for the family and may not have the time to focus on whether their children are practicing good oral hygiene at home. Watt R. G. in his paper stated that dental scientific literature from many countries has shown that the oral health of lower socioeconomic status (SES) groups is worse than those from higher SES and has stressed the need to address these social determinants to help curb prevalence of dental caries in this disadvantaged group (Watt R. G. (2007). Hallet & O'Rourke (2003) obtained similar results with a caries prevalence of 50.3% among children from low income families compared to those from higher income families.

Increased prevalence of ECC experienced by preschool children from low socioeconomic status may occur due to several factors such as limited access to professional oral health care services and not being able to afford oral health products such as toothbrush and toothpaste for their children due to financial constraints. As a result, these children will have poorer oral health which increases their risk of getting dental caries. Therefore, concerted efforts from various oral health organizations is needed to reduce the prevalence of ECC among preschool children.

Feeding habits also influences the risk of dental caries in young children. Adding sugar to formula milk and fruit juices increases a child's risk towards ECC. Besides this, giving children formula milk early in life also increases their risk of getting dental caries. This study has demonstrated a strong association between ECC and feeding habits. A study done by Ruhaya et al. in 2012 reported that 45% of parents, despite knowing the types of food that are cariogenic, still give sweetened liquid when bottle feeding. Another study conducted by Hallet et al. (2003) showed that daily bottle feeding with juice, cordial and soft drinks significantly increased the prevalence of ECC by 40.9%, 53.8%, 71.4% respectively as compared to daily bottle feeding without juice.

Although studies have shown a link between dental caries and sleeping with the bottle, this was not a significant finding in our study. However there is available scientific evidence that breastfeeding is more effective at preventing dental caries in early childhood than bottle-feeding and should be encouraged as an exclusive feeding method for up to at least six months (Avila WM et al 2015). This significant association of duration of breastfeeding and prevalence of ECC is due to caries protective elements such as maternal immunoglobulin, enzymes, leucocytes and specific antibacterial agents, which are found in human breast, milk (Annerosa Borutta et al 2010).

There were also correlations of other variables such as the age started brushing, usage of toothpaste and sweetened dummy in development of ECC as reported by other researchers. Our study did showed that children who used sweetened dummy have higher dft compared to those who do not. Those children who started tooth brushing earlier at the age of one year old were said to experience less caries a s compared to children who started tooth brushing at a later age (Hallet et al 2003). Our studies also showed that children who started brushing after aged 2 years have a higher dft compared to children who started brushing as early as 6 months. However, this is not significant probably due to the small sample size and thus further studies need to be carried out to investigate other risk factors that may influence the onset of caries in young children.

#### RECOMMENDATIONS

Early childhood caries is an important public health problem among certain segments of the society such as the socially disadvantaged and remains a persistent disease burden to health care systems. Occurrence of dental caries relies very much on the biology and pathogenesis of the disease i.e. the balance between the virulence of the attacking agent (primarily mutans streptococci), the host resistance (integrity of primary tooth enamel, saliva, protective elements) and this is further influenced by environment factors including social, cultural, demographic, behavioral and economic circumstances. This study showed association between income, education, infant formula and juices in bottle feeding as risk factors for dental caries in preschool children in the area of Shah Alam, Selangor. This information is useful for policy makers in targeting oral health promotion for preschool children especially for those from the high-risk groups. Concerted efforts must be directed towards strengthening oral health promotion programs focusing on parents and child-carers.

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Compendium of Oral Science Volume 8/2021 Original Article

### Influence of Hypnotic Suggestions to Increase Periodontal Patients' Compliance

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#### ABSTRACT

**Objective:** To evaluate the effectiveness of hypnosis 1) to reduce dental anxiety in periodontal patients, and 2) to increase periodontal patients' compliance through the reduction of dental anxiety. **Methods:** This was a randomized control trial of 22 patients (13 males, 9 females;  $40.14 \pm 19.59$  years) who underwent non-surgical periodontal therapy in the Postgraduate and Undergraduate Clinics. Patients were divided into the case, H, (hypnosis; n=11) and controlled, N, (no hypnosis; n=11) groups, where patients' dental anxiety level was assessed twice for both groups using IDAF-4C+ during the first visit and the second visit. The compliance was evaluated during the follow-up visit. **Results:** The result showed statistically significant differences (p < 0.05) in the H group during the second visit indicating a reduction in dental anxiety as compared to N group. However, there were no statistically significant differences (p > 0.05) in the patients were found to be more relaxed with hypnotherapy at the beginning of the treatment but halfway through, patients without hypnotherapy had a more significant reduction in heart rate level. **Conclusion:** Hypnotic suggestions were found to help reduce patient's fear and anxiety. However, the compliance of the patients with or without hypnotherapy proved to have a similar outcome.

Keywords: hypnosis; hypnodontics; dental anxiety; audio distraction; periodontal treatment

#### INTRODUCTION

Successful dental treatment may be gratefully influenced by the patient's compliance, despite all the revolutionary advances in the fields of dentistry, it remains as one of the main contributing factors (Gokulanathan et. al.,2014). Compliance could be defined as the extent to which a person's behaviour coincides with medical or other health-related advice. It reflects a patient's willingness to comply with preventive and therapeutic strategies set forth by his or her health care provider (Alcántara et. al., 2014). Many factors have been reported as the possible influence of patient's compliance (Alcántara et. al., 2014).



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One of the factors is a person's perception of his or her vulnerability to disease (Armfield et. al., 2007). In other words, if the patient perceived the disease to be less life-threatening, the compliance rate will be higher. Other factors include the cost-benefit ratio of preventive care versus treatment needed, the perception of the importance of patient's participation in the implementation of preventive and therapeutic strategies, the socioeconomic class of the patient, and poor communication between the oral health care provider and the patient (Alcántara et. al., 2014). This is similar to a report by Freeman (1990), where he mentioned the main four groups of barriers to compliance, (i) dental anxiety, (ii) financial costs, (iii) perceptions of need and, (iv) lack of access (Freeman, 1999). Dental anxiety was reported as one of the most important factors in determining a person's attitude towards dental care, as high levels of anxiety could lead to the abandonment of necessary dental care, which eventually impacts oral health and the quality of life negatively (Elkins, 2007). And for most dental patients, periodontal therapy is anxiety-inducing dental treatment and very expensive (Appukuttan, 2016). Which resulted in most of them deciding not to return for follow up.

Periodontal therapy is a therapy that includes both surgical and non-surgical techniques to restore health to the supporting structures of the teeth such as the gingiva and alveolar bone to avoid tooth loss (Van der Weijden et. al., 2019). As reported by Liu et. al., a high level of dental fear had been associated with patients undergoing periodontal therapy (Liu et. al., 2015). It was further reported that periodontal therapy usually consisted of multiple long treatments, and patients were subjected to a fearful situation that aggravated their dental anxiety. Studies had shown about 71% of patients had dental fear associated with periodontal therapy, and 12.1% of patients had extreme fear during treatment. Thus, the feeling of discomfort or pain during the procedure caused by constant fear might have negative effects on clinical outcomes, resulting in poor oral health. Periodontal health will deteriorate resulting from poor patient's compliance towards treatment due to dental fear (Beaton et. al., 2013).

According to Appukuttan (2016), there is no one-single therapy that could manage anxiety as there are multiple contributing factors that could lead to this psychological behavior (Appukuttan, 2016). Previous studies had reported that dentists had used many ways to tackle dental anxiety and related problems (Agras et. al., 1969; Alcántara et. al., 2014; Appukuttan, 2016; Beaton et. al., 2013; Freeman, 1999; Liu et. al., 2015). Both pharmacological interventions such as the use of nitrous oxide and/or non-pharmacological interventions, to provide distraction and relaxation to the patient were used (Agras et. al., 1969; Alcántara et. al., 2014; Beaton et. al., 2013; Freeman, 1999; Liu et. al., 2014; Beaton et. al., 2013; Freeman, 1999; Liu et. al., 2014; Beaton et. al., 2013; Freeman, 1999; Liu et. al., 2015; Mendoza et. al., 1991). Most of the methods had worked tremendously well in managing dental anxiety.

The first visit is very important as it could give an idea about the presence of the patient's anxiety and fear, this could be evaluated subjectively or objectively (Appukuttan, 2016; Corah, 1969). Calm, continuous conversation helped the dentist to identify the source of anxiety and fear that the patient is having (Appukuttan, 2016). Besides, asking open-ended questions can direct the dentist to establish a patient's reasons for attending, such as, the events that happened during the previous dental treatment, what had been troubling them regarding the treatment, and their hopes. Corah's Dental Anxiety Scale (CDAS), Modified Dental Anxiety Scale (MDAS) are commonly used, dependable, and valid to assess the level and cause of anxiety (Armfield, 2011; Corah, 1969; Humphris et. al., 1995). However, each of the anxiety scale questionnaires has its shortcomings and is not considered as the gold standard. The major limitation of CDAS is anxiety towards local anaesthesia injection is not included (Corah, 1969). These anxiety scales have different cut-off points that affected the prediction of consequences such as fear of loss of control, avoiding the dentist owing to fear and problem-oriented visiting (Armfield, 2011).

One of the methods used to overcome dental anxiety is hypnosis. There were many types of research done on the use of hypnosis in Dentistry for the past decades (Patel et. al., 2000). According to Bryant (2006), hypnosis was defined as a state or condition of mind connected to deep relaxation, narrowed focus, and increased suggestibility (Bryant & Mabbutt, 2006). It is an intermediate state between sleep and wakefulness. The term "hypnosis" is referred to as the interaction between a "hypnotist" and the "subjects". The hypnotist attempts to affect and influence the subjects' perceptions, feelings, and behaviour by focusing on ideas and images that may evoke the intended effects which can be used to provide relaxation (Appukuttan, 2016). As reported by Patel, dentists who use hypnosis regularly in their clinical practices experience some significant advantages (Patel et.

al., 2000). Currently, the most common uses of hypnosis in Dentistry are to reduce anxiety and fear encountered when attending a dental visit, and, for behavioural management in Paediatric dental patient (Glaesmer, Geupel, & Haak, 2015). Other dental applications of hypnosis include bleeding and saliva control, gagging control, physical and psychological adjustment to new prostheses and control of parafunctional habits such as bruxism (Kroger, 2008).

Despite the many applications of hypnosis in the past years, there are still many misconceptions and misunderstandings of hypnosis. According to Crawford (1992), some claim that hypnosis is insidiously coercive (Crawford et. al., 1992). While Kroger (2008) reported that some even relate hypnosis to witchcraft and antiscientific and, therefore antithetical to evidence-based clinical practice (Kroger, 2008). Moreover, Malamed (2018) pointed out that some had suggested that those who are susceptible to hypnosis are only less than 25%, although the percentage of patients influenced by hypnosis when used clinically was higher (Malamed, 2018).

Despite being a very safe practice, inexpensive, poses minimal risk, an adverse reaction to the patient, minimal studies were found on hypnotherapy use in dental settings (Bryant & Mabbutt, 2006). Most of the studies were done on paediatric patients whose dental anxiety experience was as stated before. However, it should not be used in persons or patients diagnosed with mental health problems, personality disorders, and neurodegenerative disorders for fear of potential adverse reactions to patients' mental health conditions (Appukuttan, 2016). There were a minimum number of studies testing the effect of hypnosis on adult patients seeking periodontal treatment. There was one earlier research conducted by Wood et al. in 1999 about the use of hypnotherapy in periodontal patients. A widely used comprehensive hypnosis reference by Hammond in 1990 did not mention periodontal diseases at all (Kelly et. al., 1990).

In the present study, hypnosis was used as an adjunct to reduce anxiety during periodontal treatment and to increase patient compliance. The many uses of hypnosis in Dentistry that have been described in the literature have targeted Paediatric patients and few references have been made specifically about the application of hypnosis to patients who had periodontal diseases. The current study concentrated on the use of hypnosis on the periodontal patient to tackle dental anxiety that affects the patient's compliance.

#### MATERIALS AND METHODS

This was a randomized clinical trial carried out for 10 months from February 2019 until December 2019 at the Faculty of Dentistry Universiti Teknologi MARA (UiTM). Ethical approval was obtained from the Ethics Committee of Universiti Teknologi MARA (UiTM) Shah Alam. Twenty-two (n=22) patients were selected from the undergraduate students and postgraduate students at the Centre of Periodontology Studies in UiTM; specifically, patients who underwent nonsurgical periodontal treatment such as scaling and root debridement were invited to participate. The purpose of the study was explained and written consent was obtained from participants.

The participants were randomly assigned into a) control, N (*n*=11), and, b) case, H (*n*=11) groups.

All participants were asked to complete Corah's Dental Anxiety Scale (CDAS) (Figure 1) to assess the pre-operative anxiety level before the commencement of periodontal surgery. Only participants with score  $\leq 18$  were included in this study. Score 18 was chosen because it is the maximum score for someone to be classified as fairly anxious. (Corah et al., 1978) Those with a score of 19 or beyond were considered highly anxious dental patients and therefore, they were excluded from this study.

Participants included in this study were; (i) individuals between 18 and 45 years, (ii) patients with CDAS  $\leq$ 18, (iii) patients requiring non-surgical periodontal therapy, and (iv) patients who agree to participate in this study. The exclusion criteria were; (i) patients who did not consent to participate in this study, (ii) patients who are deaf, and (iii) patients who are highly anxious.

Haemodynamic variables, systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded pre-, intra-, and postoperatively. The participants' SBP (mmHg), DBP (mmHg), and HR (bpm) were measured using a digital blood pressure sphygmomanometer for both control and case group.

#### Control group, N

1. BP and HR were recorded four times throughout the process, where:

T0 = when they sat on the dental chair

- T1 = during the administration of local anaesthesia (if any)
- T2 = 20 minutes into the periodontal procedure, which is at the same time of post-hypnotic suggestions given to the hypnosis group
- T3 = after the completion of the periodontal procedure

#### Case group, H

- 1. BP and HR were recorded four times (Tx) throughout the process, where:
  - T0 = before induction
  - T1 = during distraction manipulation
  - T2 = end of post-hypnotic suggestion
  - T3 = after completion of treatment and after awakening

For the case group, hypnosis was pre-recorded by a qualified hypnotherapist. The pre-recorded recordings of hypnotherapy were played throughout the periodontal treatment. The recording consists of all stages of hypnosis, (i) induction, (ii) manipulation of distraction, (iii) deepening, (iv) ego-strengthening, (v) homework, and (vi) awakening. The control group was not offered any form of hypnotherapy or other forms of relaxation.

During the second visit, a second IDAF-4C+ questionnaire was given to once again measure anxiety level and to observe any improvement from the first visit. The patients' compliance was assessed by their attendance and feedback and for those who underwent hypnotherapy, their conformation towards the post-hypnotic suggestions given to them previously.

#### STATISTICAL ANALYSIS

Data management and statistical analysis were done with IBM SPSS Version 25. Independent Sample T-Test was used to analyse the data to find out the differences between the means of each group; case and control group, interventions are done on each group and the change of scores in the IDAF-4C<sup>+</sup> questionnaire. The means between two unrelated groups were compared on the same continuous and dependent variable.

#### RESULTS

A total of 35 patients were approached to participate in this study and 22 met the inclusion criteria. **Table 1** shows a comparison of the number of patients between the two genders. The number of male patients slightly outnumbered females, and these numbers did not affect the validity of the results. The number of patients that undergone scaling was 72% (n=16), which was doubled as compared to patients that undergone SRD (**Table 2**).

Variable	n (%)
Gender	
Male	13 (59)
Female	9 (41)

#### Table 1: Demographic characteristics of patients

#### Table 2: Type of treatment received by periodontal patients

Type of treatment received	n (%)
Scaling	16 (72)
Scaling & root debridement (SRD)	6 (28)

The cumulative score of the questionnaire ranges from 8 to 40. The score can also be calculated by averaging the total score (range: 1-5). The mean value of pre- and post-IDAF-4C<sup>+</sup> differs in the H group and N group, which were provided in **Table 3**. In the H group, the mean total score greatly reduced from 23.55 to 18.57. However, the score for the N group slightly increased from 24.36 to 25.75 (95% CI = -3.68 - 5.32). Although the value of pre-IDAF-4C<sup>+</sup> for both groups was similar, post-hypnotic suggestions that were given to the H group was proven to be effective (p < 0.05) as the mean total score was reduced, as compared to N group.

	H Group	N Group
Pre-IDAF-4C*	23.55	24.36
Post-IDAF-4C <sup>+</sup>	18.57	25.75

#### Table 3: Mean score of IDAF-4C\*

Average blood pressure measured for the H group was shown in **Graph 1**. During the transition between T0, T1, and T2, the systolic blood pressure gave a constant mean reading of 141 mmHg (95% CI = -29.37 - 3.82). Towards the end of the treatment, where the last blood pressure was taken, the reading slightly dropped to 140 mmHg. There was more reduction seen in diastolic blood pressure between T0 and T1, and the reading slowly climbs up to 77 mmHg towards the end (95% CI = -17.85 - 0.76).



Graph 1: H group average blood pressure (mmHg)

**Graph 2** shows the average blood pressure for the N group. The systolic blood pressure slightly fluctuates during treatment. Blood pressure between T0 and T1 reduced from 124 mmHg to 120 mmHg, but slightly increased to 121 mmHg between T1 and T2 (95% CI = -38.15 - 3.60). The reading then decreased to 117 mmHg during T3. Diastolic blood pressure was continuously reduced to 71 mmHg throughout T0 to T2. The reading was elevated to 73 mmHg during the last blood pressure reading (95% CI = -17.81 - 0.72).



Graph 2: N group average blood pressure (mmHg)

**Graph 3** shows the average heart rate of the H and N groups. Heart rate for both groups started at a similar reading, which was 74 beats/min (95% CI = -9.40 - 11.21). As the treatment was carried out, the heart rate dropped to 68 beats/min. A higher amount of drop was recorded for the r N group (p > 0.05). After the treatment was completed, the heart rate of H and N group increased to 70 and 69 beats/min respectively (p > 0.05). There were no statistically significant differences (p > 0.05) in the pattern of reduction of blood pressure between both groups N and the patient's attendance for the second follow up visit determined the patient's compliance towards the treatment, as shown in **Table 4**. An equal number of patients who were compliant and not compliant were recorded for both groups, which were n=9 (81%) and n=2 (19%) respectively.



Graph 3: Average heart rate for H and N group

Patient's Compliance	n (%)
H Group	
Compliant	9 (81%)
Non-compliant	2 (19%)
N Group	
Compliant	9 (81%)
Non-compliant	2 (19%)

#### Table 4: Patient's attendance for second visit

#### **DISCUSSION & CONCLUSION**

American Psychiatric Association (2015) described stress as "*A state of complete physical, mental and social well-being and not just the absence of sickness or frailty*". Since anxiety could lead to many complications, some interventions are necessary to help lessen the adrenaline rush (American Psychological Association, 2015). Hypnosis or hypnotherapy has been suggested as one of the methods to reduce the anxiety and help patients cope with the treatment (Appukuttan, 2016).

The experience in periodontal therapy is not usually life-threatening procedures. However, invasive procedures using a hand instrument or scaler, and post-operative pain and recovery could trigger dental anxiety (Croog SH, Baume RM, & Nalbandian, 1995). The administration of local anaesthesia during procedures is one of the anxiety factors. Also, Astramskaite et al. (2016) agreed with the study done by López-Jornet et al. (2014) that the block type local anaesthesia is triggering more anxiety than infiltrative injection (Astramskaite et al., 2016; López-Jornet et. al., (2014).

Hypnosis is a useful adjunctive therapy in Paediatric dentistry (Smith, 1965). It is particularly indicated in the control and management of emotionally disturbed children who require dental work. However, little evidence revolve around adult patients. This is because children are often in a self-hypnosis state during imaginary play,

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which occurs several times in a day-causing them to be more susceptible to hypnosis than adults. Imagining and pretending is an integral part of a child's play, and for most children, an altered state of consciousness is familiar, comfortable, and easy to achieve. Children are usually very open to hypnosis because they have fewer misconceptions, and probably have never seen or heard of stage hypnosis (Smith, 1965).

Based on the difference of IDAF-4C+ score between the first and second visits of the two groups, hypnotherapy on patients who underwent non-surgical periodontal therapy did affect reducing the dental anxiety of the specified treatment. Interestingly, patients who were treated without hypnotherapy were found to have an increase in their dental anxiety level. Verbal feedback was also obtained from the patients' post-treatment, and patients who underwent hypnotherapy reported to have more positive feedback in comparison with N. However, although there was a reduction of dental anxiety for H, compliance of the patients was similar in both groups. Therefore it could be concluded, hypnotherapy was found not to have a statistically significant difference in improving periodontal patients' compliance to a dental appointment.

According to the change of pattern in blood pressure, there was no significant reduction or difference in either group. The value and reading of blood pressure for H were higher which is in contrast to reports by previous studies on hypnotherapy than N (American Psychological Association, 2015). This could be due to the presence of existing medical illnesses such as high blood pressure. At certain times, there was a sudden increase in blood pressure reading for both groups where it doubled from the previous reading. This was because the patients' arm was slightly bent during the process of recording the blood pressure value, leading to an inaccurate measurement. Based on these findings, blood pressure solely could not determine the impact of hypnotherapy in dental anxiety reduction.

As for heart rate, during the initial treatment, the H group was found or appeared to be more relaxed. However, after half of the treatment was carried out, N group recorded lower heart rate reading than H. The heart rate increased for both groups after the treatment (T3), possibly due to the patient being aware of the end of the treatment and specifically for H, due to the awakening process of hypnotherapy. Another possibility could be due to a change of posture from supine to an upright position.

The total number of patients approached was 35 however 11 were excluded due to not meeting the inclusion criteria and another two did not give their consent. Thus, the total number of patients involved in the study was 22. However, this still did not meet the initial calculated sample size of the study which was 60. For H, the recording they were exposed to was voiced by a trained professional. The questionnaire used to measure the dental anxiety level was available in two languages, namely English and Malay and has been approved for its validity and reliability (Croog SH, Baume RM, & Nalbandian, 1995).

There were some problems encountered during data collection that could have affected the study. Among it, is the first few patients complained that the sound of the ultrasonic scaler was too loud and it interfered with the recording heard through the headphones. This problem was solved by purchasing noise-canceling headphones. Other than that, the patients' preconceived idea or mindset towards hypnosis was also a problem. Some patients doubted the effectiveness of hypnosis even before the hypnotherapy. Therefore, before conducting the research, a brief explanation was given to all the patients about the definition of hypnotherapy in dentistry, the common misconceptions of hypnotherapy, and the expectation of the patient during the hypnotherapy. Besides that, the environment played a huge role in the success of hypnotherapy. The undergraduate clinic was very noisy compared to the postgraduate clinic which interferes with the focus of some of the patients. Constant instructions by the operator during the hypnotherapy also had a similar outcome. Thus, the operator was advised to minimize as much communication with the patient as much as possible unless when necessary.

There were few studies done on the effect of hypnotherapy on periodontal patients in the past. A systematic review conducted in 2013, concluded the hat effectiveness of hypnosis was demonstrated but, there was a lack of clinical studies as evidence. Hence, the clinical results of this study could not be compared with previous hypnosis- related studies.

In conclusion, hypnotic suggestions were found to help reducing patient's fear and anxiety. However, the compliance of the patients with or without hypnotherapy proved to have a similar outcome. In the future, it is recommended that more studies were to be done on the effects of hypnotherapy on periodontal patients' compliance with a larger scale of participants.

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## Influence of Music Therapy to Reduce Anxiety During Periodontal Surgical Procedures

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## ABSTRACT

**Objectives:** To evaluate the influence of music in reducing patients' anxiety during periodontal surgery. **Methods:** This is a clinical trial of involving fifteen patients undergoing periodontal surgery. Patients indicated for periodontal surgery were invited to participate in the study, and randomly assigned to music (n=8) or control (n=7) groups. Participants' dental anxiety were determined using the Corah Dental Anxiety Scale (CDAS) before and after the surgery, while their blood pressure (BP) and heart rate (HR) were recorded at pre-, intra- and post-procedures. Paired t-test was used to compare the statistical significant difference between pre- and postprocedural anxiety for both groups. **Result:** The participants of this study consist of 22 patients that underwent periodontal surgery procedures, with majority of the subjects (53.3%) were males (n=8) and the mean age was 50.8 (SD=13.21). The measurement of blood pressure increased in patients allocated in music group compared to control group were statistically significant with (p<0.05).**Conclusion:** Our study suggests that music may reduce patients' anxiety while undergoing periodontal surgery. More details on the type and intensity of music may provide further value to the finding.

Keywords: music, dental anxiety, periodontitis, audio distraction.

## INTRODUCTION

Dental anxiety is described as a common condition related with avoidance of dental care and following healthrelated and psychosocial effects (Carlsson et al. 2015). Among the causes of anxiety is traumatic childhood experience during dental therapy and indirect learning from anxious family members or friends, exposure to frightful images of dentists in the media, the coping strategy of the person when encountered with past experienced and the insecure position of sitting on the dental chair (Appukuttan, 2016). Anxiety inevitably, will result into deferment or cancelation of a dental appointment entirely as suggested by Saatchi et al. (2015), hence poses a management challenge to clinicians and dental team, particularly in complex and lengthy procedures such as periodontal surgery.



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Environment and ambience of a dental clinic has been suggested as one of the factor that can influence patient's anxiety while waiting for treatment. The effect of music, was reported to have reduced patients' systolic and diastolic blood pressure (Mejía-Rubalcava et al., 2015, Roohy et al., 2005). Instrumental music such as those composed by Enya have been shown to successfully reduced stress (Khalfa et al., 2003, Grocke & Wilgram, 2007). Such music was found to reduce cortisol levels in nervous participants who were required to do speak and do mental calculations in front of audience. They also found that exposing hospitalised patient to composed music using headphones throughout surgery helped to reduce stress while under treatment compared to patients not exposed to music.

However, not much information is available on whether music can reduce patient's anxiety during a periodontal surgical procedure. This study was aimed to investigate the effect of music on dental anxiety as perceived by patients, and on clinical blood pressure and heart rate of patients undergoing periodontal procedure.

## MATERIALS AND METHOD

A clinical trial was carried out at a government dental training institution with approved ethics for the conduct (reference REC/246/19). Twenty-two (n=22) patients indicated for periodontal surgery in the Postgraduate Periodontics Clinic were identified and invited to participate in this study. Purpose of the study were explained and written consents were obtained from participants before recruitment.

Initially, participants were asked to complete the Corah's Dental Anxiety Scale (CDAS) (Figure 1) to assess the pre-operative anxiety level and only participants with score  $\leq 18$  were included in this study as (inclusion criteria) because it was the maximum score for someone to be classified as fairly anxious (Corah et al., 1978). Those with a score of 19 or beyond were considered as highly anxious dental patients and therefore, they were excluded from this study.

NAME ( <i>NAMA</i> ) DATE ( <i>TARIKH</i> )
Norman Corah's Dental Anxiety Scale (Skala Tahap Ketakutan Pergigian Norman Corah)
1) If you had to go to the dentist tomorrow for a check up, how would you feel about it? Sekiranya anda terpaksa pergi ke doktor gigi esok untuk pemeriksaan gigi, bagaimana perasaan anda?
<b>a.</b> I would look forward to it as a reasonably enjoyable experience. Saya akan menantikannya sebagai pengalaman yang cukup menyeronokkan.
<b>b.</b> I wouldn't care one way or the other. Saya tidak kisah.
<b>C.</b> I would be a little uneasy about it.
<b>d.</b> I would be afraid that it would be unpleasant and painful. Sava akan takut bahawa ia menjadi tidak menyenangkan dan menyakitkan.
<b>e.</b> I would be very frightened of what the dentist would do. Saya akan menjadi sangat takut akan apa yang dilakukan oleh doktor gigi itu.
2) When you're waiting in the dentist's office for your turn in the chair, how do you feel? Apabila anda menunggu di pejabat doktor gigi untuk giliran anda, bagaimana perasaan anda?
a. Relaxed.
b. A little uneasy.
C. Tense.
Tegang. d. Anxious.
Bimbang.
So anxious that I sometimes break out in sweat or almost feel physically sick. Sangat bimbang sehinggakan kadang-kadang saya berpeluh atau hampir sakit secara fizikal.
3) When you're in the dentist's chair waiting while the dentist gets the drill ready to begin working on your teeth, how do you feel? Apabila anda berada di kerusi pergigian menunggu sementara doktor gigi menyediakan barangan untuk merawat gigi anda, bagaimana perasaan anda?
<b>a.</b> Relaxed. Relaks.
<b>b.</b> A little uneasy. <i>Tidak menyenangkan.</i>
C. Tense.
d. Anxious.
<b>e.</b> So anxious that I sometimes break out in sweat or almost feel physically sick. Sangat bimbang sehinggakan kadang-kadang saya berpeluh atau hampir sakit secara fizikal.
4) Imagine you're in the dentist's chair to have your teeth cleaned. While you're waiting and the dentist or hygienist is getting out instrument which will be used to scrape your teeth around gums, how do you feel? Bayangkan anda berada di kerusi pergigian untuk membersihkan gigi anda. Semasa anda sedang menunggu doktor gigi atau pakar kebersihan pergigian sedang mengeluarkan instrumen yang akan digunakan untuk mengikis gigi sekitar gusi, bagaimana perasaan anda?
<b>a.</b> Relaxed. <i>Relaks.</i>
<b>b.</b> A little uneasy.
C. Tense.
Tegang.
U. Anxious. Bimbang.
<b>e.</b> So anxious that I sometimes break out in sweat or almost feel physically sick. Sangat bimbang sehinggakan kadang-kadang saya berpeluh atau hampir sakit secara fizikal.
Scoring For Corah's Dental Anxiety Scale (CDAS)

## Figure 1: Corah's dental anxiety score questionnaire

Other inclusion criteria in this study were; (i) healthy individuals between 18 and 45 years, , (ii) patients requiring periodontal surgery, and (iv) patients who agree to participate in this study. The exclusion criteria were: (i) patients with nervous disorder and (ii) patients with hearing deficits or tinnitus.

Patients' haemodynamic variables including systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded at pre-, intra-, and postoperatively. The patient's SBP (mmHg), DBP (mmHg) and HR (bpm) were measured using a calibrated digital blood pressure sphygmomanometer.

Instrumental music track in duration of 3 to 5 minutes each from Watermark album by Enya was chosen to be played throughout the surgical procedure. At the end of the surgery, the music were stopped and anxiety level was again assessed using the CDAS questionnaire. All the data were then tabulated and compared using Paired t-test in SPSS version 23.

## RESULTS

The participants of this study consist of 22 patients that underwent periodontal surgery procedures. In Figure 2, three (n=3) patients were excluded because of the postponement of surgery due to elevated blood pressure. Nineteen (n=19) patients were randomly divided into two groups; eleven (n=11) patients having music during periodontal surgical procedures (Group A) and eight (n=8) patients having the procedures without listening to music (Group B) as control group. Three (n=3) patients from music group withdrew themselves from the research due to feeling uncomfortable while wearing headphones during the procedures. One (n=1) patient from control group withdrew herself due to feeling anxious while having procedure. Fifteen (n=15) patients completed the clinical trial.



Figure 2: Trial profile

Majority of the subjects (53.3%) were males (n=8) and the mean age was 50.8 (SD=13.21). Twenty percent (n=3) of the subjects had hypertension as their underlying disease. The demographic distribution that consists of age, gender, and underlying systemic diseases is listed in Table 1.

Variables	N=15
Age, Mean±SD	50.80±13.21 (95% CI: 43.48-58.12)
Gender, N (%)	
Male	8 (53.3)
Female	7 (46.7)
Underlying systemic disease(s), N (%)	
No systemic disease	8 (53.3)
Hypertension	3 (20.0)
Dyslipidemia	1 (6.7)
Diabetes mellitus	1 (6.7)
Back pain	1 (6.7)
Anxiety	1 (6.7)
Types of periodontal surgery, N (%)	
Open flap debridement	10 (66.7)
Surgical crown lengthening	4 (26.7)
Implant placement	1 (6.7)

#### Table 1: Demographic distribution of participants

Mean CDAS preoperatively for music and control group were 7.25 and 7.14 respectively. Table 2 shows pre-, intra-, and postoperative mean SBP (mmHg), mean DBP (mmHg), and mean HR (bpm) of music and control groups whilst Figure 3 shows pre-, intra-, and postoperative mean SBP (mmHg), mean DBP (mmHg), mean DBP (mmHg), and mean HR (bpm) comparison between groups.

Variables	Music group Mean (SD)	Control group Mean (SD)	Mean difference (95% Cl)	t statistics (df)	p value
Preoperative systolic blood pressure (mmHg)	131.75 (17.63)	135.43 (14.97)	-3.68 (-26.23, 18.87)	-0.369 (9)	0.721
Intraoperative systolic blood pressure (mmHg)	133.50 (21.02)	129.50 (11.47)	4.00 (-19.43, -27.33)	0.394 (8)	0.704
Preoperative diastolic blood pressure (mmHg)	76.25 (6.85)	83.43 (7.28)	-7.18 (-17.30, 2.94)	-1.605 (9)	0.143
Intraoperative diastolic blood pressure (mmHg)	77.50 (13.03	77.50 (3.57)	0.00 (-12.59, 12.59)	0.000 (8)	1.000
Preoperative heart rate (bpm)	73.50 (16.84)	86.14 (10.70)	-12.64 (-28.68, 3.39)	-1.704 (13)	0.112
Intraoperative heart rate (bpm)	66.88 (16.55)	79.83 (6.15)	-12.96 (-27.27, 1.36)	-1.811 (12)	0.095

#### Table 2: Pre-, intra-, and postoperative mean SBP (mmHg), mean DBP (mmHg), and mean HR (bpm) of music and control groups

73.5		70.13	Heart rate in music group (bpm)
<b>X</b> 76.25	66.88	84.75	Diastolic blood pressure in music group (mmHg)
131.75	133.5	140.25	Systolic blood pressure in music group (mmHg)
<b>▲</b> 86.14	79.83	84.43	·Heart rate in control group (bpm)
<b>8</b> 3.43 <b></b>		90.57	·Diastolic blood pressure in control group (mmHg)
◆ 135.43	129.5	• • • • • 144.14	·Systolic blood pressure in control group (mmHg)
PREOPERATIVE	INTRAOPERATIVE	POSTOPERATIVE	

# Figure 3: Pre-, intra-, and postoperative mean SBP (mmHg), mean DBP (mmHg), and mean HR (bpm) comparison between groups

Statistical analysis was performed by using paired t-test in SPSS ver. 23. The comparison of patients' haemodynamic variables (Table 3) was done between the readings pre- and intraoperatively. The postoperative readings were not used in comparison as the postoperative readings were taken after patient sit upright for a few minutes from supine position for hours.

Variables	Groups	Preoperative	Intraoperative	Difference	Mean difference (95% CI)	t statistics (df)	P value
Systolic blood pressure (mmHg)	Music group	131.75	133.50	<u></u> ↑1.75	1.70	0.62	0 551
	Control group	135.43	129.50	↓5.93	(-4.51, 7.91)	(9)	0.001
Diastolic blood pressure (mmHg)	Music group	76.25	77.50	<b>↑1.25</b>	2.20 (-3.60, 8.00)	, 0.86 , (9)	0.413
	Control group	83.43	77.50	↓5.93			
Heart rate	Music group	73.50	66.88	↓6.62	5.86	2.17	0.040*
(bpm)	Control group	86.14	79.83	↓6.31	(0.02, 11.69) (13)	(13)	0.049

Table 3: Pre- and intraoperative mean SBP (mmHg), mean DBP (mmHg), and mean HR (bpm) comparison between groups

#### \*p<0.05

The mean SBP and DBP between before and during intervention was not statistically significant (p>0.05). The mean SBP and DBP increased in music group intraoperatively compared to control group. The mean SBP and DBP in music group during the surgery increased by 1.75 mmHg and 1.25 mmHg respectively. The current study was 95% confirmed that the mean difference of SBP and DBP in the population lies between -4.51, 7.91 mmHg and -3.60, 8.00 mmHg respectively.

However, the mean HR between before and during intervention was statistically significant (p<0.05). The mean HR decreased in both groups intraoperatively. The mean HR in music and control group during the surgery decreased by 6.62 bpm and 6.31 mmHg respectively. This study was 95% confirmed that the mean difference of HR in the population lies between 0.02, 11.69 bpm.

Based on Table 4, mean CDAS in both groups was reduced postoperatively compared to mean preoperative CDAS but there was not statistically significant (p>0.05). The mean postoperative CDAS in music and control group decreased by 0.62 and 0.14 respectively. The present study was 95% sure that the mean difference of CDAS among the participants lies between -0.19, 0.99.

Group	Mean Corah dental anxiety scale (CDAS)		Difference	Mean difference	t statistics	P
	Preoperative	Postoperative		(95% CI)	(df)	value
Music	7.25	6.63	↓0.62	0.40	1.47	0.164
Control	7.14	7.00	↓0.14	(-0.10, 0.00)	(17)	

#### Table 4: The comparison of mean CDAS pre- and postoperatively between groups

## DISCUSSION

American Psychiatric Association (2015) described stress as A state of complete physical, mental and social well-being and not just the absence of sickness or frailty. Since anxiety could lead to many complications, some interventions are necessary to help lessen the adrenaline rush. Nightingale (2007) found that some windy or stringy music can soothingly calm the patients since this creates an environment that helps in the healing process.

Appukuttan (2016) proposed that the anxiety shows unappealing experiences for both patients and dentists, and these patients were most likely to present with poor oral health, more missing and decayed teeth, poor periodontal status, including requiring complicated procedures during acute emergency condition. It has been proven that anxious patients have more caries, missing and non-restorable teeth than non-anxious patients (Appukutan, 2016). Dental anxiety and fright in patients may result in a longer management as, it is difficult to manage them along the procedure and they are often uneasy with their treatment.

The experience in periodontal surgery is not usually life-threatening procedures. However, invasive procedures using a scalpel and post-operative pain and recovery trigger dental anxiety. (Croog et al., 1995) The administration of local anaesthesia during procedures is also inducing anxiety. In addition, Astramskaite et al. (2016) agreed with the study done by López-Jornet et al. (2014) that the block type local anaesthesia is triggering more anxiety than infiltrative injection.

Periodontal surgery is one of the invasive dental treatments that may trigger anxiety among the patients due to tissue invasion and longer procedure (Croog et al., 1995). This procedure can be divided into 4 categories (Lang et al, 1993):

- 1. surgical procedures for pocket elimination or pocket reduction
- 2. treatment of osseous defects
- 3. procedures for access to the root surface
- 4. procedures for mucogingival problems

In order to measure the quantitative score for dental anxiety, Nagarajan et al. (2017) mentioned multiple- and single-item self-reporting questionnaires available for evaluating anxious and phobic patients such as Corah's Dental Anxiety Scale (CDAS), Modified Dental Anxiety Scale (MDAS), Spielberger State–Trait Anxiety Inventory, Stouthard et al.'s Dental Anxiety Inventory, Kleinknecht et al.'s Dental Fear Survey (DFS), and Gatchel's 10-point fear scale. Meanwhile, single-item questionnaires that were suggested are the Dental Anxiety Question, Seattle survey item, a Finnish single dental anxiety question, the visual analog scale and a single-item dental anxiety-and-fear question. However, none of these existing instruments has been regarded as a benchmark, as they have their own limitations. Corah's Dental Anxiety Scale (Corah, 1969) was applied in this study due to the reliability and validity to measure dental anxiety. (Corah et al., 1978). According to Kvale et al. in 1998, CDAS helped in sorting up the anxious patient and borderline patient into their group, with 90% and 85% success rate respectively.

Therapeutically, music intervention has been found to be very useful to lessen anxiety (Kaempf & Amodei, 1989; Lahmann, 2008; Lai et al, 2008; Nilsson, 2008; Mejía-Rubalcava et al, 2015; Chandure et al., 2017; Maulina et al., 2017; Bradt and Teague, 2018; Maybodi et al. 2018). In 1989, Kaempf and Amodei found that their experimental group had a significantly lower respiration rate than the control group. By introducing the patient to sedative music, they found respiration rates in experimental group after music intervention was significantly reduced after 20 minutes than in the control group. However, both the experimental and control group seems beneficial when there were lowered SBP and anxiety test scores.

In 2015, Mejía-Rubalcava et al. summarized that music helps in reducing patient dental anxiety by looking at their cortisol concentrations in patient's saliva, as cortisol is an important biomarker to investigate the stress level. They found that by introducing music to the patient, there's significant differences were noted in the salivary cortisol concentration, SBP, DBP, HR, body temperature and stimulated salivary flow, compared to the control group. The current research also showed the decrease of HR intraoperatively.

Review done by Nilsson (2008) suggested that music has been used in health care services to lessen patient perception of pain, anxiety scores, and stress level, even though the specific mechanism of these therapies are not clearly understood. Nilsson found that music intervention to patients had a very positive impact in perioperative settings. Lahmann et al, (2008) compared a brief relaxation method with music distraction and with a control group and found that both interventions reduced dental anxiety significantly. In a study done by Bradt and Teague (2016) case group were given music to listen to prior dental treatment, to prevent anxiety arising, as the patient is waiting for the treatment to start.

In the current study, SBP and DBP increased among the patients in the music group compared to control group. This result is different from the results of past studies (Kaempf and Amodei, 1989; Mejia-Rubalcava et al., 2015) that concluded the lowered blood pressure intraoperatively. Regardless of this difference, there were studies done by Lai et al. (2008) and Roohy et al. (2005) partially in the same path as the current study. Lai et al. (2008) reported that music intervention during root canal treatment reduces subjects' anxiety level but music does not affect SBP and DBP. Roohy et al. (2005) reported that there was no significant difference between the anxiety level, physiological responses, HR and respiratory rate in two groups before intervention but there were only differences in the level of anxiety and mean of arterial blood pressure in the intervention group.

There were definite reasons why the result was not satisfying enough. Limitations arose during the research was done. Some of the patients withdrew from the surgery procedure due to various reasons, which were elevated blood pressure, complaints of not comfortable to wear headphones, refused as they want to focus more on what the operator are doing and had concern if the complication will happen throughout the surgery. For instance, elevated blood pressure caused the surgery to be called off to avert any complications along the procedure. Moreover, uncomfortable feeling to use headphones were aroused when it involved surgeries at the posterior tooth since they need to tilt their heads, following the operator's instructions. Next was the determination to focus on what operators will be doing in the procedure cause them to withdraw from the research and last but not least, patients concerned if something bad happens during the procedure, so they were preferably not joining the research as the therapy will be intimidating to them.

Despite of music therapy such as both active and receptive music can be useful to improve health or functional outcomes, this study shows that music intervention increasing the blood pressure and lowering the heart rate. However, the current study could not conclude that music is less effective to reduce anxiety during periodontal surgical procedures as the smaller sample size. As recommendation for the use of future studies, a larger sample is needed to get better results on music to reduce anxiety during periodontal surgical procedures. The usage of earphones is better and making the patients feel comfortable to wear them along the surgical procedures as they will not restrict the movement of the patient's head.

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## Image Quality Optimization of Dental Panoramic Tomogram and Lateral Cephalogram: A Pilot Study on Human Skull

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## ABSTRACT

**Purpose**: The purpose of this study was to investigate the effects of varying scanning parameters of DPT and LC on diagnostic performance and quality of the images. **Materials and Methods**: Clinical evaluations of image quality were performed using an adult human skull with permanent dentition. Dental panoramic tomogram (DPT) and lateral cephalogram (LC) images were obtained using two different radiographic machines Instrumentarium 3000P taken at Sungai Buloh (SB) and Sirona Orthophos 3D taken at Puncak Perdana (PP) by varying tube voltages. Two orthodontic residents assessed images based on overall quality using a five-point rating scale and diagnostic value of the images were analyzed using Pearson's Correlations between radiation doses calculated for the evaluation for image quality. Intra-class Correlation Coefficient (ICC) was used to test for intra-rater and inter-rater reliability. **Results**: Both modalities taken at both centers showed negative correlation between dosage and detection of anatomical landmarks except for LC SB. All images were rated at least with median of 3= more than adequately presented regardless of the radiation dosage except for DPT PP (median 5= inadequately presented). **Conclusion**: Lower dosage parameters should be used when taking DPT and LC as images appeared darker, lower in quality and less anatomical landmarks can be detected at higher scanning parameter.

Keyword: dose reduction, dental radiography, image quality, diagnostic performance

**Abbreviations:** Dental panoramic tomogram (DPT), lateral cephalogram (LC), Sungai Buloh (SB), Puncak Perdana (PP)





## INTRODUCTION

Dental panoramic tomogram (DPT) is a very popular technique with more than 2 million views taken per year in UK alone (Murray, Diane, 2002). It is due to its quick and relatively simple procedure (Rushton and Horner, 1996). In orthodontics, DPT is essential to give the general information about the anatomy of maxilla and mandible for example erupted and unerupted teeth, the root formation, suggestion of carious teeth, periapical pathology, general bone condition or any presence of impacted or supernumerary teeth. Image quality and diagnostic value of the images is absolutely critical to ensure that all information needed for diagnosis and treatment planning are not obscured.

Lateral cephalogram (LC) since its introduction by Broadbent in 1926, has become a standard assessment tool in orthodontics (Broadbend B Sr, Broadbent B Jr, 1975; Devereux *et al.*, 2011). Lateral cephalogram is indicated when functional and fixed appliances to be used in patients with skeletal discrepancy, for teaching purposes in patients with moderate skeletal discrepancies, to assess the location and assessment of unerupted, malformed or ectopic teeth, for assessing growth and planning orthodontic-orthognathic surgery (Isaacson, Thom, Atack & Horner, 2015).

Despite the need and indications of the radiograph in dental practice, International Commission on Radiological Protection (ICRP) has outlined the optimization principle in patient exposure to ensure that the exposure to radiation is kept as low as reasonably achievable (ALARA) (ICRP, 2007). With increasing use of radiographs for orthodontic diagnostic and treatment planning, particularly DPT and LC has raised concern about radiation risks particularly somatic stochastic effect (Whaites E, 1992; Devereux *et al.*, 2011). Radiation exposure increases the risk of cancer throughout life and the dose-response relation for cancer at low doses is assumed to be linear without threshold (Kamiya *et al.*, 2015).

By using digital modalities, it is possible to provide low radiation dose (Murray, Diane, 2002) by means of adjustments variables on radiographic machines; tube potential (kV), tube current (mA) and time of exposure (seconds). However, this should not result in a significant drop in image quality and the diagnostic performance of the images. The challenge in optimization of DPT and LC is to decrease radiation dose without drastically reducing the diagnostic value and quality of the images. Due to variety of scanning parameters between different types and manufacturers, such approach require machine- specific examinations. Thus, this study was conducted to investigate the effects of varying scanning parameters of DPT and LC of different radiographic machines on diagnostic performance and quality of the images.

## MATERIALS AND METHODS

#### **Ethical Consideration**

The ethics for this study was obtained from UiTM Ethics Research Committee in July 2017. This study was conducted in accordance to the ICH Good Clinical Practice Guidelines and the Declaration of Helsinki.

#### **Study Design and Sampling**

This study was conducted using a cross- sectional study design with convenient sampling method. The sample size included different variations of the scanning parameters on the radiographic machine. There were 35 DPT (60-73 kV, 3.2- 13 mA) and 6 LC (85- 90 kV, 8.0- 13 mA) taken using Orthopantomograph® OP300 (Instrumentarium DENTAL, Finland) at Sungai Buloh (SB) and 16 DPT (60- 90 kV, 10- 16mA) and 16 LC (60- 90 kV, 9- 16mA) were captured using Sirona Orthophos 3D (Denstsply, USA). The time of exposure remained constant throughout the procedures.

#### **Image Acquisition**

An adult human skull with dentition was positioned upright to ensure the stabilization of mid sagittal plane and Frankfort plane using indicating light beam (Hofmann *et al.*, 2016). All radiographic acquisition procedures were performed by a single operator to reduce inter- operator variability.

#### **Image Evaluation**

All images were saved in JPEG digital format and were displayed on LENOVO Ideapad 310 with 14.0" HD LED (2685 x 2235 resolution) for image assessment and evaluation. All other setting of contrast and brightness were kept constant at 80% and all images were viewed in dark room to increase visibility. All images were blinded and randomized by a central trial coordinator. Prior to image assessments, a calibration process was conducted for the assessors who have more than seven years clinical experience. All images were assessed 3 times at separate occasions by first assessor for intra-rater reliability assessment (Houston, 1983). Ten images from each modality were randomly selected using digital generator and assessed by a second assessor to determine inter-rater reliability.

#### **Treatment Outcome**

There were two outcomes that were assessed in this clinical trial: diagnostic performance and image quality. For assessment of diagnostic performance, anatomical landmarks on dental panoramic tomograms and lateral cephalogram were scored based on Table 1 (Maeda *et al.*, 2018) and Table 2 (Durão *et al.*, 2015) as being presented or not. All images were scored for overall image quality based on a five-point rating scale; 1= excellent, 2= more than adequately presented, 3= adequately presented, 4= barely adequately presented, 5= inadequately presented (Dannewitz *et al.*, 2002).

<b>Regio</b> n	Anatomical Landmarks
Maxilla	Anterior nasal spine
	Nasal septum
	Inferior concha
	Right and Left maxillary tuberosity
	Right and Left maxillary sinus
	Right and Left floor of maxillary sinus
	Right and Left zygomatic arch
	Right and left zygomatic bone
	Articular eminence
	Periapical of tooth 13
	Periodontal ligament space of tooth 26
	Pterygopalatine fossa
Mandible	Periapical of tooth 37

#### Table 1: Anatomical landmarks on DPT

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Periodontal ligament space of tooth 46
Styloid process
External auditory meatus
Disc space
Dentino-enamel junction of 46
Right and Left mandibular canal
Right and Left mental foramen
Trabecular structure of mandibular horizontal ramus
Right and left condylar head
Right and Left coronoid processes
External oblique ridge

#### Table 2: Aanatomical landmarks on LC

Νο	Anatomical Landmarks
1	Sella (S)
2	Nasion (N)
3	Orbitale (Or)
4	Porion (Po)
5	Anterior Nasal Spine (ANS)
6	Posterior Nasal Spine (PNS)
7	A point
8	B point
9	Pogonion (Pog)
10	Menton (Me)
11	Gonion (Go)
12	Condylion
13	Articulare (Ar)
14	Nasale

15	Basion
16	Gnathion
17	Incision inferius
18	Root apex of lower incisor
19	Root apex of upper incisor
20	Incision superius
21	Pterygopalatine Fossa

#### **Statistical Analysis**

Statistical analysis was conducted using SPSS version 23.0 (SPSS Inc. Chicago IL). Univariate analysis was performed for the image quality assessment and reported as median and inter-quartile range (IQR). The relationship between dose of radiation and detection of anatomical landmarks was demonstrated using Pearson's Correlation. All statistical tests were interpreted at 5% significance level. The intra- and inter-rater agreements were calculated using Intraclass Correlation Coefficient (ICC).

#### RESULTS

For evaluation of diagnostic performance, Table 3 showed that there were negative correlations between detection of anatomical landmarks and radiation dose for DPT taken at both centers and LC PP. These results indicated that when there was increase in radiation dose, less anatomical landmarks can be detected on the images. For LC taken at SB, there was a fair correlation between scores of detections of anatomical landmarks and radiation dose. All results were found to be statistically insignificant except for DPT PP (p < 0.001).

Components	Pearson's Correlation (r)	p- value	Description
DPT SB	-0.128	0.464	Negative
LC SB	0.452	0.368	Fair
DPT PP	-0.918	0.000*	Negative
LC PP	-0.147	0.602	Negative

#### Table 3: Pearson's Correlation between radiation dose and score of anatomical landmarks on DPT

\*Correlation is significant at the level of 2-tailed (p<0.05)

For image quality assessment, all images showed adequately presented images with median score of 3.0 except for DPT PP where the median score was 5.0 (inadequately presented) (Figure 1 a-d). The examples of DPT and LC taken using different scanning parameters were shown in Figure 2 (a-c) and Figure 3 (a-c).



Figure 1a: Boxplot diagram showing the range of scores for image quality of DPT SB with median score of 3.0 (IQR 2.0).



Figure 1b: Boxplot diagram showing the range of scores for image quality of LC SB with median score of 1.0 (IQR 1.0).



Figure 1c: Boxplot diagram showing the range of scores for image quality of DPT PP with median of 5.0 (IQR 1.0).



Figure 1d: Boxplot diagram showing the range of scores for image quality of LC PP with median of 2.0 (IQR 1.0).







Figure 2: LC taken with different scanning parameters a) 85kV, 8mA b) 85kV, 10mA c) 85kV, 13mA



(a)



(b)



(c)

Figure 3: DPT taken with different scanning parameters a) 60kV, 3.2mA b) 66kV, 6mA c) 70kV, 8mA

## DISCUSSION

The concept of optimization as defined International Commission on Radiological Protection (ICRP) as the source- related process in order to keep the magnitude of radiation doses, the number of people exposed and the likelihood of potential exposure as low as reasonably achievable (ALARA) (ICRP, 2007). Since the radiation is cumulative, health professional must limit radiation exposure to the absolute minimum and radiographic examination and exposure must be optimal and justifiable (Tanner *et al*, 2000). According to general rule of radiation protection, the indications for exposure of dental panoramic tomogram and lateral cephalogram must be reviewed and approved by clinician in charge in order to avoid any unnecessary exposure to patients(Isaacson, Thom, Atack & Horner, 2015). This is very important to minimize stochastic effect of radiation that can lead to cell changes and mutations (Ribeiro and Angelieri, 2008).

In the current study, negative correlations between scores of detections of anatomical landmarks and radiation doses because at higher doses, images appeared darker thus less anatomical landmarks can be scored. This is particularly true especially for DPT PP using Sirona Orthophos 3D when the result was found to be statistically significant. Thus, the optimal value for each radiographic modality must carefully be tested and selected based on physical characteristics of the patient and the specific diagnostic imaging task (Huda and Abrahams, 2015). A contradicting result of LC SB taken using Instrumentarium 300 OP indicates that more anatomical landmarks can be detected when the doses increases. This fair correlation might be due to limited variation of the parameters as there were only six combinations of tube potential and tube current available on the machine.

For image quality assessment, all the images except DPT PP were adequately presented with median score of 3.0. This finding was supported by previous studies by (Dannewitz *et al.*, 2002; Kaeppler, Dietz and Reinert, 2006; Alkurt *et al.*, 2008) when they found that there was no significant differences of scores of image quality when radiation doses were reduced. In contrast, DPT PP images were found to be inadequately presented with median score of 5.0. This is because as tube potential increases, contrast of the images will reduce causing the images to appear darker and poorly presented (Brindhaban *et al.*, 2005). This is correlated with evaluation of diagnostic performance which resulted in significantly less detection of anatomical landmarks when the radiation doses increase (p<0.001).

## CONCLUSION

In conclusion, when radiation dose increases by increasing the dose parameters of digital dental panoramic tomogram and lateral cephalogram, less anatomical landmarks can be detected thus reducing the diagnostic performance of the images.

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## Model to Aid Teaching of Electronic Apex Locator Use for Endodontics in Dental Pre-Clinical Training – A Uitm Experience Pilot Study

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## ABSTRACT

**Background:** Electronic Apex Locators (EAL) has been increasingly used to facilitate working length determination in endodontics. This instrument is becoming more important to be used in addition to radiographs. *A steep learning curve has existed between EAL use in the clinical, from the pre-clinical settings.* **Objectives:** To fabricate a model that will facilitate dental students to use Electronic Apex Locator (EAL) in the dental simulation clinic and to conduct a questionnaire-based survey to investigate Electronic Apex Locator Model (EALM) effectiveness. Materials and Methods: Construction of model master jaw, EALM, using materials available in the prosthetic laboratory. The model can be mounted on the phantom head which when connected to an EAL will simulate its clinical use. A validated questionnaire was distributed to a group of n=10 pre-clinical students before and after demonstration conducted at the simulation clinic. **Results:** A prototype EALM was successfully fabricated at Universiti Teknologi MARA Dental Prosthetic Laboratory. with features incorporating conductive-media-chamber, with attached anatomically-correct fabricated model teeth. The teeth were constructed incorporating continuous access cavity, root canal, through to a patent apex. When attached to the jaw model, the electrical circuit was connected allowing EAL to function. Conclusion: EALM can be conveniently constructed at the Dental Prosthetic Laboratory by using materials readily available here. Furthermore, a steep learning curve exist between pre-clinical and clinical studies was bridged by the use this EALM and this allowed familiarity of clinical handling EAL. However, this study was limited by the small number of students exposed to this new method. Further prospective study is required by increasing the sample size to provide more significant results.

Keywords: Dental education, Apex locators, Dental simulation, Apex locator model





## INTRODUCTION

Root canal treatment (RCT) is a multi-stage procedure and working length determination is one of many crucial stages. Failure to determine the correct working length will lead to inadequate canal preparations which may lead to reduced RCT success.

The use of Electronic Apex Locators (EAL) as an adjunctive tool has been increasing, so it is becoming more important to teach students in addition to the use of radiographs (Chen et al., 2011). Their study aimed to develop a simple and inexpensive ex vivo model, using extracted human teeth, to teach students the use of electronic apex locators in a preclinical setting. Furthermore, the advantage and the precision of electronic working length measurement depends on the device used and the type of irrigation and is not influenced by the status of the pulp tissue (Tsesis et al., 2015)

In a recent study, (Suksudaj et al., 2015)showed that their students' admitted that their learning experiences (such as using additional training aids) are one of the key components to understand new skills in an educational setting. The role of the laboratory tutors was also found to be important in creating an effective learning environment by providing demonstrable techniques in pre-clinical setting (Suksudaj et al., 2015).

A study illustrated the need for an improved evidence based on dental simulations to inform curriculum designs and psychomotor skill learning in dentistry (Perry et al., 2017)

Presently, artificial models to aid EAL (EAL-model) are already commercially available as well as those non-commercially types and they are already made accessible by various authors sharing their expertise to guide fabrication. Nissin Dental Products Inc, Japan is selling the models which cost around RM700.00 (Figure 1).

(Tchorz et al., 2012), has outlined a detailed description to fabricate their version of EAL-model incorporating natural teeth. They developed a simple model, where extracted teeth were placed in a mould and embedded in acrylic resin. The resin was applied in two consecutive steps to form a cavity around the root apices. A closable plastic tube served as a valve, and a steel wire connects to the EAL (Tchorz et al., 2012).

Recently also Hanafi et al., 2020 showed that a 3D print training dental model with embedded human teeth and electronic working length determination was used and the vast majority of students rated the modular 3D print training model positively. The model allowed a more realistic simulation of the clinical situation with a simultaneous use of EALs and led to reduced stress levels in endodontic treatment in the subsequent clinical courses. (Hanafi et al., 2020).

However, the use of these natural teeth presented problems due to cross-infection issues (Nawrocka & Łukomska-Szymańska, 2019), ethics (Holden & Dracopoulos, 2017) and more importantly variations in canal anatomy leading to unsuitability for undergraduate pre-clinical training (Decurcio et al., 2020) (see Figure 2).

## **PROBLEM STATEMENTS**

There exists a steep learning curve for students to use EAL in patients. Currently there is a relative lack of bridging the skills gap between pre-clinical and clinical settings particularly in handling EAL. Commercially available EALMs are costly particularly for equipping large number of students. This does not include the added cost of repair and maintenance. Nevertheless, there have been articles which guided us to fabricate EALMs and some suggested to use extracted teeth which led to difficulties outlined above.

So to fabricate EALMs from available dental laboratory materials and adapt them to the available training equipment would be very flexible and indeed, feasable. This will facilitate customizing to the current curriculum and allow low cost maintenance and repair.

Furthermore the need to test the acceptance of this prototype by students, based on the current curriculum has developed.

Research questions include whether we can fabricate a totally artificial model with artificial teeth thus eliminating the problems outlined above. Also whether the students may find it useful when they are trained handling this pre-clinical tool.

## **OBJECTIVES**

- 1. To fabricate a model (EAL-model) using materials available in a dental prosthetic laboratory.
- 2. To test students' feedback via questionnaires on the effectiveness of this adjunctive tool.

## MATERIALS AND METHODS

#### **Ethics Approval**

Ethics Approval: UiTM Research Ethics Committee, Institute of Research Management & Innovation Universiti Teknologi MARA, 600-IRMI (5/1/6) REC/387/19 dated 25 July 2019.

## Evolution of EAL- Model (EALM) Fabrication – UiTM Experience



Figure 1: Nissin ® Apex Locator Models



Figure 2: UiTM 1<sup>st</sup> prototype model incorporating natural teeth. It is fabricated incorporating a compartment which can be filled with contact media and sealed posteriorly with a rubber stopper.

In Figure 2, natural teeth were used and the model was constructed following instructions by (Tchorz et al., 2012). Their method was to use extracted teet, placed in a mould and embedded in acrylic resin. The resin was then applied in two consecutive steps to form a cavity around the root apices. A closable plastic tube serves as a valve, and a steel wire connects to the EAL.

This base portion was used as a template to fabricate the  $2^{nd}$  prototype his and artificial teeth were used for reasons explained previously and are shown in figures 3-7. The detail step-by-step instructions will not be outlined in this article until copyright and patent issues are settled.

This pilot study, involved constructing EAL-model with anatomically-correct fabricated teeth (Figure 3). All teeth from incisors to molars were individually fabricated in the dental laboratory.

The latest models are shown in Figures 3 and 4. The fabricated tooth (Figure 5 and 6) is made with the root canal extending continuously from the access cavity to the apex. The tooth is made up of transparent material to let the students see the advancing file in the canal. Figure 7 shows the tooth having sufficient contrast to show up in the radiograph despite it being transparent.

#### **Pre-clinical Exercise and Data Gathering**

This EAL-model can be mounted on the phantom head so that the EAL can be correctly handled in a preclinical setting (Figure 8). A small survey is conducted with supervisor-student input collected via questionnaire. The questionnaire was first validated among 70 students and consent was acquired.

Groups of ten (n=10) students were supervised by the same lecturer over two weeks. The feedback from student-supervisor grouping, comparing the pre- and post- demonstration via the validated questionnaire (Table 1), is collected and analyzed. Figures 8 and 9 show how the EAL-model is attached to the phantom head and the EAL is connected to demonstrate its use.

No	Part 1 Questions
Stud	ents' Perspective*
1.	I love Endodontics
2.	I enjoy learning Endodontics with the current method of teaching
3.	I know the importance of Endodontics in my undergraduate studies
4.	I have the required knowledge on working length determination
5.	I think working length determination's lecture is important
6.	I think working length determination's demonstration is important
7.	I think working length determination lecture and demonstration is equally important

\*Likert Scale 1-5 (Strongly disagree – Strongly agree)

No	Part 2 Questions			
Students' Practices on Electronic Apex Locator (EAL) **				
1.	I already had working length determination lecture previously			
2.	I already had working length determination demonstration previously			
3.	U understand about working length determination			
4.	I had experience using EAL this year			
5.	I am confident using EAL in clinic			
6.	I am competent using EAL on patients			

\*\*Likert Scale 1-5 (Never - Always)

## RESULTS

Electronic Apex Locator Artificial Model (EALM, with artificial teeth) Fabrication at UiTM



Figure 3: UiTM 2<sup>nd</sup> prototype model with removable artificial teeth. It is also fabricated incorporating a compartment which can be filled with contact media and sealed posteriorly with a rubber stopper.



Figure 4: View from the underside showing the metal disc and posterior placed chamber plugs sealing the compartment filled with contact media.



Figure 5: Labial view of artificial tooth (21) showing the access cavity and canal outline.



Figure 6: Distal view of artificial tooth (23) showing the continuous outline from access cavity to the apex.



#### Figure 7: Periapical radiograph of artificial tooth 23 with an endodontic file inserted.

A 2<sup>nd</sup> prototype EAL-model was successfully fabricated in the dental prosthetic laboratory, see figures 3-7). The artificial teeth were made to replace the natural teeth. Radiographic comparison will still be possible for comparison with the EAL.

There are special features incorporated by the artificial models (EALM) namely:

- 1. The jaw part (the base) contained a sealed hollow chamber.
- 2. The roots of artificial teeth are inserted and are in contact within the chamber (for file clip).
- 3. Anteriorly, a lip electrode is also fabricated to be in contact within the chamber (for lip clip).
- 4. The sealed chamber\*\* is filled with a liquid contact media, like glycerine or washing liquid and is sealed or plugged posteriorly.
- 5. The removable fabricated tooth has a simulated root canal that is continuous from access cavity to patent apex.
- 6. The artificial tooth is placed and sealed with plumber's tape within the jaw socket. The jaw sockets are continuous with the sealed chamber\*\* and allowed the apices of the teeth to be connected with the contact media.
- 7. The base also incorporates a metal plate and is compatible for mounting to Kavo ® Phantom Head.

The model once mounted will allow the attachment of file clip and lip clip of the EAL to complete the circuit when an endodontic file is inserted into the into the artificial root canal.

## Supervision



Figure 8: Demonstration conducted at Simulation Clinic, by a supervising lecturer to students.



Figure 9: The pre-clinical students handling the mounted artificial model with EAL.



Figure 10: Connection between EALM and EAL.

## **Data Gathering**

Data were entered onto a spreadsheet (Microsoft Office Excel 2010) and transferred to a data analysis and statistical software programme (SPSS version 24). The result is shown in Table 2. Score of pre-demonstration is 46.50 and post-demonstration is 59.50. A Wilcoxon Signed-Rank Test indicated that the median and interquartile range post total score in students' perspective and practical, is significantly higher than the median and interquartile range pre- total score, with the *p*-value=0.036 (Table 2).

Table 2: Result of Pre-Demonstration and Post-Demonstration
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Variable	Pre-Demonstration Median (IQR)	Post-Demonstration Median (IQR)	Z statisticª	p-value
Total Score	46.50 (5)	59.50 (12.5)	-2.095 <sup>b</sup>	.036



Figure 11: Students' evaluation before and after EALM demonstration/hands-on.

## DISCUSSION

The EALM was fabricated manually which was different from that fabricated by Hanafi et al., 2020, where they used 3D printing plus natural teeth. Another difference was that we fabricated our artificial teeth using the same method as for the base, not natural teeth. Furthermore, our EALM was adapted to be used to our phantom-head which proved that ease of customizing, can be achieved when fabrication is concurrently being conducted.

The was significantly better acceptance by the students on training with the help of EAL-model. Since the EAL-model can be mounted on the phantom head this provided a better learning experience for competent clinical practice.

Based on another questionnaire-based study, the phantom head simulator was found to produce the best motor skills compared with those who had traditionally trained on bench-tops (Clancy et al., 2002).

Further questionnaire-based study conducted by Mirza, 2015, aimed to evaluate the short comings in preclinical endodontic training and to find out key areas to stress upon for better student understanding and treatment outcome. He showed that, locating the apical constriction has the highest percentage of difficulty among all the groups and concluded that the training for students in future needs to be amended so that they are better able to manage such difficulties (Mirza, 2015). So using this EAL-model, the students were able to detect their own errors in their own performance and they noted that this has helped them to improve. This is similar to the study concluded by Suksudaj *et al*, 2014 and Hanafi et al., 2020.

The EAL-model used in this pilot study is tested showing, positive and significant results. The use of artificial teeth fabricated avoided the variation of canal anatomy as well as cross-infection issues. To date there are no studies done to test the students' response on EAL-model effectiveness.

## CONCLUSION

The EAL-model mimics the RCT procedure of working length determination carried out in patients. Although, the students will still be able to compare their EAL readings with radiographs. The reliance of visual feedback can supplement the instrument-feedback of EAL. This is due to the transparent material used.

This pilot study showed that students' feedback after using this EALM is significantly better than the before using the artificial model.

## SUGGESTION

Further to this we can conduct the study for a large-scale number of students. We may compare the EAL-model with a commercially available EAL-model.

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Compendium of Oral Science Volume 8/2021 Original Article

# The Impact of Clinical Teacher: The Dental Students' Perception

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#### ABSTRACT

**Aims**: This study aims to evaluate the impact of the clinical teachers and the effectiveness of their supervisory skills in clinical settings from the dental students' perception using the cognitive apprenticeship model. **Materials and Methods**: A total of 273 undergraduate clinical dental students, from Faculty of Dentistry UiTM, were asked to complete the modified and validated Maastricht Clinical Teaching Questionnaire (MCTQ) which consists of twenty-seven questions distributed on seven domains: Modelling, Coaching, Scaffolding, Articulation, Reflection, Exploration and General Learning Environment. The responses were descriptively analysed. **Results**: The clinical experience of 162 dental students, who responded, was evaluated. Overall, the students conveyed positive and neutral perceptions of their clinical experience in all criteria of the seven domains. Articulation domain showed the highest negative feedback (93.5%) while the general learning environment domain showed the highest negative feedback (28.1%). **Conclusions:** The clinical experience and the impact of the clinical teachers were mostly satisfactory. Further improvements of the clinical environment can be achieved regarding the areas of concern.

Key words: Clinical teacher; Dental students' perceptions; Dental education.

### INTRODUCTION

Education has always been an important factor for a successful future of an individual. Teaching and learning are part of the education system. A quality dental education can provide a quality platform for well-educated future dentists who can contribute to the society. Education in the dental clinical setting is an effective platform for dental students in order to prepare them for future clinical practice as dentists. Clinical supervision is an essential part in the process of learning and an effective way to train the dental students in a clinical setting. In general, dental clinical settings provide the most appropriate learning environment to enable students to integrate their knowledge of basic dental science and operative dental technique skills (Mullins et al., 2003). A good level of supervision and communication should be present in order to deliver safe and effective teaching in a clinical setting in a clinical setting communical setting to challenge themselves out of their comfort zone and at the same time encourage a "learning community" environment to achieve productive clinical teaching.



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According to Gerzina et al. (2005), skilful guiding of clinical students, bridging teaching and learning as well as initiating appropriate changes in knowledge, communication, technical skills, attitudes and behaviours in daily practice should be practiced by the clinical teachers to be effective for the benefit of patients and communities. It is the clinical supervisors' role to produce a positive environment for clinical students to try new things and at the same time promote a "learning community" environment for effective clinical teaching (Carnell, 2007).

Lack of proper models addressing the teaching approach taken by clinical teachers was highlighted by Graffam (2008), he further suggested that specific teaching models could guide the clinical teachers to fulfil their role. The cognitive apprenticeship model was one of the models developed for clinical supervision. The main idea of the original cognitive apprenticeship concept was to bring the thinking to the surface, to make it visible through experts' internal cognitive processes that can guide the students in observing, performing and practicing clinical procedures under supervision (Collins et al.,1989). The six proposed teaching methods: modelling, coaching, scaffolding, articulation, reflection, and exploration of the cognitive apprenticeship, are designed to help students to obtain both cognitive and meta-cognitive skills (Collins et al.,1989). According to Stalmeijer et al. (2008), it is recommended to use a model as a useful instrument in studies focusing on evaluation, feedback, self- assessment, and faculty development in clinical teaching. The cognitive apprenticeship model in clinical practice, originally designed by Stalmeijer et al. (2008), was employed in a previous study conducted in Faculty of Dentistry, University of Malaya. The authors concluded that students' perception is essential to increase the quality of learning environment in dental education especially in clinical teaching (Shoaib et al., 2016). They also recommended further studies to be conducted in other universities and dental faculties in Malaysia to have more insight on dental students' perceptions of the impact of clinical teachers on their clinical training.

This study aimed to address this recommendation to identify the effect of clinical teachers on the learning environment in dental education. Furthermore, this study is an answer to a call by Universiti Teknologi Mara (UiTM) deputy vice chancellor during UiTM academic conference in 2016 to evaluate the role of clinical teachers with the aim of building a clinical conduct guideline for the teachers. The deputy vice chancellor addressed the clinical supervision in his speech. He highlighted that a clinical expert does not necessarily means a great or good teacher and that adequate training in teaching need to be provided to the clinicians before they supervise students. His remarks were the motivation for this study with the objective of evaluating the impact of the clinical teachers and the effectiveness of their supervisory skills in clinical settings from the dental students' perceptions.

### MATERIALS AND METHODS

A total of 273 undergraduate clinical dental students (years 3, 4 and 5) from Faculty of Dentistry, UiTM were involved in this study. After ethics approval was obtained from Research Ethics Committee, Faculty of Dentistry, UiTM, a set of questionnaires which is the modified and validated Maastricht Clinical Teaching Questionnaire (MCTQ) (Stalmeijer et al., 2008) was distributed to all the clinical dental students. This questionnaire was adopted from cognitive apprenticeship model in clinical practice to assess students' learning environment in order to gain relevant information related to dental clinical teaching (Stalmeijer et al., 2008; Shoaib et al., 2016). The MCTQ contains twenty-seven multiple choice questions (items) divided on seven domains which are Modelling (four items), Coaching (four items), Scaffolding (four items), Articulation (four items), Reflection (two items), Exploration (three items) and General Learning Environment (six items) (Stalmeijer et al., 2010). The MCTQ was measured on a three-point Likert Scale from "disagree", "neutral" and "agree".

The questionnaire was administered among the clinical dental students after a short briefing, the students were informed that their responses will be anonymous. A satisfactory response rate of 59% was achieved, where total of 162 out of 273 undergraduate clinical dental students from UiTM completed and returned the questionnaire.

IBM SPSS Statistics 23 was used to analyse the data obtained and cross tabulation was used to summarise the obtained data for each year and domain. Pearson Chi Square was used to identify the significant difference among clinical years.

# RESULTS

The clinical experience of 162 out of 273 dental students, who responded, was evaluated. The response rate was 59%. The number of respondent students were 57 of year 5, 62 of year 4 and 43 of year 3. The results of all items in the questionnaire based on the apprentice cognitive model are shown in Table 1.

Table 1: Student's res	ponses in percentag	e to Maastricht Clinica	l Teaching	Questionnaire	(MCTQ)
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Domains	Year	N	Disagree %	Neutral %	Agree %	
Modelling. The clinical teacher						
Demonstrated how different skills should be performed		43	4.7	39.5	55.8	
	4	62	4.8	37.1	58.1	
	5	57	5.3	49.1	45.6	
Explained while performing a task, which aspects were	3	43	7	27.9	65.1	
important and why	4	62	1.6	32.3	66.1	
	5	57	8.8	36.8	54.4	
Created sufficient opportunities for me to observe him or her	3	43	9.3	53.5	37.2	
	4	62	11.3	40.3	48.4	
	5	57	10.5	36.8	52.6	
Was a role model for me	3	43	4.7	53.5	41.9	
	4	62	3.2	43.5	53.2	
	5	57	17.5	42.1	40.4	
Coaching. The clinical teacher						
Observed me while I was performing a task		43	16.3	67.4	16.3	
		62	14.5	48.4	37.1	
	5	57	10.5	54.4	35.1	
Provided me with constructive and concrete feedback during		43	2.3	32.6	65.1	
direct observation	4	62	8.1	41.9	50	
	5	57	14	40.4	45.6	
Was willing to teach rather than doing it for you/leaving you	3	43	11.6	32.6	55.8	
alone to do it independently	4	62	12.9	41.9	45.2	
	5	57	10.5	50.9	38.6	
Provided me better insight in areas of my performance that	3	43	4.7	39.5	55.8	
need to be improved		62	11.3	27.4	61.3	
		57	17.5	47.4	35.1	
Scaffolding. The clinical teacher						
Adjusted his/her teaching actives to my level of experience	3	43	9.3	53.5	37.2	
and competence	4	62	14.5	46.8	38.7	
	5	57	8.8	35.1	56.1	

Allowed me to perform tasks independently		43	7	30.2	62.8
	4	62	1.6	17.7	80.6
	5	57	8.8	47.4	43.9
Was supportive when I experienced difficulties with a task	3	43	7	51.2	41.9
	4	62	8.1	35.5	56.5
	5	57	12.3	47.4	40.4
Gradually decreased the amount of guidance in order to bolster	3	43	11.6	67.4	20.9
my independence	4	62	3.2	37.1	59.7
	5	57	12.3	36.8	50.9
Articulation. The clinical teacher					
Asked me to explain my reasoning and actions	3	43	4.7	32.6	62.8
	4	62	3.2	16.1	80.6
	5	57	14	38.6	47.4
Alerted me to gaps in my knowledge and skills	3	43	2.3	44.2	53.5
	4	62	3.2	38.7	58.1
	5	57	7	50.9	42.1
Asked questions to increase my knowledge and understanding	3	43	7	27.9	65.1
	4	62	3.2	3.2	93.5
	5	57	5.3	33.3	61.4
Stimulated me to ask questions to increase my knowledge	3	43	2.3	37.2	60.5
and understanding	4	62	9.7	22.6	67.7
	5	57	3.5	31.6	64.9
Reflection. The clinical teacher					
Stimulated me to think about my own strengths and weaknesses	3	43	4.7	37.2	58.1
	4	62	4.8	24.2	71
	5	57	7	33.3	59.6
Stimulated me to reflect on the profession of a dental student	3	43	2.3	39.5	58.1
	4	62	6.5	21	72.6
	5	57	7	31.6	61.4
Exploration. The clinical teacher					
Stimulated me to formulate my own goal	3	43	9.3	46.5	44.2
	4	62	11.3	41.9	46.8
	5	57	15.8	43.9	40.4
Stimulated me to achieve my goals	3	43	11.6	41.9	46.5
	4	62	12.9	33.9	53.2
	5	57	7	35.1	57.9
Challenged me to explore new tasks and possibilities	3	43	7	46.5	46.5
	4	62	9.7	25.8	64.5
	5	57	10.5	47.4	42.1

General learning environment. The clinical teacher						
Established an environment where I felt free to ask questions		43	4.7	37.2	58.1	
or make comments	4	62	1.6	25.8	72.6	
	5	57	7	50.9	42.1	
Showed an interest in me as a student	3	43	11.6	53.5	34.9	
	4	62	12.9	41.9	45.2	
	5	57	15.8	47.4	36.8	
Treated me and my patent with respect		43	9.3	65.1	25.6	
		62	9.7	54.8	35.5	
		57	12.3	45.6	42.1	
Took enough time to supervise me	3	43	4.7	53.5	41.9	
		62	3.2	58.1	38.7	
	5	57	26.3	38.6	35.1	
Is constantly available in the clinic	3	43	18.6	53.5	27.9	
		62	12.9	56.5	30.6	
	5	57	28.1	52.6	19.3	
Is punctual for clinical session	3	43	11.6	60.5	27.9	
	4	62	16.1	64.5	19.4	
	5	57	22.8	59.6	17.5	

- 1. **Modelling domain:** Based on the data analysis, most of year 3 and year 4 responded with agreement (55.8% and 58.1% respectively) for the criteria of *"clinical teacher demonstrated how different skills should be performed"*. However, year 5 students mostly responded as neutral (49.1%) for the same criteria.
- 2. Coaching domain: Neutral score was the highest for all clinical years with 67.4% for year 3, 48.4% for year 4 and 54.4% for year 5 for the criteria of "*observed me while I was performing my task*". For the criteria of "*provided me with constructive and concrete feedback during direct observation*", most of the students agree with the criteria with 65.1% of agreement from year 3 followed by 50% from year 4 and 45.6% from year 5. A high percentage for the neutral score in year 5 (50.9%) compared to year 3 and year 4 who have a high percentage for the agree score of 55.8% and 45.2% respectively for the criteria of "*was willing to teach rather than doing it for you or leaving you alone to do it independently*". A similar trend was observed for the criteria for "*provided me better insight in areas of my performance that need to be improved*", where 47.4% of year 5 have a high score for neutral while 61.3% and 55.8% from year 4 and year 3 respectively agree with this criteria.
- **3.** Scaffolding domain: 56.1 % from year 5 agree with the criteria of "*adjusted his or her teaching activities to my level of experience and competence*". However, 53.5% from year 3 and 46.8% from year 4 have a neutral response for this criterion.
- 4. Articulation domain: Majority of students agree with "*asked questions to increase my knowledge*" with year 4 having the highest percentage (93.5%) followed by year 3 (65.1%), and year 5 (61.4%). "*Stimulated me to ask questions to increase my knowledge and understanding*" also showed the highest percentage of agree among all students which was 60.5% of year 3, 67.7% of year 4 and 64.9% of year 5.
- 5. **Reflection domain:** All items in this domain showed that majority of students have highest percentage of agree responses and lowest percentage of disagree responses. Year 4 have the highest percentage of agree (71%) on "*stimulated me to think about my own strengths and weakness*". The criteria of "*stimulated me*

*to reflect on the profession of dental student*" also have the highest percentage of agree among all students (58.1% of year 3, 72.6% of year 4 and 61.4% of year 5). The aforementioned criteria had the lowest percentage of disagree among year 3 students (2.3%).

- 6. Exploration domain: Both year 3 and year 5 have higher score of neutral for "*stimulated me to formulate my own goal*" (46.5% and 43.9% respectively). For "*stimulated me to achieve my goals*", all students showed highest percentage of agree response with year 5 being the highest at 57.9%. Among year 4 students, 64.5% agreed with "*challenged me to explore new tasks and possibilities*", the agree response was less in year 3 and 5 (46.5% and 42.1% respectively). Only 7% of year 3 disagreed with this criterion.
- 7. General learning climate domain: Based on the data analysis, all criteria in this domain have a higher score in neutral responses among all students except for the criteria of "*established an environment where I felt free to ask questions or make comments*" where the agree responses were highest. The criterion of "*constantly available in the clinic*" showed the highest disagree percentage compared to other criterion, which was 28.1% of year 5 followed by 18.6% of year 3 and 12.9% of year 4.

Pearson Chi square test results: The Pearson chi square was used to identify significant differences between responses of year 3, year 4 and year 5. The modelling domain showed significant differences in responses for the item "*was a role model for me*" (p=0.037). There was also significant difference in domain coaching for item "*provided me better insight in areas of my performance that need to be improved*" (p=0.026). In the scaffolding domain a significant difference was detected in "*gradually decreased the amount of guidance in order to bolster my independence*" (p=0.001) and the general learning environment domain also showed significant difference for item "*took enough time to supervise me*" (p=0.001).

### DISCUSSION

The purpose of this study was to evaluate the perceptions of dental students on their clinical teachers in the clinical setting using MCTQ questionnaire based on the cognitive apprenticeship model. The results of this evaluation can be presented and discussed at the faculty to serve as a guidance in drafting a clinical conduct guideline and to identify possible pathways to a more effective clinical teaching. The response rate in the current study was 59%. Prior studies on response rate suggested a benchmark of 35-40% as being an acceptable response rate (Rogelberg & Stanton, 2007; Weiner & Dalessio, 2006). In the current study the students were reminded to respond to the questionnaire at three separate times after it was initially handed to them. It was reported in a previous study that possible reasons given by non-respondents include over -surveying where subjects are flooded with questionnaires which results in fatigue, other given reasons were that they were busy or that they considered the questionnaire irrelevant (Weiner & Dalessio, 2006). It seems possible that the previously reported reasons could have affected the response rate in the current study.

In this study, the results showed that overall, the dental student perceptions were positive in all domains. The lowest score for agreement was 16.3% and the highest score for disagreement was 28.1%. It was observed that whenever the score of agreement was less than 50%, high percentage of neutral score were seen. This observation is consistent with that of Shoaib et al. (2016), in a study conducted in Faculty of Dentistry, University of Malaya using the same model of the present study. The results where high score for neutral were seen could be due to the students' tendency to show reservation in expressing their opinion which may be due to cultural background of East Asian people as suggested by previous studies (Shoaib et al., 2016; Wong & Niu, 2013; Frambach et al., 2014). The neutral score could also be due to their positive experiences with clinical teachers that may balance out their negative experiences. Overall, for all students and all domains the agree and neutral responses were higher than the negative responses. The criteria from the coaching domain that has high disagreement score was "observed me while doing my task". The highest score is from year 3 followed by year 4 and year 5 with a score of 16.3%, 14.5% and 10.5% respectively. This could be due to the teacher /student ratio in clinical settings where one clinical teacher is usually assigned to supervise 8-12 students. Another likely cause for disagreement score of 16.3% for year 3, is their need for more guidance than other senior students.

Based on the articulation domain, the criteria for asking questions received a high percentage of agree for all students especially year 4 which could be attributed to their increased interest in clinical tasks as they become more efficient in clinical performance. In the current study, items in the articulation domain demonstrated a high percentage of agreement which corroborates the findings of Shoaib et al. (2016).

In the reflection domain a tendency for positive responses for all clinical years was detected. Year 4 students recorded higher agree scores than year 3 and 5, which shows a similar trend to that of the articulation domain which could be attributed to their increased interest and efficiency in the clinical tasks. The results of the reflection domain seem to be consistent with the previous Malaysian study by Shoaib et al. (2016). The general learning environment domain showed most of the criteria with highest percentage of neutral responses. However year 5 students expressed their need for more time given to them by the clinical teachers, this could be attributed to the fact that most year 5 students were trying to accomplish their required tasks of clinical assignments to be able to sit for the final exam. These findings are consistent with those of previous studies by Shoaib et al. (2016) and Polyzois et al. (2010), a which indicates that this is a common problem in most dental schools. Moreover, these results highlight the need for improvements in this area. The aforementioned general similarities between the findings of this study and that of Shoaib et al. (2016), could be attributed to the fact that both studies were conducted in a public Malaysian university, however, it is important to bear in mind that these results cannot be generalized and that more studies are needed in other public and private dental schools in Malaysia. According to Fugill (2005), clinical teachers' punctuality, consistency, availability, understanding, and respect were important aspects highlighted by students. Students' evaluation on identifying the characteristics of effective clinical teachers are important in drafting guidelines for teachers' conduct in clinical settings for a comprehensive and effective way to educate and create an effective learning environment for the students. Moreover, the result of this study and other similar studies could aid in establishing an effective clinical conduct guideline.

## CONCLUSIONS

The clinical experience and the impact of the clinical teachers were mostly satisfactory in faculty of dentistry, UiTM. Further improvements of the clinical environment can be achieved regarding the areas of concern.

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Compendium of Oral Science Volume 8/2021 Original Article

# Characteristics and Association of Gender to Dental and Occlusal Anomalies in Malaysian Primary School Children

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#### ABSTRACT

Aim: To describe the distribution and association of dental and occlusal anomalies to gender in children of mixed and early permanent dentition. Methods: It is a cross-sectional study with stratified random sampling based on the main ethnic composition involving 413 subjects aged between 9 and 11 years old enrolled in 7 national primary schools in Sungai Buloh, Selangor. A calibrated operator carried out clinical examinations, and study models were fabricated. All dental and occlusal anomalies were recorded accordingly and were analysed using SPSS version 21.0. Pearson chi-square test was used to determine the gender-based differences for various parameters. Results: The reported dental anomalies were supernumeraries and clinically missing teeth (impacted or hypodontia) with a prevalence of 1.5% and 6.3%, respectively. The occlusal abnormalities were: crowding (54.0%), sagittal discrepancies (overjet; increased, reduced, and reversed overjet: 55.5%), vertical discrepancies (overbite; increased, reduced, and open bite: 37.5%) and transverse discrepancies (unilateral and bilateral posterior crossbite: 5.1%). Gender-based differences were not statistically significant to all reported dental and occlusal anomalies (p>0.05). Conclusions: Children in the mixed and early permanent dentition showed various dental and occlusal anomalies with crowding being the highest anomaly. Gender was not associated with any type of dental or occlusal characteristics in the studied population.

Keywords: Dental anomalies, Malocclusion, Mixed dentition, crowding, Overjet, Overbite

### INTRODUCTION

The understanding of the classification of malocclusion and occlusal anomalies are essential for the diagnosis and treatment plan. Epidemiological studies on the characteristics and prevalence of malocclusion have been investigated tremendously in many years throughout different countries (Fu et al., 2002; Brito et al., 2009; Borzabadi-Farahani et al., 2009; Rapeepattana et al., 2019; Kharbanda, 2019). A recent systematic review reported that most of the prevalence of malocclusion studies were published between the 1940s and 1990s (Alhammadi et al., 2018). In recent years, studies concentrate more on the determination of treatment need, treatment mechanics and outcome of orthodontic treatment. However, it was proven that prevalence studies were essential as they play an indispensable role to determine the health status of a studied population. Determination of the distribution of



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malocclusion among the community may be carried to determine the individual treatment need and priority and to gather beneficial information for the planning of fund allocation and facilities for orthodontic treatment (Foster & Menezes, 1976). The data determines the resources required for the provision of orthodontic treatment, such as human resources, skill, time, facilities, and orthodontic materials.

Dental epidemiological surveys were conducted under the Ministry of Health Malaysia to plan and evaluate oral health care services since the 1990s. Dental surveys on common dental pathology and verbal health-related behaviour as recommended by the World Health Organization (WHO) were carried out regularly with ten years interval on the index age groups. The age groups involved in these national surveys were growing individuals (5, 12 and 16 years of age) and adults. The main variables of the studies were dental caries and periodontal disease in all groups with the addition of the edentulous area and the need for a prosthesis in an adult group. At present, 16 surveys have been undertaken on a national basis.

Following a great effort by the Malaysia Ministry of Health, there has been a decreasing trend of oral disease including dental caries and periodontal disease in the last two decades, whereby in the year 1995 the oral disease was reported to involve 87.1% of Malaysian children, followed by 76.2% and 71.3% in the year 2005 and 2015, respectively (Oral Health Division, 2015). This data was found to agree with a global pattern of reduction in oral diseases among children (World Health Organization, 2003). However, malocclusion is not included in the surveys and study on the malocclusion among Malaysian children are lacking. Currently, the majority of cases seen in the Orthodontic Clinic, Faculty of Dentistry UiTM are adults, and some of them came with more complex cases which require a more complicated and comprehensive treatment which could have been intercepted if they were recognised early.

Therefore, this study aimed to investigate the distribution and association by gender of dental anomalies and occlusal characteristics in all three planes of dimension and other occlusal anomalies seen among primary school children in Sungai Buloh, Selangor.

#### MATERIALS AND METHODS

This cross-sectional study was conducted over 10 months between January 2018 and October 2018 in Sungai Buloh, Selangor. These findings are part of a study in developing an index. The study was approved by the Research Ethics Committee Universiti Teknologi MARA (UiTM), Malaysia (600-IRMI (5/1/6), 29<sup>th</sup> March 2017) and written informed consent was obtained from their parents/guardians. The sample size was calculated using "Single Proportion Formula" based on a previous study, with the statistical power of 97% (Zreaqat et al., 2013). Acceptable margin of error was set at 5%. Therefore, the minimum sample size was 385. The probability of the non-participation rate was considered; hence, the sample size was increased by 30% to 500.

Seven national primary schools were conveniently selected after approval obtained from the Ministry of Education and the Selangor Department of Education. Following that, stratified random sampling was performed for the subjects' recruitment based on the Malaysian main ethnic composition (Department of Statistic Malaysia Official, 2018). Inclusion criteria were: (1) Standard 3 until Standard 5 (age 9 to 11 years), (2) obtained written parental consent. To potential confounding factors, such as children with syndromes, or those with a history of orthodontic treatment were excluded.

A single operator (NNZ) performed all clinical examinations to avoid inter-examiner bias. Calibration of the operator was carried out against an orthodontic specialist (SDS) for inter-examiner reliability testing for the assessment of occlusal characteristics. Intra-examiner reliability testing was done 14 days afterwards. A total of 20 study models were examined and calibrated. As the occlusal features were categorical, the results were analysed using the Kappa Coefficient Analysis.

Data collection involved clinical assessments and analysis of fabricated study models. The occlusal characteristics were measured and recorded in the malocclusion assessment form, which was designed based on an orthodontic assessment form. A detailed description of the criteria adopted for each dental and occlusal anomaly is given in Table 1.

Dental Anomalies	Descriptions
Clinically missing teeth	• Clinically missing (not due to extraction), could be due to impaction or hypodontia. The appropriate eruption time had already passed, or any bulge could not be seen intraorally.
Supernumerary	Clinically presence or absence
Occlusal Anomalies	Descriptions
<ul> <li>Anteroposterior</li> <li>Increased Overjet (OJ)</li> <li>Reduced OJ</li> <li>Reversed OJ</li> <li>Anterior Crossbite</li> </ul>	<ul> <li>Increased OJ &gt;3.5mm: (3.5<oj≤6mm), (6mm<oj≤9mm),="" oj=""> 9mm</oj≤6mm),></li> <li>Reduced OJ: Edge to edge (ETE) ≤ OJ &lt; 2mm</li> <li>Reversed OJ: All 4 incisors were in crossbite</li> <li>Anterior crossbite: At least 1 anterior tooth in crossbite, not all incisors</li> </ul>
Vertical ☐ Increased Overbite (OB) ☐ Reduced OB ☐ Openbite	<ul> <li>Increased OB: OB &gt; 1/2</li> <li>Reduced OB: OB &lt;1/3, not exceed ETE</li> <li>Openbite: Absence of vertical overlap</li> </ul>
<b>Transverse</b> Posterior crossbite	Posterior crossbite: With or without mandibular displacement
<ul> <li>Other occlusal anomalies</li> <li>Crowding</li> <li>Midline shift</li> <li>Generalised spacing</li> </ul>	<ul> <li>Crowding: Presence of irregularity of teeth of either the upper or lower arch or both.</li> <li>Midline shift: Deviation of the dental midline from the facial midline</li> <li>Spacing: Presence of space except spacing due to the normal eruption process</li> </ul>
<ul><li>Midline diastema</li><li>Scissors bite</li></ul>	<ul> <li>Midline diastema: Presence of thick and low frenal attachment or palpable bulge (&gt;2mm)</li> <li>Scissors bite: Presence or absence</li> </ul>

All variables were documented as categorical and the results presented as percentages. Pearson chi-square tests were used to analyse the association between gender and each occlusal characteristic. Statistical significance was defined as p-value < 0.05. All analyses were performed using Statistical Package for Social Sciences (SPSS) version 21.0 (IBM, Armonk, New York).

# RESULTS

The inter and intra-examiner reliability test showed a high level of agreement (kappa statistic 1.00). The demographic characteristics of this study in percentage are shown in Figure 1. A total of 413 school children were successfully examined and included in this study (82.6% participation rate). The highest percentage of participation was Standard 3 (9 years old), female and Malays. The ethnic proportion was as the result of stratified random sampling. Hence, it reflected the Malaysian ethnic composition.



Figure 1: Demographic characteristics of the studied population

The distribution of dental anomalies by gender, including supernumerary and clinically missing teeth, are shown in Table 2. The clinically missing teeth could be due to impaction or hypodontia. Supernumerary and clinically missing teeth were reported to be present in 1.5% and 6.3% of the studied population, respectively. The distribution of the occlusal anomalies in all three planes and other occlusal anomalies based on gender are shown in Table 3-4.

Anomalies	Ge	Total (n=413)	*p-value	
	Male (n=190)	Female (n=223)	(11 110)	
Clinically missing teeth	6.3%	6.3%	6.3%	0.99
Supernumerary	2.1%	0.9%	1.5%	0.31

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\*Significance level set at p-value <0.05 (Pearson Chi-square Test)

In the sagittal plane (Table 3), overall findings showed a little over half of the studied population had an overjet within the normal range. Among those with the sagittal discrepancy, increased overjet was more common than reduce overjet (increased overjet (OJ >3.5mm): 28.8%; reduced overjet (OJ <2mm): 16.7%), with the highest frequency was overjet of  $3.5mm < OJ \le 6.0mm$ . Whereas, overjet of >9mm was almost equivalent with reverse overjet in which they became the least prevalent sagittal discrepancy. Despite some differences in the distribution of sagittal discrepancy between genders, the Pearson chi-square test revealed that there was no statistically significant difference (p = 0.88). Moreover, 14.3% of all subjects had anterior crossbite either with or without displacement in which anterior crossbite with mandibular displacement being predominant (Table 4), with no statistically significant difference reported between genders (p-value = 0.674).

Gender	Overjet Category, %			<i>p</i> -value			
	Normal		Increased		Reduc	ced	
		3.5 <oj≤6.0< td=""><td>6.0 <oj≤9.0< td=""><td>&gt;9.0</td><td>2&gt;OJ≤ETE</td><td>Reverse overjet</td><td></td></oj≤9.0<></td></oj≤6.0<>	6.0 <oj≤9.0< td=""><td>&gt;9.0</td><td>2&gt;OJ≤ETE</td><td>Reverse overjet</td><td></td></oj≤9.0<>	>9.0	2>OJ≤ETE	Reverse overjet	
Male	53.2%	22.1%	4.7%	2.6%	15.3%	2.1%	
Female	55.6%	19.7%	7.2%	1.4%	14.8%	1.4%	0.88
Total	54.5%	20.8%	6.1%	1.9%	15.0%	1.7%	
Gender	Normal Overbite	R	educed Overbit	e	Increased (	Overbite	*p-value
	Overbike	1/3rd >OB≤ ETE	Anterior Open Bite	Posterior Open Bite	With Palatal Trauma	With Palatal Trauma	
Male	59.5%	12.6%	2.6%	0	19.5%	5.8%	
Female	65.0%	13.5%	3.1%	0	11.7%	6.7%	0.226
Total	62.5%	13.1%	2.9%	0	15.2%	6.3%	

#### Table 3: Distribution and Association Between Gender to the Sagittal and Transverse Discrepancy

\*Significance level set at p-value <0.05 (Pearson Chi-square Test)

Note: Increased overjet category is based on IOTN-DHC grades

In the vertical plane (Table 3), the finding showed that 37.5% of the subjects showed some degree of vertical discrepancy with more subjects having an increased overbite. The increased overbite was found to be predominant in both genders. The frequency of anterior open bite was found to be almost equivalent between genders. The Pearson chi-square test revealed that there was no statistically significant difference (p = 0.22) between genders to the vertical anomalies.

In the transverse plane, subjects who had posterior crossbite either with or without functional shifts were recorded and analysed (Table 4). Overall results demonstrated that 5.1% of the population had posterior crossbite. The prevalence was found to be slightly higher in female than male subjects. Amongst those with the transverse discrepancy, posterior crossbite without displacement predominates. There was, however, no statistically significant difference reported with regards to the gender distribution of the transverse discrepancy (p-value = 0.74).

Anomalies	Gender		Total (n=413)	*p-value
	Male (n=190)	Female (n=223)	(	
Crowding	52.6%	55.2%	54.0%	0.88
Anterior crossbite	15.8%	13.0%	14.3%	0.67
Midline shift	13.2%	11.2%	12.1%	0.55
Generalised spacing	8.9%	7.6%	8.2%	0.63
Midline diastema	8.4%	4.0%	6.1%	0.06
Transverse anomaly (posterior crossbite)	4.2%	5.8%	5.1%	0.74
Scissors bite	1.6%	1.3%	1.5%	0.84

#### Table 4: Association of Transverse and Other Occlusal Anomalies to the Gender

\*Significance level set at p-value <0.05 (Pearson Chi-square Test)

The distribution of other occlusal anomalies that included crowding, generalised spacing, midline diastema, midline shift and scissors bite based on gender are described in Table 4. Amongst all, crowding was the most common occlusal anomaly in both genders, which represented the highest frequency of occlusal discrepancy in this study. In contrast, scissors bite was the least common anomalies. Statistical analysis revealed that there were no significant differences between other occlusal anomalies and gender.

### DISCUSSION

This study on the prevalence of malocclusion in Malaysian children fills the existing lacunae on information about dental anomalies and occlusal characteristics among Malaysian children. The findings of this study showed that children exhibited various types of dental and occlusal discrepancies. In terms of sample distribution, this study showed a higher percentage of females, which contradicted with the gender ratio of the Malaysian population. The difference could be since this study involved a specific age group while the Malaysian statistic of gender proportion involved all age groups (Department of Statistics Malaysia Official, 2018).

This study demonstrated no significant differences between gender to all occlusal anomalies described. The most predominant occlusal discrepancy was crowding, affecting 54.0% of children, which compliments with an earlier study investigating malocclusion in subjects aged 10 to 16 years old, reporting 52.3% of crowding (Siddegowda & Rani, 2014). When we compare it with a study that was conducted in an early mixed dentition stage (6-8 years old), the prevalence of crowding in their study population was significantly lower (26.3%) (Tausche et al., 2004). The crowding at this stage has not developed with the presence of mostly deciduous teeth only. In contrast, another study reported a higher prevalence of crowding (65.2%) in an older age group with permanent dentition (12-17 years) compared to our study (Gelgör et al., 2007). Nevertheless, crowding is a common malocclusion that manifests early, and orthodontic treatment can be initiated first or delayed based on other factors and the expected outcome (Gianelly, 2002; Winnier & Nayak, 2014).

To report the prevalence of increased overjet, based on IOTN-DHC (Brook & Shaw, 1989), an increased overjet of >3.5 mm was used. This reference was chosen as it is the index that has been widely used among Malaysian dental practitioners in both public and private settings for orthodontic referral and guidance. Our findings are in agreement with earlier reported studies for increased overjet (Tausche et al., 2004; Brito el., 2009). They reported that 29.7% of 9-12 years old Brazilian and 31.4% of 6-8 years old children had increased overjet of >3.5mm, respectively. However, it was much lower than a study that was conducted among Thai children aged 8-9 years old in which they reported that 47.7% of had overjet of >3.5mm (Rapeepattana et al., 2019). Some studies used a lower overjet reference (>3mm) (Gelgör et al., 2007; Yu et al., 2019). On the other hand, there was also a study that used >4mm as reference overjet (Thilander et al., 2001). Nevertheless, the frequencies of overjet in the majority of the mentioned studies were found to be comparable with our result, except for a study conducted among children in Shanghai, China where they reported a predominantly high percentage of increased overjet (40.8%) (Yu et al., 2019). The study involved children aged between 7 and 9 years old and the reference for increased overjet was >3mm.

This study reported that 37.5% of subjects had a discrepancy in the vertical dimension, mostly involving an increased overbite (21.5%). In agreement with our result, there was another study which reported that 21.6% of children aged between 5 and 17 years old had increased overbite (Thilander et al., 2001). Comparing our work with studies that were conducted among a younger age group, they reported a predominantly higher frequency of subjects with an increased overbite (Tausche et al., 2004; Rapeepattana et al., 2019). These studies conducted among 8-9 and 6-8 years old, reporting 48.2%, and 46.2% of their subjects had increased overbite, respectively. In contrast, another study conducted among the older age group (12-17 years) demonstrated a little lesser frequency (18.3%) (Gelgör et al., 2007). A comparison between our study and the above-mentioned studies indicates that increased overbite was higher in the younger age group than the older age. To support the above findings, another study reported a significant reduction of overbite from 9 to 18 years of age (Baccetti et al., 2011).

The reported prevalence of anterior openbite (2.9%) was equivalent to a study conducted in Karnataka state, Bangalore, which was 2.5% (Siddegowda et al., 2014). It was lower compared to a study with a similar age group (7.8%) (Brito et al., 2009). Comparing our results with studies among younger age groups (below 5 years old) and (6-8 years old), they reported a distinctly higher prevalence of anterior openbite, which were 12% and 17.7% (Tausche et al., 2004; Machado et al., 2014). In agreement, a study revealed an improvement of open bite tendency during the pre-pubertal stage, indicating a reduction of open bite with growth (Phelan et al., 2014).

The prevalence of anterior crossbite was 14.3%. The corresponding value reported by a previous study was relatively equivalent (15.0%) (Siddegowda et al., 2014). In a study of Chinese and Brazilian children, the prevalence was reported to be lower, which were 10.5% and 10.1%, respectively (Brito et al., 2009; Yu et al., 2019). In contrast, a study among Thai children revealed a higher prevalence of anterior crossbite (19.0%) (Rapeepattana et al., 2019). In this present study, amongst subjects with an anterior crossbite, 61% of them had mandibular displacement. It was higher than a study that investigated the prevalence of anterior crossbite in preadolescent children, which reported that 48.2% had anterior crossbite with displacement (Vithanaarachchi & Nawarathna, 2014). The purpose of the interceptive orthodontic treatment was to avoid several complications caused by anterior crossbite as if left untreated, it may cause attrition to the labial surface of the upper incisors, fracture, or mobility of incisor teeth and gingival recession (Borrie & Bearn, 2013). Moreover, it may contribute to the alteration of mandibular function and lead to more complex management in the future (Fleming, 2017).

In the transverse plane, posterior crossbite was presented in 5.1% of this studied population. The result relatively coincided with previous studies: 5-8% (Bell & Kiebach, 2014), 5.7% (Thilander et al., 2001) and 4.6% (Gelgör et al., 2007). In contrast, studies among Indian and Thai children demonstrated a lower prevalence of posterior crossbite, which were 0.9% and 1.0%, respectively (Siddegowda et al., 2014; Rapeepattana et al., 2019). In contrast, other studies reported a higher percentage: 12.0% (Perrotta et al., 2019) and 19.0% (Brito et al., 2009). The untreated, posterior crossbite may also result in a few complications, as mentioned above. Hence, these characteristics should be concerned as an urgent need for interceptive orthodontic treatment in the mixed dentition stage.

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Another common occlusal anomaly was midline shift, affecting 12.1% of all subjects. Few previous studies reported a higher prevalence of midline shift ranging between 32% and 44% (Siddegowda et al., 2014; Mohamed et al., 2014; Yu et al., 2019). In contrast, another study demonstrated a little less percentage (7.0%) (Thilander et al., 2001). The previous study suggested that this condition permits interceptive treatment to alleviate developing malocclusion. If it is left untreated at the early stage, it may lead to prolonged orthodontic treatment, and more complex management as midline corrections can be time-consuming (Mohamed et al., 2014). Nevertheless, diagnosing the midline discrepancy is not incorporated in the IOTN, which led to the underestimation of developing malocclusion in mixed dentition children.

Dental anomalies such as supernumerary and clinical missing teeth were recorded. In this study, the prevalence of erupted supernumerary was 1.4%, which is relatively equivalent to the prevalence of supernumerary reported by other studies: 1.8% (Thilander et al., 2001) and 1.0% (Rapeepattana et al., 2019). A study investigating the prevalence of supernumerary and its association between genders reported that the prevalence was 2.14%, and it was significantly higher in females than males (1.28:1) (Demiriz et al., 2015), which contradicted with our findings. The prevalence of supernumerary in our study was slightly low, and the difference between genders and ethnicity to this anomaly was not significant. Moreover, as this study was conducted based only on the clinical assessment, the possibility that supernumerary was impacted and unerupted was unable to be ascertained and not included in this study. Nevertheless, the presence of supernumerary should be recognised as early as possible to alleviate the potential complications such as failure of eruption of permanent teeth, displacement or rotation, crowding, abnormal diastema or premature space closure, dilaceration, delayed or abnormal root development of permanent teeth and cystic formation (Rajab & Hamdan, 2002).

Clinically missing teeth were also recorded. This may include hypodontia or impacted teeth because it was purely assessed clinically during screening, and further investigations were not carried out at the point of assessment. The reported prevalence was higher compared to a study among younger age group (Yu et al., 2019). A study investigating malocclusion among children aged between 6 and 8 years old reported that 3.2% of their subjects had missing teeth (Tausche et al., 2004). This could be due to the difference in age group, in which there were lesser permanent teeth that could have been erupted developmentally compared to ours. Therefore, this condition is more pronounced in our study.

We investigated the presence of midline diastema based on the presence of thick and low frenal attachment with >2mm space. It was consistent with the general guideline stating that maxillary midline diastema exceeding 2mm is unlikely to close spontaneously following the eruption of the canine and lateral incisors (Gkantidis et al., 2008; Abraham & Kamath, 2014). Our result was in agreement with another study that reported midline diastema of >2mm affecting 7.0% of their studied population (Thilander et al., 2001). An earlier investigation provides a reference on a clinical assessment for the prediction of the closure of midline diastema (Sanin et al., 1969). They reported that for 1.85mm diastema, the possibility of spontaneous space closure was 50%, and the percentage dropped to 1% if space was 2.7mm or more (Rajab LD, et al 2002). Therefore, we excluded the presence of minimal midline diastema due to physiological spacing. Furthermore, a study conducted among the similar age group of subjects with a midline diastema reference of  $\geq$ 1mm reported a higher prevalence compared to our study (Brito et al., 2009). This could be due to the inclusion of subjects with diastema of physiological factors such as the ugly duckling stage in their study as the reference value was lower.

## CONCLUSIONS

- 1. Children in mixed and early permanent dentition demonstrated various types of dental and occlusal anomalies.
- 2. Crowding was the predominant occlusal anomaly, followed by increased overjet and overbite.
- 3. For dental anomalies, the prevalence of clinically missing teeth was higher than supernumeraries.
- 4. None of the anomalies demonstrated an association with gender.
- 5. Due to the various types of occlusal anomalies present in the groups of children, it is recommended to carry out early orthodontic screening to allow timely orthodontic consults and appropriate interceptive interventions if required.

## **CONFLICT OF INTEREST**

All authors reported no conflict of interest.

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# Prosthetic Management of Unfavourable Nasal Defect: A Case Report

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#### ABSTRACT

**Introduction**: Facial defects can affect the appearance of an individual, resulting in psychological and social problems. In certain cases, surgical reconstruction of facial defects may not be feasible and prosthodontic rehabilitation may be the best option. **Case description**: A 72-years old gentleman was referred for the rehabilitation of a facial defect on the right side of his nose. The defect was affecting him psychologically and socially. The decision was made to construct a nasal prosthesis for him that would be retained by desirable undercuts and adhesive. **Discussion**: Management of facial defects are challenging due to multiple reasons such as matching of the prosthesis to surrounding skin and retention of the prosthesis. The prosthesis can be retained with implants, facial accessories, desirable undercuts, or adhesives. For this patient, the prosthesis was retained by using undercuts combined with medical-grade adhesive. A thin layer of flash at the edges of the prosthesis was maintained to ensure even finish margin. The prosthesis fabrication successfully resolved the patient's condition.

Keywords: Nasal prosthesis, Basal cell carcinoma, Nasal defect

# INTRODUCTION

Maxillofacial defects can be caused by multiple factors such as congenital malformation, trauma, or neoplasm. Such defects can affect and individual's sense of identity and personality. Correction of facial defects involves a multidisciplinary approach involving surgical, prosthetic, and psychological rehabilitation (Aggarwal, Datta, & Kaur, 2016). Nasal defects are divided into favourable defects such as total rhinectomy and unfavourable defects such as partial rhinectomy. For partial rhinectomy, the rehabilitation is challenging due to multiple factors including displaceable residual nasal tissue, difficulty in restoring the nasal symmetry, difficulty in retaining the prosthesis and hiding the margins of the nasal prosthesis. Moreover, other difficulties in the rehabilitation of facial defects include limitation in the surrounding soft tissue quantity and mobility, reduced vascularisation, underlying physical condition of the patient, and material availability (Beumer et al, 2011).

Skin cancer in the facial region is one of the contributing to maxillofacial defects. It could be divided into non-melanoma skin cancer and melanoma. Non-melanoma skin cancer (NMSCs) includes basal cell carcinoma





(BCC; 75% of NMSCs), squamous cell carcinoma (SCC; 20% of NMSCs), and a few rarer malignancies such as Merkel cell tumour, dermatofibrosarcoma protuberans, and adnexal tumours. BCC originates from pluripotential cells in the epidermis and hair follicles. The most common predisposing factor of BCC is prolonged exposure to the sun. The treatment of BCC involves wide margin excision of the tumour and confirmation of clear margin with microscopic examination, followed by radiotherapy. Rehabilitation of the defect can be achieved by surgical reconstruction or prosthetic restoration. The treatment plan depends on several factors such as the contour of the excised lesion, availability of the soft tissue, vascularisation of defect area, need for radiation to the area of defect, and physical and medical conditions of the patient (Beumer et al., 2011; Jain et al., 2011; Miloro & Peterson, 2012).

This case report aimed to describe the prosthetic rehabilitation of a partial nasal defect by using a nasal prosthesis fabricated with silicone elastomer.

#### **Case Description**

A 72-years old male patient was referred to the Postgraduate Prosthodontic Clinic, Faculty of Dentistry, Universiti Teknologi MARA for rehabilitation of partial nasal defect. The patient had a history of BCC on the right side of the nasal region and underwent partial rhinectomy procedure followed by radiotherapy. He completed all his treatment a year before presenting to this clinic. The nasal defect following the cancer treatment resulted in negative psychological impact on the patient, including low self-esteem and social avoidance.

Clinical examination revealed a defect on the right side of the nose with healthy boundaries. The defect was  $2 \times 3$  cm and bordered the right nasal alar distally, part of the right nasal wall superiorly, and mid of nasal bridge and part of the nasal tip medially (Figure 1). The nasal septum and inferior turbinate bone were exposed with intact mucosal lining. Based on the anatomical features, the defect was classified as an unfavourable defect.

In order to improve the patient's appearance and psychological well being, a treatment plan was laid out based on the limitations of the defect extension. It was aimed to rehabilitate the defect using a prosthesis that would be retained by a combination of desirable undercuts and adhesive.



Figure 1: Extra-oral view of patient showing the defect region.

### **CLINICAL PROCEDURE**

Two primary impressions were made, namely the nasal and facial impressions. The facial impression was made by using irreversible hydrocolloid impression material (Kromopan, Lascod, USA) while the nasal impression was made using light-body and heavy-body polyvinyl siloxane impression material (VPS, Chemi-Sil, B&E, Korea). Additionally, the airway patency was maintained using a plastic tube that was held passively.

A nasal cast and facial cast were fabricated and trimmed using Type 3 dental stone (Model Stone, Zhermack, Italy). The wax pattern of the nasal prosthesis was sculptured on the facial cast to ensure the parallelism with other facial landmarks. Then, soft wax was inserted into the desirable undercuts on the nasal cast. Following that, the wax pattern was attached to the soft wax on the nasal cast to ensure the proper extension of the prosthesis the undercuts (Figure 2a, 2b, 2c & 2d). Wax pattern adaptation was assessed. Skin texture and contours were evaluated (Figure 3).









Figure 2: The facial and nasal casts without (a & b) and with (c & d) the nasal wax-up pattern.

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Figure 3: Try-in stage of the nasal wax pattern.

A reline impression was made by relining the wax pattern using light-body silicone impression material. The light-body Vinyl PolySiloxane (VPS, Aquasil, Dentsply Sirona, USA) was injected on the borders of nasal defect and the remaining area of the nose. Then, the wax pattern was picked up with a special tray loaded with heavy-body VPS (Aquasil, Dentsply Sirona, USA) (Figure 4). The base colour of the skin shade was taken during the same visit. It was a mixture of cream, light brown, and grey intrinsic stains (P115 intrinsic colour, Technovent, UK).



Figure 4: Reline impression of the wax pattern (a), custom tray loaded with heavy-body polyvinyl siloxane (b), and picked-up impression (c).

The nasal prosthesis was then fabricated using heat-vulcanised silicone material (Cosmesil series maxillofacial rubber M511, Technovent Co, UK). The maxillofacial silicone was mixed and packed into two-piece dental flask and polymerised according to the manufacturer's instructions (Figure 5).



Figure 5: The master cast investment (a) and the final nasal prosthesis after polymerization (b).

On the day of delivery, the nasal prosthesis was first fitted to the nasal defect. It was able to engage all the available undercuts, thus providing sufficient retention. The silicone flash on the peripheries was retained on purpose to ensure transitional blending to the skin. The prosthesis was in an acceptable symmetry when compared to the left side of the nose and other facial structures (Figure 6). After checking the fitting of the prosthesis, the external surface was stained with extrinsic stains (P702i extrinsic colour, Technovent, UK) followed with sealant application (P799 extrinsic sealant, Technovent, UK). The wearing of the prosthesis was demonstrated to the patient. Detailed instructions regarding the care and use were provided to the patient and his son.

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Figure 6: Try-in of nasal prosthesis prior to extrinsic staining.

The patient returned for first review after one week. He was concerned about slight losseness of the prosthesis. However, he was satisfied with the appearance and color of the prosthesis. A decision was made to improve the retention of the prosthesis by usage of adhesive.

Therefore, the patient was reassured and provided with a water-based adhesive (G609 Probond Adhesive, Technovent, UK). Instructions on its usage were given to the patient. Color stability, tissue health, and his satisfaction towards the prosthesis were also assessed. In general, he was satisfied with the outcome (Figure 7).



Figure 7: Nasal prosthesis after extrinsic staining, glazing and characterization.

#### DISCUSSION

Defects in the nasal region can be divided into favourable and unfavourable defects. Total rhinectomy is a more favourable defect compared to partial rhinectomy. The rehabilitation of partial rhinectomy can be challenging due to multiple factors such as displaceable residual nasal tissue, difficulty to restore the symmetry, and difficulty to hide the margins (Beumer et al., 2011). Moreover, the usage of an implant to rehabilitate nasal defect is limited by the physical condition of the patient, availability of bony structure, financial limitation, and history of radiation to defect area (Louis, Torres Terán, & Cardín, 2016). For this case, the nasal defect was considered as unfavourable based on the limited remaining undercuts and position of the defect. Furthermore, it was difficult to match the colour due to the variety of skin tone and amount of hyperpigmentation on his facial region.

Nasal prosthesis can be retained by multiple methods such as undercuts, facial accessories (such as spectacles), medical-grade adhesive, or osseointegrated implants (Beumer et al., 2011; Jain et al., 2011; Saker, Zarrati, Mroue, & Mangoli, 2018). However, implant placement is also a challenge nasal defect rehabilitation. In this case, implants were not considered due to the location of the defect and unavailability of bone, and a history of radiotherapy. In addition, spectacles were not considered as a mean of retention because the location of defect margin were not in proximity to the nasal bridge. Therefore, the best retention option the prosthesis would be the utilization of available undercuts and skin creases with the usage of an adhesive if needed. However, prolonged usage of adhesive was not recommended mainly due to the level of maintenance required to apply the adhesive and it would be possible to tear the borders during the application. Furthermore, it would require more care for cleaning of the prosthesis and defect. The purchase of the adhesive would also represent an extra financial burden to the patient.

Nasal prostheses can be fabricated by using conventional or digital techniques. The conventional technique requires multiple lengthy clinical and laboratory steps. With the current advancement with digital dentistry, nasal and other maxillofacial prostheses can be fabricated by the utilization of Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) systems (Farook, Jamayet, Abdullah, Rajion, & Alam, 2019). While the initial cost of conventional technique is lower, running cost and time required for fabrication of nasal prosthesis digitally is lower. Additionally, MRI, CT Scan, photogrammetric systems, or laser scanners are usually used for fabrication of digital impressions which will reduce discomfort to the patients (Farook et al., 2019). Despite the advantages of digital nasal prosthesis, the availability of a CAD/CAM systems hindered the usage in many cases including this case.

There are multiple materials that can be used for fabrication of nasal prosthesis such as acrylic resins, vinyl polymers, polyurethane elastomers, and silicone elastomers; However, none of them is fulfilling all the requirements for a satisfactory prosthesis (Shetty, Mohammed, Kamath, & Shenoy, 2018). Maxillofacial silicone material is commonly used to fabricate extraoral prostheses for its good surface texture and hardness. The main problem lies within the short lifespan of the prosthesis when made using this material. A study was conducted to evaluate the stability of HTV silicone (Cosmesil series maxillofacial rubber M511, Technovent Co, UK) by immersing it for six months (equivalent to 1.5 years of clinical service) in different solutions. It was found that continuous immersion of silicone specimens for six months revealed only slight colour changes and limited solution absorption (Al-Dharrab, Tayel, & Abodaya, 2013). In view of its superior properties, this material was chosen. Yet, the patient was still be reminded not wash the prosthesis with acidic or basic solutions to decelerate colour fading.

### CONCLUSION

Utilization of remaining undercuts with assistance of adhesive are advantageous for prosthesis retention in un favorable nasal defect. Excellent homecare maintenance, avoidance of exposure to direct sunlight and periodic reviews are the essential cores to ensure prosthesis success.

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# Orthodontic Management of a Severely Rotated Central Incisor: A Case Report

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#### ABSTRACT

**Background:** Crowding, rotation and impaction of teeth are some of the complications of supernumeraries. This article aims to discuss the orthodontic treatment of a severely rotated upper left central incisor (UL1) secondary to an erupted mesiodens. An 18-year old Malay male presented with Class I malocclusion with severely crowded upper arch, presence of erupted mesiodens, severely rotated upper left central incisor, displaced upper left lateral incisor and upper left canine and centreline discrepancy. **Methods:** He had a combination of segmented arch and couple force mechanics to correct severely rotated central incisors. Following anchorage reinforcement, the upper mesiodens and the upper right first premolar was extracted. Subsequently, treatment was continued with conventional straight wire mechanics. **Results:** The severely rotated upper left central incisor was successfully corrected, and the upper arch crowding was resolved. The fixed appliances were debonded and he was provided with upper dual retention. He had gingival recession Type 1 at UL2 due to the bony defect. **Conclusion:** Severe crowding can be managed with segmented arch mechanics without any detrimental effects using low forces and good planning. Further periodontal consultation and management were required for the treatment of UL2.

Keywords: Segmented arch mechanics, Couple force mechanics, Supernumerary Teeth, Rotated Teeth

### INTRODUCTION

Supernumerary teeth can be defined as an excess in the number of teeth when compared with the normal series of dentition. Few studies reported a lower prevalence of supernumerary in the deciduous dentition than in permanent dentition which ranges from 0.1% to 3.8% (Rajab & Hamdan, 2002). It can occur as single, multiple, unilateral or bilateral, involving maxilla or mandible (Shah et al., 2008). In addition, this pathology is reported to be more common in males than in females with a proportion of 2:1 (Yusof, 1990; Rajab & Hamdan, 2002; Yassin & Hamori, 2009).

Shah et al. (2008) reported that there are four types of supernumerary teeth based on the form and position of teeth. Conical supernumerary, when occurred in the midline, is known as mesiodens. It is the most commonly



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found supernumerary (Primosch, 1981; Rajab & Hamdan, 2002). Although only 13-34% of supernumeraries erupt into the oral cavity, it can give rise to complications such as rotation or displacement of the adjacent teeth. Yassin & Hamori (2009) reported that the most common complication of supernumeraries was delayed eruption of the permanent teeth (23.1%). Severely rotated teeth can be challenging to treat with conventional technique as it may result in excessive deflection of archwire beyond the optimum activation and may require additional anchorage reinforcement.

This article discusses the orthodontic mechanics used to correct the severely rotated upper left central incisor and the orthodontic treatment of his malocclusion.

# **CASE REPORT**

MM was an 18-year-old, fit and healthy Malay male who attended the Postgraduate Orthodontic Clinic, Faculty of Dentistry Universiti Teknologi MARA (UiTM), with a chief complaint of crooked teeth. He presented with a Class I incisor relationship on Class II skeletal base and average vertical proportions, which was complicated with the following features:

- 1. Presence of a supernumerary (mesiodens) between the upper right central incisor (UR1) and the upper left central incisor (UL1)
- 2. More than 90° rotation of the labially positioned UL1
- 3. Moderate crowding of 6mm in the upper arch but the lower arch was fairly well aligned
- 4. The upper left canine (UL3) was labially positioned while the upper left lateral incisor (UL2) was palatally positioned
- 5. Upper centreline had shifted to the left by 5mm
- 6. Class II molar relationship on the right and Class I molar relationship on the left
- 7. Bolton discrepancy (anterior ratio was 82.1%): upper incisors required build up to eliminate discrepancy, if necessary.

Pre-treatment records were taken prior to the start of the orthodontic treatment, which included extra-oral photographs, intra-oral photographs, dental panoramic tomograph (DPT) and lateral cephalometric (LC) radiograph (Figure 1-4). MM presented with a convex profile and Class 2 skeletal pattern. The severely rotated UL1 and the mesiodens were prominent upon smiling. Intraoral examination revealed that he had good oral hygiene and excellent gingival health despite the severely crowded upper arch. Generally, he was very eager and motivated to commence orthodontic treatment. The dental panoramic tomography (Figure 3) showed the presence of all permanent teeth except the lower third molars. The mesiodens was located between the UR1 and UL1. The lateral cephalometric tomograph (Figure 4) and the cephalometric values (Table 1) confirmed a mild Class 2 skeletal pattern and average vertical proportions.



Figure 1: Pre-treatment extra-oral photographs



Figure 2: Pre-treatment intra-oral photographs



Figure 3: Pre-treatment dental panoramic tomograph.



Figure 4: Pre-treatment lateral cephalometric radiograph and hand tracing.

Variables	Patient values	Caucasian Norm
SNA	<b>77</b> °	81°±3°
SNB	74°	78°±3°
ANB	3°(EC: 5°)	3°±2°
MMPA	32°	26°±3°
SNMxP	11 °	8°±3°
%LFH	53%	Mean 55%
UIA	110°	109°±6°
LIA	92°	93°±6°
IIA	136°	135°±10°

#### Table 1: Pre-treatment LC values

\*Red denotes values out of the standard deviation

\*EC: Eastman correction

#### Aims and Objectives of Treatment

- 1. Maintain optimum dental health and oral hygiene throughout treatment
- 2. Accept the underlying Class 2 skeletal pattern
- 3. Relieve the crowding and align the severely rotated central incisor
- 4. Level the upper and lower arches
- 5. Normalise the overbite and overjet
- 6. Correct the centreline discrepancy
- 7. Maintain the Class I molar relationship on the left and Class II molar relationship on the right
- 8. Achieve Class I canine relationship bilaterally
- 9. Finishing and detailing the occlusion
- 10. Retain the corrected occlusion
- 11. Monitor eruption of the upper third molars

#### **Treatment Plan**

- 1. Maintenance of his oral hygiene through oral health education and instructions
- 2. Transpalatal arch (TPA) for anchorage reinforcement
- 3. Extraction of the mesiodens and the upper right first premolar (UR4)
- 4. Upper and lower pre-adjusted edgewise fixed appliances on a 0.022"x0.028" bracket slot with MBT prescription
- 5. Retention

# SEQUENCE OF TREATMENT

Following the cementation of the TPA, extractions of the mesiodens and the UR4 were carried out. Then, the upper arch was bonded segmentally (Figure 5) on the right side of maxilla from the upper right second premolar (UR5) to UR1 (Burstone, 1966). Upper 0.014" Nickel-Titanium (NiTi) archwire was placed segmentally.



Figure 5: Segmented arch mechanics for initial alignment of upper teeth (5a: Frontal view, 5b: Occlusal view)

After 2 months, the upper archwire was progressed to 0.018" NiTi, followed by 0.018"  $\times$  0.025" NiTi and 0.018"  $\times$  0.025" stainless steel (SS). Space creation for the alignment of UL1 and centreline correction was performed by distalizing the UR3 into the extraction space using elastomeric chain.

When the space for alignment of UL1 was obtained, the left quadrant was bonded from UL3 to UL6, and 0.012" NiTi archwire was placed segmentally, whilst maintaining the 0.018"  $\times$  0.025" SS archwire on the right quadrant. Two buttons were bonded on the mesial and distal surfaces of UL1 prior to the introduction of the couple force technique [7]. The 0.018"  $\times$  0.025" SS archwire on the right was bent incisally at the mesial end to act as a point of attachment. Two sets of elastomeric chains were used. One of them was attached from the mesial end of 0.018"  $\times$  0.025" SS (bent end) to the bonded button on the mesial surface of UL1 and the other elastomeric chain from the bonded button at the distal surface of UL1 to the molar band hook of upper left first permanent molar (UL6) (Figure 6). This mechanic is known as the couple force technique, which was created by two forces that have equal magnitude but exerted in opposite direction to one another with parallel forces (Upadhyay and Nanda, 2015). The optimum force applied, which ranged between 50 and 100 grams, was confirmed with a strain gauge (Correx Strain Gauge).


Figure 6: Couple force mechanic

The position of the buttons at the mesial and distal aspect of UL1 were gradually repositioned to allow full correction of the rotation until bonding of the bracket was possible (Figure 7). He was reviewed monthly, and after 7 months, the UL1 was successfully aligned. Following the correction of the UL1, a continuous upper archwire was placed, and the wire sequences were 0.014" NiTi, 0.018" NiTi, 0.018"  $\times$  0.025" NiTi, 0.018" SS (centreline correction) and 0.018"  $\times$  0.025" SS. Figure 8 shows upper arch on 0.014" continuous NiTi archwire.



Figure 7: Adjustment of the button on mesial UL1 (7a: button was labially positioned, 7b: button was repositioned mesially)

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Figure 8: Continuous upper archwire

Figure 9 shows an upper continuous 0.018" SS archwire placed with the elastomeric chain from UR3 to UR6 to allow retraction of the upper right canine (UR3) for the midline correction. At this stage, the upper centreline was further corrected and the space for alignment of UL2 was obtained. Once there was adequate space for the UL2, a 0.012" NiTi archwire was used to piggyback UL2 on the 0.018" SS main archwire. The bracket on UL2 was inverted to facilitate a 20° conversion of root torque on the UL2 (-10°).



Figure 9: Placement of elastomeric chain on right quadrant

Once the upper arch was aligned, the lower teeth were bonded, and the archwire sequence progressed from 0.014" NiTi to 0.018" NiTi and followed by  $0.018" \times 0.025$ " NiTi and  $0.019" \times 0.025$ " SS (Figure 10a). The prominent buccal root torque of the upper canines were reduced by adding palatal root torque (Figure 10b).



Figure 10: Finishing stage (10a: Lower archwire (0.019" × 0.025" SS) and prominent buccal torque upper canines, 10b: The prominent upper canines corrected with the introduction of palatal root torque

### TREATMENT RESULT

Segmented arch and couple force mechanics were utilised to successfully correct the position of the UL1 leading to the improvement in aesthetics. Near-end DPT (Figure 11) showed a slight distally angulated UR2 and mesially angulated UL3. Second-order bends were incorporated for the detailing. Figure 12 shows manual superimposition of the pre- and near-end LC radiographs. Overall superimposition revealed no significant changes in the anteroposterior and vertical dimension indicating that the patient did not demonstrate any obvious growth in the anteroposterior or vertical plane. Additionally, the orthodontic mechanics that were applied was able to control the vertical movement of posterior teeth. Apart from that, the soft tissue superimposition also showed minimal changes. Dentally, the upper first molar moved slightly forward to finish in Full unit Class II molar, while the upper incisors were slightly retroclined compared to the initial position. This was beneficial and expected to allow the camouflage of his skeletal pattern. No significant changes can be seen on the lower arch.



Figure 11: Near-end DPT



Figure 12: Manual superimposition

Figures 13-14 show the post-treatment extra oral and intra oral photographs. Generally, good occlusion and interdigitation have been achieved. However, it was anticipated that the canine relationship in Class II <sup>1</sup>/<sub>4</sub> unit especially on the left due to the Bolton discrepancy. To correct the discrepancy, further treatment such as extraction, distalization, and additional second order bend at upper canines may have been necessary, but it may associate with the long-term dental maintenance. He was happy with outcome and refused on further orthodontic treatment. There was a gingival recession noted at UL2 (3mm) due to bony defect without deep periodontal pocket. He was referred to the Periodontology department and was diagnosed with Gingival Recession Type 1 (Cairo et al., 2011), which require coronally advanced flap and connective tissue graft. We will discuss with MM if he is keen for the periodontal surgery upon review.



Figure 13: Post-treatment extra-oral photographs



Figure 14: Post-treatment intra-oral photographs

### DISCUSSION

Couple force mechanics is a simple and useful method to correct the rotation of permanent teeth utilizing light forces. This force should be directed in opposite directions facilitating the derotation and alignment of teeth. It can be used in conjunction with other mechanics, such as centreline correction. Upadhyay & Nanda (2015) described couple as a form of moment, and because the forces carry the same magnitude but oppositely directed, the net potential of this particular force system to move the body upon which it acts will be negated; thus, there is only rotation. Therefore, this type of orthodontic mechanics was suitable and favourable for this case.

#### **Patient's Compliance and Cooperation**

Patient cooperation is an essential factor in the success of orthodontic treatment. According to Albino (2000), the conceptual model of factors influencing orthodontic treatment decision consists of patients' perception of dento-facial attractiveness and patients' perceived need for treatment, albeit an orthodontist evaluation of treatment need that shows a need for orthodontic treatment. The positive result of orthodontic treatment requires not only knowledge and technical competence but also a considerable effort by the patient. Earlier studies demonstrated that a lack of cooperation from the patient had a significant effect on the length of orthodontic treatment time, including patient's personal characteristics even though it did not significantly alter the quality of orthodontic treatment. Subsequently, the patient must wear the appliance longer, and this will give rise to multiple complications (Beckwith et al., 1999; Skidmore et al., 2006). MM was very motivated and the continuous correction of the rotated UL1 was obviously appreciated. His cooperation and commitment throughout the treatment led to a successful outcome.

#### **Initial Alignment**

In this case, accurate bracket placement facilitated the initial alignment. It was followed by the introduction of a flexible NiTi archwire into the bracket slots. The light force was applied to allow tooth movement in all three planes of space. An ideal archwire should be able to minimise patient discomfort, tissue hyalinization and

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root resorption. Previous studies showed that NiTi would provide considerable deflection by delivering a light and relatively constant amount of force. Moreover, it also exhibits an exceptional feature in terms of elasticity and maintaining shape memory which can be seen by a larger spring back capacity compared to a stainless-steel wire (Gurgel et al., 2001; Ferreira et al., 2012). Due to the mentioned properties of NiTi, it was used in the initial alignment of teeth. However, another study reported that except for a higher stiffness of multi-stranded stainless steel archwire, there were no differences in the rate of alignment or pain between multi-stranded stainless steel and NiTi wires (Jian et al., 2013).

Once the right quadrant was aligned, stainless steel wire was then used for retraction of anterior segment to provide space for de-rotation of UL1 and midline correction. It provided enough rigidity to allow an optimum tooth movement.

#### **Segmented Arch Mechanics**

The segmented arch mechanic was introduced by Dr Charles Burstone in 1966. It was designed to control tooth movement with a known moment to force ratio and to optimise biologic response through the application of a relatively constant force at an optimal magnitude (Burstone, 1966). This technique was usually implemented in an extraction case for anchorage control. In segmented archwire mechanics, site of force dissipation can be selected, whereby in continuous arch mechanics, reactive forces are dissipated around points of the force application. Thus, it was decided to use segmented mechanics in this case. It is also suggested for other specific case such as canine extrusion and retraction, deep bite correction, molar uprighting and occlusal plane correction (Caldas et al., 2014). After the initial segmented arch mechanics, treatment was continued with straight wires.

The resilient force of elastomeric in tension or compression is typically used to move a tooth or an orthodontic appliance relative to other teeth or orthodontic appliances. In this case, we used elastomeric elongated chain-like modules (powerchain) on a segmented arch mechanic to exert forces for orthodontic tooth movement. We used a strain gauge to measure an optimal amount of force. The light continuous force was proven to give an ideal tooth movement and provided minimal strain on anchorage (Samuels et al., 1993). Furthermore, a higher force (300 grams) would not result in a faster tooth movement or reduction in overall treatment time, yet it will predispose to a higher site of hyalinization (Owman-Moll et al., 1996; Yee et al., 2009). Hence, we decided to introduce an optimal force measured for the derotation of UL1 and throughout the treatment to ensure a successful outcome.

#### Anchorage Reinforcement

Anchorage control has continuously been an area of concern in orthodontics. It is common to reinforce the anchorage in the upper arch during the fixed appliance treatment. This can be in the form of transpalatal arch (TPA), mini-implant (MI) or headgear. However, a non-compliant (TPA and MI) anchorage control is always preferable over headgear (Alhadlaq et al., 2015). In the presented case, correction of severely rotated teeth and centreline shifts required a localised moderate-high anchorage demand. Although Sharma et al. (2012) reported that MI had shown significant anchorage control over other types of anchorage, the use of TPA when combined with segmented arch results in adequate anchorage control.

As described by Goshgarian in 1972, TPA can provide passive and active orthodontic forces in all three planes. The wire goes across the palatal contour from one molar to the contralateral molar and is soldered to the molar bands. The advantages of the TPA are to reduce anterior molar movement and act as an anchorage reinforcement. Besides that, it also provided arch width stabilisation during orthodontic treatment. It can be modified to incorporate other components such as anterior bite plane, Nance button (introduced by Nance in 1947), hook to facilitate orthodontic treatment and auxiliary springs. In this case, a hook was soldered to the palatal part of the transpalatal arch to provide an attachment of the elastomeric chain to a rigid wire. However, the severely rotated UL1 was derotated successfully using the couple force. However, it was fabricated at the start as the cost to re-fabricate a new TPA if the hook was required would increase the overall cost of the orthodontic treatment. Having that in mind, the hook was incorporated at the initial treatment plan.

#### Retention

Overall superimposition showed that this patient was not actively growing. Dental superimposition showed minimal dental changes which enhances the stability of the treatment. Stability is a concern with any severely rotated teeth post orthodontic treatment. In this case, it had a high risk of relapse due to over-stretched supra alveolar and transeptal fibres indicating fixed retainer (Littlewood et al., 2017). In agreement, previous studies investigating relapse tendency after orthodontic correction of anterior teeth reported that it was reduced after retained with fixed retainer (Naraghi et al., 2006; O'Rourke et al., 2016). In addition, there are reports of occasional, severe and unwanted tooth movement and relapse caused by failed fixed retainers as a result of bonding or wire fatigue (Shaughnessy et al., 2016; Littlewood et al., 2017). Therefore, we decided to implement dual retention with fixed and removable retainers. The Hawley retainer was chosen over thermoplastic retainer as it was superior in allowing settling of occlusion and better oral hygiene maintenance (Sauget et al., 1997). On top of it, we achieved good overjet, overbite and interdigitation. In terms of retainer regime, MM was advised to wear the retainers full time for the first 6 months and night-time only afterwards. Although previous studies reported no difference in the stability of teeth in a patient wearing full-time or night-time only (Thickett & Power, 2009; Gill et al., 2007), we encourage this patient to wear it full time for the first 6 months to ensure compliance and motivation. He was also informed of the importance of long-term retention to ensure the stability of the orthodontic outcome.

#### CONCLUSION

Couple force and segmented arch mechanics can successfully be implemented to correct a severely rotated central incisor. The use of light forces and careful monitoring can avoid trauma to the rotated tooth. The proposed technique is a clinically manageable and relatively simple procedure.

### DECLARATION

This work was previously presented as a poster presentation at the 9<sup>th</sup> Dental Student's Scientific Symposium, held on 9<sup>th</sup> -10<sup>th</sup> April 2019, in Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh, Selangor.

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- **Human subjects:** When reporting on human subjects, authors should indicate whether the procedures followed were in accordance with the ethical standards of the Helsinki Declaration (1964, amended most recently in 2008) of the World Medical Association. Manuscripts should include a statement that the patient's written consent was obtained and any information, including illustrations, should be as anonymized as far as possible. Authors should indicate that the design of the work has been approved by local ethical committees or that it conforms to standards currently applied in the country of origin. The name of the authorizing body should be stated in the paper.

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Authors should indicate that the design of clinical trial study has been approved by local ethical committees / appropriate authority or that it conforms to standards currently applied in the country of origin. The name of the authorizing body should be stated in the paper. The clinical trial registration number and name of the trial register will then be published with the paper.

### Funding

All sources of funding should be declared in the Acknowledgements. If a private/commercial sponsor supported the research, authors are advised to describe the role of the study sponsor (s), if any, in study design; in the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication. If the funding source had no such involvement, this should be stated.

Details of all funding sources for the work in question should be given in a separate section entitled 'Funding'. This should appear before the 'Acknowledgements' section.

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An example is given here: 'This work was supported by the National Institutes of Health [AA123456 to C.S., BB765432 to M.H.]; and the Alcohol & Education Research Council [hfygr667789].'

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Submitted manuscripts are subject to peer review and are expected to meet standards of academic excellence. Peer-reviewers identities will remain anonymous to the authors. The Editor-in-Chief's decision regarding publication is based on the recommendation of the reports of reviewers, which will, at the Editors' discretion, be transmitted to the authors.

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- 2.5 cm (1 inch) margins
- Justifiy
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A desirable plan for the organization of a **Regular Paper** is as follows: (1) **TITLE (2) ABSTRACT, (3) INTRODUCTION** with no heading, (4) **MATERIALS AND METHODS (5) RESULTS (6) DISCUSSION** (7) **REFERENCES.** 

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Provide a title page, containing the following items.

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The main part of an article should start with a brief Introduction, which outlines the historical or logical origins of the study and clearly states the aim of the study and/or hypothesis to be tested, without repeating the abstract or summarizing the results. Avoid giving an extensive review of the literature.

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This section should present clearly but succinctly the experimental findings. Only results essential to establish the main points of the work should be included. Numerical data should be analyzed using appropriate statistical tests. For guidelines on how to report statistical results, see Bailar, JC, Mosteller, F (1988) Guidelines for statistical reporting in articles for medical journals. Ann Intern Med, 108:266-273; Curran-Everitt, D, Benos DJ, (2004) Guidelines for reporting statistics in journals published by the American Physiological Society. J Neurophysiol, 92:669-671; Lang, TA, Secic, M (2006) How to report statistics in medicine: annotated guidelines for authors, editors and reviewers, 2nd edition, Philadelphia, PA, ACP Press; Sarter M, Fritschy JM (2008) Eur J Neurosci 28:2363-2364. compact presentation.

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The observations should be presented with minimal reference to earlier literature or to possible interpretations. The main statistical results should be reported in the Results section. The description of the statistical results should include the proper statistical term (such as the F statistic) as well as the degrees of freedom and the P value. The description of statistical results in the figure legends should be limited to important post hoc comparisons.

Statistical methods should be described with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, findings should be quantified and appropriate measures of error or uncertainty (such as confidence intervals) given. Details about eligibility criteria for subjects, randomization and the number of observations should be included. The computer software and the statistical method(s) used should be specified with references to standard works when possible.

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The discussion section presents the interpretation of the findings, this is the only proper section for subjective comments. The discussion section should be as concise as possible and should include a brief statement of the principal findings while avoiding repetition of statements provided in the Abstract or the Results section. A discussion of the validity of the observations, a discussion of the findings in light of other published work dealing with the same or closely related subjects, and a statement of the possible significance of the work. Extensive discussion of the literature is discouraged.

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  - 12. Messing J (1983) New M13 vectors for cloning in *Methods in Enzymology* (Wu, R., Grossman, L., and Moldave, K., eds.) Vol. 101, pp. 20–51, Academic Press, New York
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A short statement about grant and other financial support should be given, along with a list of contributions from collaborators who are not co-authors (it is implicit that they agree with this mention), and a declaration of competing interests. See above under Editorial Policies for additional items to be addressed in the Acknowledgements.

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