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Consultant Oral & Maxillofacial Surgeon,
Columbia Asia Hospital-Setapak
53300 Kuala Lumpur, Malaysia.
E-mail: mdj@mda.org.my

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Editor:
Malaysian Dental Journal
Malaysian Dental Association
D-5-1, Pusat Komersial Parklane,
Jalan SS7/26, 47301 Petaling Jaya
Selangor, Malaysia
E-mail: mdj@mda.org.my

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The Malaysian Dental Journal covers all aspects of work in Dentistry and supporting aspects of Medicine. Interaction with other disciplines is encouraged. The contents of the journal will include invited editorials, review updates, original scientific articles, case reports, and technical innovations. The mission is to promote and elevate the quality of patient care and to promote the advancement of practice, education and scientific research in Malaysia.

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Editorial

In the rapidly evolving landscape of dental health care, Malaysia stands at the crossroads of tradition and innovation. As we embark on this journey through the 21st century, the Malaysian Dental Journal remains steadfast in its commitment to advancing dental science, promoting oral health, and fostering professional growth among dental practitioners in our country.

This issue of the Malaysian Dental Journal marks a giant leap forward in our quest to be indexed. We have collaborated with an international publication house, namely, Wolter Kluwer to uplift the status of our journal.

The Malaysian Dental Journal plays a pivotal role in this dynamic environment. As a leading publication, it serves as a platform for disseminating cutting-edge research, sharing best practices, and encouraging dialog among dental professionals. Our commitment to maintaining high standards of scientific rigor and editorial integrity ensures that we continue to be a trusted source of knowledge and inspiration for our readers.

In this edition, we are proud to feature a diverse array of articles that reflect the breadth and depth of contemporary dental research and practice. We are also showcasing the abstracts that were presented in our annual conference SCATE 2024.

As we look to the future, it is essential for us to remain adaptable, proactive, and collaborative. The dental profession in Malaysia is poised for continued growth and innovation, driven by the dedication and expertise of our practitioners. By staying abreast of global trends and fostering a spirit of continuous improvement, we can ensure that our patients receive the highest standard of care.

We invite our readers to engage with the content of this journal, contribute their insights, and join us in this journey toward excellence. Together, we can navigate the challenges and seize the opportunities that lie ahead, shaping a brighter future for dental health care in Malaysia.

Kathiravan Purmal

Editor in Chief, Consultant Oral and Maxillofacial Surgeon, Consultant Orthodontist, Columbia Asia Hospital, Kuala Lumpur, Malaysia

Address for correspondence: Dr. Kathiravan Purmal, Editor in Chief, Malaysian Dental Association, D-5-1, Pusat Komersial Parklane, Jalan SS7/26, Kelana Jaya, 47301 Petaling Jaya, Selangor, Malaysia.
E-mail: mdanews1@gmail.com

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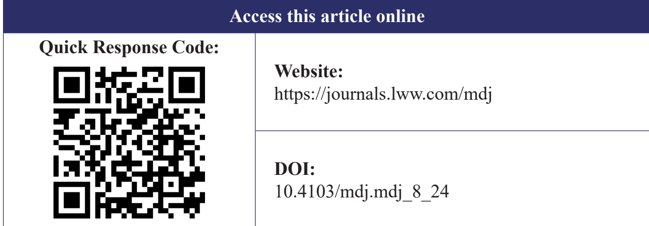

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Impact of Non-surgical Periodontal Therapy on Oral Health-related Quality of Life amongst Primary Dental Care Patients: A Prospective Cohort Study

Vanaja Planisamy[1], Ee Ai Yin[2]

[1]Ipoh Dental Clinic, Ministry of Health Malaysia, Ipoh, Perak, Malaysia, [2]Buntong Dental Clinic, Ministry of Health Malaysia, Ipoh, Perak, Malaysia

Abstract

Aim: The aim of this study was to determine the impact of non-surgical periodontal therapy (NSPT) on oral health-related quality of life (OHRQoL) of a selected group of the Malaysian population at the primary dental care setting. **Participants and Methods:** This study was conducted from year 2021 to 2022. Patients attending four government dental clinics in Kinta district were included in the study after basic periodontal examination was conducted. The sample size was calculated using the NCSS PASS 11 power analysis and sample size, and a final sample size of 94 was used. A short version of the Malaysian Oral Health Impact Profile (S-OHIP[M]) questionnaire was given as a baseline before the intervention. NSPT was provided in a single session or by a quadrant approach. Patients were then called for review after 6 weeks during when they were required to complete the S-OHIP(M) questionnaire again. All data were then entered and analysed using SPSS version 26.0. **Results:** The prevalence of impact decreased significantly post-treatment (*n* [%] pre vs. post: 91 [96.8%] vs. 70 [74.5%]; $P < 0.001$). A significant decrease was observed in the severity of impact (additive score) (median [interquartile range (IQR)] pre vs. post: 8.5 [5.0–15.0] vs. 2.0 [0.0–6.0]; $P < 0.001$) and extend of impact (simple count score) (median [IQR] pre vs. post: 0.5 [0.0–2.0] vs. 0.0 [0.0–0.0]; $P < 0.001$) post-treatment compared to pre-treatment too. **Conclusion:** The OHRQoL status amongst gingivitis and mild-to-moderate periodontitis patients in primary care has improved after treatment.

Keywords: Non-surgical periodontal therapy, oral health-related quality of life, periodontitis, primary care

Introduction

Quality of life (QoL) refers to one's perceptions about life, both positive and negative, which can be directly related to the culture and environment in which one lives. Common dental problems such as pain, dental abscesses and discoloured, decayed or missing teeth can affect the general population's daily life and general well-being. Oral health-related QoL (OHRQoL) is an essential component of general health and is a significant segment of the Global Oral Health Programme by the WHO. It is an intricate idea that can be defined as a person's assessment of how functional, psychological and social factors, pain or discomfort affect their overall well-being about oral health.[1]

Periodontal disease is a chronic, inflammatory condition recognised as a major global oral health burden with dental caries.[2] It is one of the major contributors to tooth loss and causes a significant negative impact on the QoL.[3] The Global Burden of Disease Study in 2016 reported that severe periodontal disease was the 11th most prevalent condition globally and that periodontal diseases accounted for 3.5 million years lived with disability.[4] Based on the Malaysian National Oral Health Survey of Adults (NOHSA) 2010, 94% of dentate adults have some form of periodontal disease, which has remained the same for the past 20 years. Bleeding gums in adults are a cause for concern since they generally reflect ineffective personal oral hygiene practices, which will most likely severely impact periodontal health in the long

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Address for correspondence: Dr. Vanaja Planisamy, Ipoh Dental Clinic, Jalan Panglima Bukit Gantang Wahab, Ipoh 30590, Perak, Malaysia. E-mail: vanajaplanisamy@gmail.com

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term.[5] The National Oral Health Plan for Malaysia 2011–2020 proposed to increase preventive behaviour in adults, promote preventive visits amongst adults as a way of life to encourage flossing behaviour and improve tooth brushing effectiveness among adults.[6]

Non-surgical periodontal therapy (NSPT) is the first line of treatment for gingival and periodontal diseases. It has been defined as plaque removal, plaque control, supra- and subgingival scaling, root surface debridement and the adjunctive use of chemical agents.[7] Studies have proven that the NSPT alone effectively improves the clinical parameters in periodontitis patients.[8] Based on studies done in the Malaysian population, the OHRQoL was better in healthy/mild–moderate periodontitis patients compared to severe chronic periodontitis.[9] There was also improvement in OHRQoL of obese patients with chronic periodontitis after NSPT.[10] A multi-centred cohort study concluded that NSPT positively impacted OHRQoL. However, it was noted to be associated with the severity of the disease, treatment method and the role of the caregiver.[11] Moreover, several other studies worldwide also concluded that there was a positive change in the Oral Health Impact Profile (OHIP)-14 scores after NSPT.[12-15]

Periodontal disease undoubtedly affects patients' well-being and QoL, but only a few studies have reported on the effects of mechanical non-surgical periodontal treatment. Moreover, providing NSPT in specialist clinics in Malaysia has had a significant economic impact.[11] Since periodontal disease is a chronic condition, this emphasises the crucial role of implementing both primary and secondary preventive measures to mitigate this burden. By emphasising the significance of prevention and early intervention in primary care clinics, individuals can take proactive steps to maintain their oral health and potentially reduce the economic impact of periodontal disease on both individuals and healthcare systems.[11]

Therefore, this study aimed to determine the impact of NSPT on OHRQoL, specifically amongst primary care patients.

Participants and Methods

Study description

This prospective cohort study was conducted amongst adults aged 18 years and above attending four government dental clinics in Kinta district: Klinik Pergigian Ipoh, Klinik Pergigian Simee, Klinik Pergigian Jelapang and Klinik Pergigian Buntong.

Sample size

The sample size was calculated using the NCSS PASS 11 power analysis and sample size calculator, and studies done by Sulaiman *et al*.[9] and Basher *et al*.[10] were used as references for proportion estimation. A sample size of 93 achieves 80% power to detect an odds ratio of 1.898 using a two-sided McNemar test with a significance level of 0.05. The odds ratio is equivalent to a difference between two paired proportions of 0.290, which occurs when the proportion in cell 1, 2 is 0.613 and the proportion in cell 2, 1 is 0.323. The proportion of discordant pairs is 0.936. Allowing for a 10% dropout, a final sample size of 104 was used. Over the course of the study, 10 participants (9.6%) withdrew, leading to a final sample size of 94 participants. Dropouts were due to various reasons, including relocation (3 participants), lack of time (4 participants) and loss of interest (3 participants). While the dropout rate did not significantly affect the study's outcomes, it highlighted areas for improving participant retention in future research.

Sampling method

The participants were selected through convenience sampling after basic periodontal examination was conducted.

Data collection method

A short version of the Malaysian OHIP (S-OHIP[M]) questionnaire was given as a baseline before the intervention. NSPT is standard dental care for gingivitis/mild–moderate periodontitis, including oral hygiene instructions and ultrasonic scaling, provided in a single session or by a quadrant approach. No calibration was required as all the dentists were trained to give this NSPT. Patients were then called for review after 6 weeks, during which they were required to complete the S-OHIP(M) questionnaire again. The questionnaires were self-administered during both visits.

Data collection tool

The 14-item Malaysian short form of the OHIP was developed following the cross-cultural adaptation of the original English language OHIP developed in Australia. It was designated as the S-OHIP(M).[16] The S-OHIP(M) questionnaire measures people's perception of the social impact of oral disorders on their well-being. The questionnaire consists of 14 questions based on seven domains: functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. The participants were required to rate their OHRQoL on a Likert scale ranging from never to very often (score 0–4). The total scores of all domains were then calculated, and a higher score indicated poorer OHRQoL. This questionnaire was obtained with permission from Prof. Dr. Roslan Bin Saub (Department of Community Oral Health and Clinical Prevention, Faculty of Dentistry, Universiti Malaya).

Data analysis

Data were cleaned, explored and analysed using SPSS version 26.0 (IBM Corp., IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY, USA). The distribution of continuous data was checked using skewness, kurtosis and histogram. Continuous variables were presented as mean ± standard deviation if the data were normally distributed; otherwise, median (25th percentile and 75th percentile). Categorical variables were presented as frequency and percentage.

Three methods of scoring were computed:

1. Prevalence of impact: Percentage of participants reporting one or more impacts 'very often' or 'often'

2. Severity of impact: Additive (ADD) score, calculated by adding up the response codes for each item. The ADD score could range from 0 to 56
3. Extend of impact: Simple count (SC) score, calculated by summing the number of items reported as 'very often' and 'often'. The SC score could range from 0 to 14.

The changes in ADD score and SC score pre- and post-treatment were tested using the Wilcoxon signed-rank test as the data did not fulfil the assumption for the paired sample *t*-test. The McNemar test was used to explore the changes in paired binary data, and the changes for ordinal data were checked using the marginal homogeneity test. All the tests were two-sided, and the statistical significance was $P < 0.05$.

Results

The socio-demographic characteristics of the participants are summarised in Table 1. This table shows that 94 patients were included in this study with a mean age of 44.6 years. Most were female (53.2%) and had their highest education until secondary school (50.0%). An equal proportion of Indian (33%), Chinese (33%) and Malay (33%) were recruited. None of the patients reported to have lost all their teeth on the upper gum; however, one patient (1.1%) lost all his teeth on the lower gum. Eleven (11.7%) patients wore dentures on the upper arch, whereas 2 (2.1%) patients reported to wear dentures on the lower arch. Table 2 shows the patient's feedback before and after the NSPT. In general, patients reported higher satisfaction, as more patients gave a rating of '0' post-treatment compared to pre-treatment.

Table 1: Characteristics of the study participants

Demographic characteristics	*n* (%)
Age, mean±SD	44.60±16.22
Gender	
Female	50 (53.2)
Male	44 (46.8)
Race	
Indian	31 (33.0)
Chinese	31 (33.0)
Malay	31 (33.0)
Others	
Education	
No formal education	2 (2.1)
Primary	3 (3.2)
Secondary	47 (50.0)
University	32 (34.0)
Others	10 (10.6)
Clinical characteristics	
C1: Lost all teeth on upper gum	
No	94 (100.0)
Yes	0
C2: Lost all teeth on lower gum	
No	93 (98.9)
Yes	1 (1.1)
C3: Wear dentures on upper gum	
No	83 (88.3)
Yes	11 (11.7)
C4: Wear dentures on lower gum	
No	92 (97.9)
Yes	2 (2.1)

SD: Standard deviation

Figure 1 shows the mean score distribution in the seven different OHIP domains. After the intervention, mean scores across all domains reduced on average. The most significant improvement was observed in the category of psychological discomfort with a mean difference of 1.69, followed by functional limitation (1.4) and physical pain (1.13). On the other hand, social disability had shown the slightest difference of 0.44. Table 3 shows the changes in outcomes before and after intervention. The prevalence of impact decreased significantly post-treatment (*n* [%] pre vs. post: 91 [96.8%] vs. 70 [74.5%]; $P < 0.001$). A significant decrease was observed in the ADD score (median [interquartile range (IQR)] pre vs. post: 8.5 [5.0–15.0] vs. 2.0 [0.0–6.0]; $P < 0.001$) and SC score (median [IQR] pre vs. post: 0.5 [0.0–2.0] vs. 0.0 [0.0–0.0]; $P < 0.001$) post-treatment compared to pre-treatment too. Besides, patients perceived better oral health post-treatment than pre-treatment ($P < 0.001$). A significantly lower proportion of patients reported the need for dental treatment post-therapy compared to before as well (*n* [%] pre vs. post: 87 [92.6%] vs. 36 [38.3%]; $P < 0.001$). The proportion of patients who were satisfied with their current oral health had significantly increased post-treatment (*n* [%] pre vs. post: 46 [48.9%] vs. 91 [96.8%]; $P < 0.001$).

Discussion

Oral health profoundly impacts several fundamental aspects of our lives, influencing our overall sense of well-being in significant ways. Primary care is the first stop[12] visited by patients related to any oral health problems, and it is a critical component of any healthcare system.[13] They are often the first point of contact for patients. Based on the NOHSA 2010, 94% of dentate adults have some form of periodontal disease,[5] and their first stop will be at the primary care clinic. This study shows that there were more female patients visiting the primary care clinics compared to the males. However, there was no difference in terms of their race. The differences in oral health behaviours and perceptions between males and females highlight important gender disparities in dental care and hygiene practices. Males tend to have fewer dental visits compared to females. This could be due to various factors such as perceived importance of dental care, access to healthcare services or personal attitudes towards preventive care.[14]

In general, patients reported higher satisfaction post-NSPT. Assessing patient satisfaction following periodontal treatments provides valuable insights into treatment effectiveness, patient experiences and areas for improvement in patient-centred care. Studies and clinical assessments generally show that patients report moderate-to-high levels of satisfaction with various

Table 2: Participants' feedback before and after intervention

Questions	0, *n* (%)	1, *n* (%)	2, *n* (%)	3, *n* (%)	4, *n* (%)
1. Have you experienced difficulty chewing any food because of problems with your teeth, mouth or dentures?					
Pre	41 (44.1)	21 (22.6)	21 (22.6)	7 (7.5)	3 (3.2)
Post	70 (74.5)	14 (14.9)	8 (8.5)	1 (1.1)	1 (1.1)
2. Have you felt problems related to your teeth, mouth or dentures cause bad breath?					
Pre	39 (41.9)	21 (22.6)	20 (21.5)	8 (8.6)	4 (5.4)
Post	65 (70.7)	20 (21.7)	7 (7.6)	0	0
3. Have you experienced discomfort eating any food because of problems with your teeth, mouth or dentures?					
Pre	40 (42.6)	25 (26.6)	16 (17.0)	9 (9.6)	4 (4.3)
Post	62 (66.0)	23 (24.5)	6 (6.4)	3 (3.2)	0
4. Have you had ulcers in your mouth?					
Pre	43 (48.9)	25 (28.4)	13 (14.8)	5 (5.7)	2 (2.3)
Post	70 (76.1)	18 (19.6)	2 (2.2)	2 (2.2)	0
5. Have you felt uncomfortable due to food getting stuck in between your teeth or dentures?					
Pre	14 (15.2)	17 (18.5)	27 (29.3)	27 (29.3)	7 (7.6)
Post	42 (44.7)	32 (34.0)	12 (12.8)	5 (5.3)	3 (3.2)
6. Have you felt shy because of problems with your teeth, mouth or dentures?					
Pre	49 (53.3)	15 (16.3)	18 (19.6)	7 (7.6)	3 (3.3)
Post	70 (75.3)	19 (20.4)	3 (3.2)	1 (1.1)	0
7. Have you avoided eating certain foods because of problems with your teeth, mouth or dentures?					
Pre	44 (46.8)	15 (16.0)	22 (23.4)	7 (7.4)	6 (6.4)
Post	61 (64.9)	23 (24.5)	5 (5.3)	3 (3.2)	2 (2.1)
8. Have you avoided smiling because of problems with your teeth, mouth or dentures?					
Pre	60 (65.9)	12 (13.2)	14 (15.4)	4 (4.4)	1 (1.1)
Post	79 (84.9)	12 (12.9)	1 (1.1)	1 (1.1)	0
9. Has your sleep been disturbed because of problems with your teeth, mouth or dentures?					
Pre	60 (64.5)	18 (19.4)	10 (10.8)	1 (1.1)	4 (4.3)
Post	84 (89.4)	7 (7.4)	1 (1.1)	1 (1.1)	1 (1.1)
10. Has your concentration been disturbed by problems with your teeth, mouth or dentures?					
Pre	49 (52.7)	27 (29.0)	12 (12.9)	2 (2.2)	3 (3.2)
Post	82 (87.2)	11 (11.7)	0	0	1 (1.1)
11. Have you avoided going out because of problems with your teeth, mouth or dentures?					
Pre	79 (84.9)	9 (9.7)	3 (3.2)	1 (1.1)	1 (1.1)
Post	88 (94.6)	4 (4.3)	1 (1.1)	0	0
12. Have you experienced problems in carrying out your daily activities because of problems with your teeth, mouth or dentures?					
Pre	68 (72.3)	17 (18.1)	7 (7.4)	1 (1.1)	1 (1.1)
Post	84 (89.4)	8 (8.5)	1 (1.1)	1 (1.1)	0
13. Have you had to spend a lot of money due to problems with your teeth, mouth or dentures?					
Pre	64 (69.6)	22 (23.9)	5 (5.4)	1 (1.1)	0
Post	78 (83.0)	12 (12.8)	3 (3.2)	1 (1.1)	0
14. Have you felt less confident of yourself due to problems with your teeth, mouth or dentures?					
Pre	59 (62.8)	19 (20.2)	12 (12.8)	2 (2.1)	2 (2.1)
Post	76 (80.9)	16 (17.0)	1 (1.1)	1 (1.1)	0

periodontal treatments, including scaling and root planing, periodontal surgery and laser therapy.[15]

The results of this study also showed that the most significant mean OHIP score was seen in the psychological discomfort domain, followed by functional limitation and physical pain. Similarly, a study conducted amongst young adults in Saudi Arabia and another study in Jazan City of Saudi Arabia reported that physical pain and psychological discomfort domains had higher OHIP scores.[16,17] The study conducted by Papaioannou *et al*. amongst the Greek population highlighted significant differences in OHRQoL scores between their findings and those of other studies, possibly due to varying participant demographics and survey methodologies. Their study reported elevated scores in the functional limitation, physical pain and handicap domains, indicating that participants perceived significant impacts on their daily activities, physical comfort

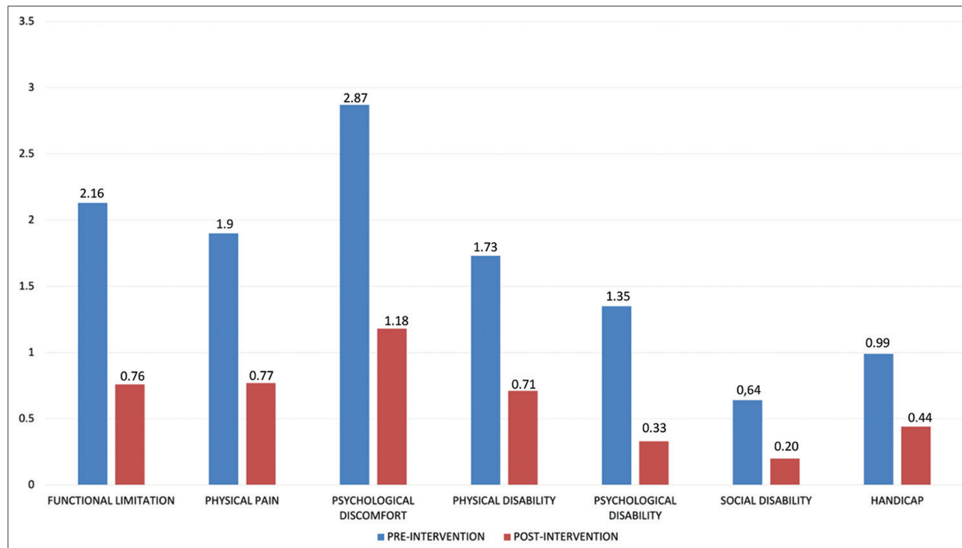

Figure 1: Mean score distribution in different Oral Health Impact Profile-14 domains

Table 3: Changes in outcome pre- and post-non-surgical periodontal therapy

Outcome	Pre-intervention, *n* (%)	Post-intervention, *n* (%)	*P*
Prevalence			
No	3 (3.2)	24 (25.5)	<0.001[a]
Yes	91 (96.8)	70 (74.5)	
ADD score, median (IQR)	9.5 (5.0–15.0)	2.0 (0.0–6.0)	<0.001[b]
SC score, median (IQR)	0.5 (0.0–2.0)	0.0 (0.0–0.0)	<0.001[b]
B1: Perceived oral health			
Very good	2 (2.1)	12 (12.8)	<0.001[c]
Good	28 (29.8)	63 (67.0)	
Normal	56 (59.6)	19 (20.2)	
Not good	8 (8.5)	0	
B2: Perceived need for dental treatment			
No	7 (7.4)	58 (61.7)	<0.001[a]
Yes	87 (92.6)	36 (38.3)	
B3: Satisfaction with current oral health			
No	48 (51.1)	3 (3.2)	<0.001[a]
Yes	46 (48.9)	91 (96.8)	

ADD: Additive, SC: Simple count, IQR: Interquartile range. [a]McNemar Test, [b]Wilcoxon Signed Rank Test, [c]Marginal Homogeneity Test

and overall well-being due to oral health issues. These high scores may be influenced by factors such as access to dental care, oral health education, socioeconomic status and cultural perceptions of oral health within the studied communities.[18]

A significant decrease in the prevalence of impact score from 96.8% to 74.5% indicates that there was a reduction in participants reporting one or more impacts ‘very often’ or ‘often’. The decrease in the prevalence of impact score may indicate that the NSPT provided has been effective in reducing the severity or frequency of symptoms experienced by the participants. This could be attributed to interventions such as early detection, scaling and root surface debridement and patient education of self-care practices. Improved adherence to treatment plans can contribute to better outcomes and decrease the impact of the periodontal condition on daily life.[19]

There was also a significant improvement in the severity of the impact score. This improvement could be attributed to a variety of reasons such as modification in patient behaviour or can directly be linked to the oral health impact and motivation as well as the Scaling and Root Debridement (SRD) provided. Understanding and accounting for these dynamics are essential in accurately assessing the efficacy and impact of oral health interventions in clinical research.[10]

In terms of the extent of the impact score, there was a great reduction. Achieving a reduction in the extent of impact score is a positive outcome in OHRQoL assessments. It indicates that the interventions or treatments have effectively minimised the diversity of ways, in which oral health issues affect an individual’s life. This can lead to improved overall well-being, better social interactions, reduced psychological distress and enhanced functional abilities related to oral health.

Primary care clinicians are well positioned to reduce rates of oral disease. By leveraging their position as frontline healthcare providers, primary care clinicians can contribute significantly to improving oral health outcomes for their patients, as oral health directly affects overall health and QoL.[20] This study's results demonstrate an increase in the proportion of patients who express satisfaction with their oral health post-treatment (46%–91%). Self-perception of health amongst primary care service users in Porto Alegre confirmed that individuals satisfied with their last appointment were likelier to assess their health as good.[21] Positive experiences with healthcare services, such as satisfaction with a recent appointment, can contribute to a more favourable health self-assessment. This connection between patient satisfaction and perceived health is essential to patient-centred care. Understanding the link between patient satisfaction and self-perception of health is valuable for healthcare providers and policymakers. By addressing factors that contribute to patient satisfaction, healthcare systems can potentially enhance patients' perceptions of their health and well-being. This study provides us with the local data for the impact of NSPT on OHRQoL. More local evidence is needed to show how vital simple periodontal treatment is for the community, not only for the clinical outcome but also in terms of patient-centred outcome. Treating the disease early will lead to better outcomes, prevent the disease's progression and be more cost-effective.

Limitations

One of the major limitations in this study was that the participants were recruited based on convenience sampling, presenting with a sampling bias. Second, being a questionnaire-based study, selection bias also needs to be considered when interpreting the results.

Conclusion

NSPT improves the OHRQoL amongst gingivitis and mild–moderate periodontitis patients in primary care. Improvement in the prevalence, extent and severity of impact after NSPT suggests that the intervention has positively affected the OHRQoL. However, this study mainly focuses on patient-centred outcomes and cannot be used to justify clinical outcomes. Further studies are required to correlate with the clinical outcomes. A multi-centre study with a larger sample size can also be considered for a more significant result.

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Conflicts of interest

There are no conflicts of interest.

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Audit on Effectiveness of the Dental Information System Utilisation by Dental Post-graduates and Academicians at the Department of Restorative Dentistry

P. L. Ranganayakidevi S. Palaniappan[1], Lim Ghee Seong[2]

[1]Department of Prosthodontic, Faculty of Dentistry, SEGi University, Selangor, Malaysia, [2]Department of Restorative Dentistry, Faculty of Dentistry, University Malaya, Kuala Lumpur, Malaysia

Abstract

Introduction: A Dental Information System (DEISY) is a web-based application that facilitates data collection, retrieval of the history of patients and exchange of information on treatments performed for similar cases. Patient information and record keeping are essential for record management and follow-up for treatments conducted. A digital management system will improve the effectiveness and efficacy of the entire process. **Aims:** The aim of the study was to study the effectiveness of the DEISY system among dental post-graduates and the dental academicians of the restorative department. **Methodology:** Participants were required to fill out the questionnaire through the Google Form. Information gathered includes the clinician's usage of DEISY, their experience, expectations and recommendations to improve the existing system for a more effective way of managing the patient's healthcare records. The data were collected, and descriptive analysis was performed. **Results:** A total of 40 questionnaires were sent to the participants. About 70.4% of them responded that they will key in the patients, 29.6% of them will sometimes key in and about 7.4% of them will not key in these records at all. In line with this, approximately 66.7% responded that they will key in the outcome of the treatment on their own for each patient, whereas 7.4% do not key in the outcome of the treatment to the DEISY system. **Conclusion:** All participants realise the importance of the DEISY system but fail to utilise it due to technical difficulties. Without a doubt, utilising such system will provide more advantages than disadvantages.

Keywords: Data, patient, record keeping, treatment

Introduction

Information systems and technology in the healthcare setup have become increasingly advanced over the last decade, and their ever-growing ranges of capabilities have led to widespread use of these systems throughout the healthcare industry. The use of the information management system has become vital among healthcare providers both in the public and private sectors.

Among the benefits of a patient information management system are: (1) storage of patient personal and treatment records, (2) a patient recall system and (3) tracking inventories of materials and goods in the practices. The digital healthcare infrastructure is responsible for collecting, managing and integrating the tremendous volume of clinical, financial and operational information generated daily in today's healthcare system, which is deemed troublesome compared to the traditional manual records. Besides, the digital management system also ensures the safety, effectiveness and efficiency of data management.

In Universiti Malaya's Faculty of Dentistry, students and lecturers work with the Dental Information System (DEISY), which they use to record, store and manage all the treatments administered by them to patients' files. In other words, DEISY is a web-based application designed primarily for capturing case histories and retrieving such records easily.

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Address for correspondence: Dr. P. L. Ranganayakidevi S. Palaniappan, Department of Prosthodontic, Faculty of Dentistry, SEGi University, Selangor, Malaysia.
E-mail: plranganayakidevi@gmail.com

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Aims and objectives

The present audit is to study the effectiveness of the DEISY system at the Faculty of Dentistry, University of Malaya, among the dental post-graduates and the dental academicians in the restorative department. It also aims to study the willingness of usage and user-friendliness of the mentioned system.

Methodology

Audit cycle [Figure 1]

The targeted subject group in this audit are dental post-graduates and academicians who are from the department of restorative dentistry at the faculty of dentistry. Academic staff, namely the professors, associate professors, senior dental lecturers and dental lectures are included in the pool of data collection.

The participants were required to fill up the questionnaire through Google Form. Information gathered included the clinician's usage of DEISY, their experience, expectations and recommendations to improve the existing system for a more effective way of managing the patient's healthcare records. The audit was done anonymously and voluntarily. No personal information was recorded in the process. The data were collected and descriptive analysis was performed.

Identifying the audit topic

The DEISY was not fully utilised by everyone in the faculty of dentistry. The information technology department has received several complaints regarding the system from the clinicians. Therefore, the aims and objectives of this audit were to identify and assess the effectiveness of the implemented system.

Define standard

All clinicians are compulsorily required to complete the DEISY records for each patient after every clinical step that is performed. Comprehensive and accurate records are a vital part of the dental practice. Good record-keeping is fundamental for good clinical practice and is an essential skill for practitioners.

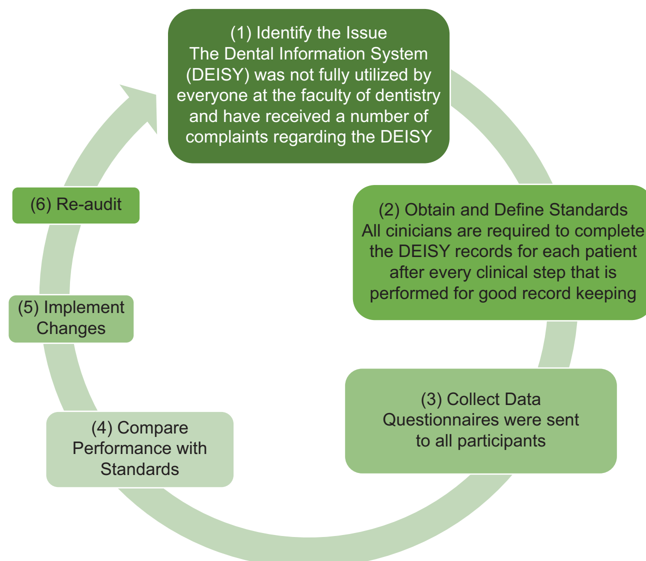

Figure 1: Audit cycle

The primary purpose of maintaining dental records is to deliver quality patient care and follow-up. There is a professional obligation to create records to document dental treatment that is provided to patients (Charangowda, 2010).[1]

Data collection

A total of 40 questionnaires were sent to the participants, who comprised 10 post-graduate students and 30 academic staff from the restorative department. Twenty-seven responses were received. They were all asked the following questions:

1. Position (post-graduate student or academician) of the participant from the restorative department
2. Function of DEISY database
3. Experience in using the DEISY database
4. Confirmation of participants that they key in all the personal details of the patient and other pre-treatment records
5. Confirmation of participants that they key in the outcome after the treatment for each patient
6. Frequency of using the DEISY system
7. Major issues faced at the point of using the DEISY system
8. Accessing/getting the medical history of the patient's treatment before giving treatment for the current problem
9. Opinion and suggestion to improve current DEISY systems.

Results and Data Analysis

The number of post-graduates who responded was 8 of 10, whereas the number of academicians who responded was 19 of 30. Fewer faculty members responded when compared to the post-graduates. This survey was conducted around the professional examination timing and most of the participants were busily involved in its preparation. This may be the probable reason for only 27 respondents of 40. From a total of 27 participants who responded, 8 of them were post-graduates (29.6%) and the remaining 19 of them were academicians (70.4%) from the restorative dentistry department. All 27 participants are aware and well equipped with knowledge about the usage of the DEISY system. They have the experience of using it for recording and checking the health status of the patients at restorative clinic.

About 70.4% of them responded that 'they will key-in the patient's records' (e.g., the radiographic information, history taken and other pre-treatment records), followed by 29.6% of 'will sometimes key-in' and finally, about 7.4% of them 'will not key-in these records at all'. In line with this, approximately 66.7% keyed in the outcome of the treatment on their own for each patient, whereas 7.4% did not key in the outcome of the treatment to the DEISY system [Figure 2].

From the results is also seen that 74.1% of them immediately key in the information after the completion of each treatment of a patient, 14.8% of them will only key in the information at the end of the day for all patients cumulatively, 7.4% of them will never key in the information while remaining 3.7% of them will key in the information of the patients only on weekly basis.

In terms of the responsibility to enter the data, the majority of the clinicians key in the information on their own, which amounts to 85.2%, followed by 11.1% who do not key in the information at all. The remaining 3.7% of them will get the dental surgery assistant who assist them in keying in the information [Figure 3].

Moreover, about 88.9% of them have responded that 'they face problems or difficulties when keying the information to the DEISY system' and the remaining 11.1% responded that 'they do not encounter any issues at all'. The primary issue faced included the database system being non-responding and the department computer being out of service with 62.5% of respondents. Other problems mentioned by the clinicians are listed in Table 1. Based on the trend, technical issues faced by the DEISY system must be seriously investigated for rectification.

The data on the participants who use the DEISY database to refer to patients, and to gather treatment guidelines or methods (e.g., ICDAS score and BPE), were also collected. Only 18.5% of them agreed to refer to the records, while the majority of the participants (44.4%) did not utilise the system. About 37% of them occasionally refer to the system only at the point of need. This could be due to a lack of understanding of the importance of such data that may be readily available for further treatment references. This outcome proves that the majority of the participants do not check the history of the patients before diagnosing the current problem. The most common reasons given by them included the unfriendliness of the system, multiple tabs to be clicked before obtaining information and doubts about whether previous clinicians have entered reliable data. Apart from the above, some subjective questionnaires were also included to get a better understanding of how to improve and utilise the DEISY system efficiently.

Table 1: List of problems faced by the clinicians when keying in the data into the Dental Information System

Problems faced by the clinicians	Percentage
Database down/computer not working	62.5
Busy with scheduled work (lack of time for the operator, need to attend meetings/seminars)	29.2
Loss of data or missing word count when the data are being entered	4.2
All the above	4.1
Total	100.0

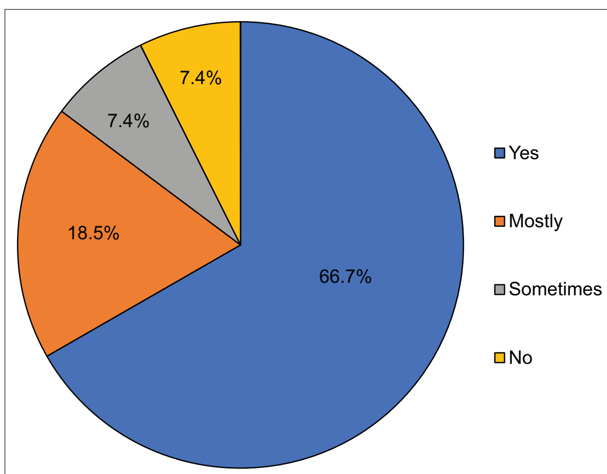

Figure 2: Frequency of data being keyed into the Dental Information System by the clinicians

The participants were asked to give their opinions on the DEISY system. Their responses are tabulated in Table 2.

Change implementation

Based on the audit conducted, it is observed that the existing DEISY system can be improved. Among the suggestions are:

i. Technically improve the existing system to overcome issues such as making it more user-friendly, adapting an easier way to store and retrieve data, upgrading the version of the current system and use the cloud database to store files
ii. Reinforcement and make it compulsory for each dental practitioner to key in the information and records of each patient on the completion of treatment. The same goes for referring to the history of the patient's health history before providing new treatment
iii. To check if there is any readily existing system that can be used and has a better data interface compared to the DEISY system. Looking into other options for record-keeping purposes
iv. Development of a comprehensive treatment plan comprising all disciplines. This will allow all the members and operators to view the whole treatment plan
v. The DEISY system should be able to notify if the operator is a student or a lecturer. This will enable easy identification and overall management
vi. Have the DEISY system made downloadable for each smartphone, either IOS or Android. This will enable each dental practitioner to key in the patient's information from time to time
vii. Ensure the availability of computers in working condition at the clinics. Furthermore, arrange for periodic checks on the functionality of the available devices.

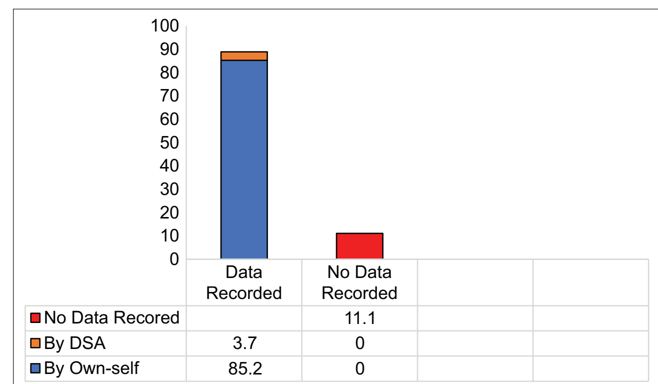

Figure 3: Percentage of the data recorded in terms of the responsibility

Table 2: Responses of opinions on the Dental Information System of all the participants involved in the survey

Participants	Responses in their own word
1	Could be improved to make it more user-friendly
2	Time-consuming. The user interface is not friendly. The current computer system causes DEISY to hang frequently. The data are lost sometimes which leads to the need to re-enter the data. Too much unrelated information is required to enter
3	A bit tedious
4	The software has some minor glitches
5	Most of the time the system tends to hang, especially when updating the charting section
6	It is a useful tool. However, it always has issues opening/approving/filling in data in some sections such as prosthodontics or endodontic sections
7	It is good as in paperless but always has glitches and missing notes; even when the data are keyed in, the supervisor is unable to approve for some technical issues, loading time and change of interface are very slow and occasionally, when the approval is made, during the next visit, the system still shows as not approved
8	Not user-friendly
9	Not user-friendly
10	Perhaps paper files are easier to write up and recall data
11	It should be reliable and secure, but records are found missing from time to time. Hence, it is not as reliable as it is supposed to be
12	Easy enough to use
13	Time-consuming
14	Lousy and not user-friendly
15	Not user-friendly, not able to view previous entries on one page, difficult to enter the charting details
16	Ok but need to upgrade the system to avoid technical issues
17	Not user-friendly. The system is outdated and troublesome
18	No computer is provided in the clinic
19	A lot of improvement is needed, especially to link to radiographs. Poor software
20	A good centralised database for patient records; however, its responsiveness is poor, especially at the start of the day
21	Although it is very comprehensive, it is not user-friendly. It is difficult to see the past treatment records and it takes too long to complete all the different tabs
22	Not user-friendly
23	Slightly time-consuming, but it will be good if all disciplines fill in the necessary information whenever they see the patient. Issues on radiographs and payment records also need to be linked to the patient profile
24	It is necessary as the use of hard copy will be fading off soon
25	Too many buttons to click. Radiographs cannot be viewed directly in DEISY
26	It is horrible, the system is not updated and is rigid. Unable to update diagnosis. It crashes all the time and is no longer linked with SYNGO (radiograph record-keeping system), causing multiple loss of data
27	An excellent data storage platform

DEISY: Dental Information System

Re-audit

Following 6 months of practical changes being implemented, a second audit cycle is to be carried out to examine the changes in the performance and effectiveness of utilisation of the DEISY systems for recording and checking the health records of the patients. A separate meeting is to be conducted to inform the dental team of the outcomes of this audit and further changes to the existing DEISY system, to achieve maximum output of the DEISY.

Discussion and Conclusion

DEISY is a specialised healthcare information system, a multidisciplinary record-keeping method that is practised at clinical setups. DEISY system is all about the intersections of health information and dentistry. As a result, we do see the growing demand to promote and improve such systems to meet their clinical, administrative, research and educational needs (Shekelle *et al*., 1999).[2]

A clinician-driven electronic healthcare system will have the potential to streamline virtual workflows and the management of health information to improve patient safety, reduce burnout and increase job satisfaction (Guo *et al*., 2007).[3] When the system used is a combined platform that supports semantic interoperability, protects privacy and provides various clinical research tools, it can offer very important functions beyond the single institution and, in some cases, beyond national borders. It will enable data to be compiled across multiple practicing locations (Coorevits *et al*., 2013).[4] Data integration and manipulation allow processes to be conducted in a synchronised fashion, improve diagnosis and treatment offered because more data and cross-check available functions and, in general, improve the quality of health services and patients' quality of life (Helgheim *et al*., 2019).[5] This will foster the growth of evidence-based patient management, reduce medical errors and enforce the documentation of the medical procedures that took place and why they were chosen.

The specialised healthcare information system for dental practices known as the DEISY is a comprehensive record-keeping tool used in clinical settings. DEISY is an example of how health information management principles have been combined with dentistry to meet various clinical, administrative, research and educational requirements within the dental care (Shekelle *et al*., 1999).

In addition, if such a system were to adopt a shared platform capable of supporting semantic interoperability while still ensuring privacy protection along with strong clinical research tools, it would be able to go beyond individual institutions, even crossing national boundaries, thereby enabling data aggregation across multiple practice sites (Coorevits *et al*., 2013). This system can integrate the patient history in the dental and medical sides which will enable the operator to provide a more comprehensive treatment plan after all the necessary considerations. In other words, the operator will be able to treat the patient as a whole and not just treat the complaint.

These systems contribute towards better diagnosis and treatment results through seamless integration as well as manipulation of data between synchronised processes, thereby allowing for improved cross-checking functions. They also enhance quality standards in healthcare provision together with patients' quality of life by promoting evidence-based patient management practices, which help in reducing medical errors while at the same time ensuring wider coverage on documentation about medical procedures carried out and the reasons behind the treatments given (Helgheim *et al*., 2019). This kind of all-inclusive strategy not only facilitates decision-making by clinicians but also ensures that there is transparency as well as accountability within healthcare service delivery systems.

The DEISY system has many advantages; however, from the results, it is evident that it may not be user-friendly and is very time-consuming. These reasons will hinder the clinician from using the system effectively. Poor record-keeping practices among practitioners lead to a breakdown in communication among them. It also increases medico-legal risks. It is recommended that there should be continuous training, monitoring and evaluation of clinicians and nurses on record-keeping issues, supply of adequate knowledge and proper time management to improve record-keeping challenges. This will indirectly improve patient care (Mutshatshi *et al*., 2018).[6]

The current audit clearly shows that all participants realise the importance of the DEISY system but fail to utilise it due to the technical difficulties as presented above. Without a doubt, utilising such system will provide more advantages than disadvantages. Since the pool of data is small when comparing data available if the entire faculty members were involved, this audit may be considered a pilot study and be conducted again for a larger sample.

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Conflicts of interest

There are no conflicts of interest.

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Application of Radiographic/Imaging Techniques: A Questionnaire Study Involving Private Practitioners in Malaysia

Ye Weng Puang[1], Fatin Hanisah Suib[1], Bryan Hean Kean Chan[1], Phrabhakaran Nambiar[1,2], Ratnasothy Subramaniam[3], Nuruljannah Nor Azmi[4], Gou Rean Wong[1]

[1]Department of Preclinical Sciences, MAHSA University, Bandar Saujana Putra, Malaysia, [2]Department of Oral and Maxillofacial Sciences, Faculty of Dentistry, University of Malaya, Kuala Lumpur, Malaysia, [3]Department of Family Dentistry, MAHSA University, Bandar Saujana Putra, Malaysia, [4]Department of Dental Public Health, Faculty of Dentistry, MAHSA University, Bandar Saujana Putra, Malaysia

Abstract

Background: A study was carried out to get an updated overview of the applications of radiographic/imaging techniques, types of dental X-ray machines, and radiation hygiene tendencies among private dental practitioners. **Materials and Methods:** A survey was carried out to obtain an overview of the application of radiographic techniques by sending a questionnaire (Google Forms) to more than 1000 private dental practitioners in all states of Malaysia. In addition, several questionnaires were also completed by visiting many dental clinics in person. **Results:** A total of 410 responses were received. Results indicated that a majority of the practitioners owned at least an intraoral radiographic machine (90.9%). A relatively high number had panoramic machines (76.1%) and cone-beam computed tomography (CBCT) machines (42.5%). Intraoral images were acquired by private dentists at a rate of 11–20 per month (34.3%, n = 116 respondents), with only 13.6% (n = 46 respondents) acquiring more than 50 per month. With regard to panoramic and CBCT imaging, most of them took between 1 and 30 panoramic images and 1–20 CBCT scans, respectively, in a month. **Conclusion:** General dental practitioners in Malaysia are very dependent on various dental imaging techniques that can be performed in their own clinics. The demographic status indicated that most of the advanced imaging machines were owned by young practitioners as they are better exposed to these imaging modalities. Moreover, although the respondents graduated from universities in different countries, they had a high level of knowledge of radiation protection (>80%) when practicing oral and maxillofacial radiography.

Keywords: Cone-beam computed tomography scans, intraoral imaging, panoramic imaging, private practitioners, survey

Introduction

The discovery of X-rays and taking of radiographs/acquiring images has made an impactful change in the health-care field. Not only it helps clinicians to have a view inside our body, but also it helps in discovering the hidden pathologies and subsequent management of them. In current modern dentistry, dental radiography/imaging is one of the pivotal procedures that enable the dental professional to diagnose diseases that cannot be detected clinically, identifying the extent of severity, assisting in treatment planning, monitoring, and many more. Due to their multifunctional applications and with advancements in imaging technologies, there has been an increase in the number of dental X-ray machines among the private dental clinics in Malaysia.

Intraoral images, panoramic images, and cone-beam computed tomography (CBCT) are the available imaging modalities used in private clinics. Although it has been known that radiation doses from dental radiographic procedures are significantly less compared to medical imaging, we must ensure that all dental professionals are practicing proper imaging techniques, thereby reducing unnecessary radiation exposure.[1] A few studies

Address for correspondence: Mr. Gou Rean Wong, Department of Preclinical Sciences, Faculty of Dentistry, MAHSA University, Bandar Saujana Putra 42610, Malaysia. E-mail: gourean@gmail.com

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have shown that there is an increase in the risk of contracting cancer even at low levels of radiation exposure, particularly in children.[2] Thus, radiation protection measures and guidelines must be followed by dental practitioners and dental surgery assistants (DSAs) to ensure the safety of any X-ray operator as well as their patients.

In accordance with the principle "as low as reasonably achievable" (ALARA), a few measures are undertaken to reduce the amount of X-ray radiation exposure, and this includes patient selection criteria, receptor selection, collimation, beam filtration, patient protective equipment, using receptor holders, operator's position when making exposures, and many more.[3] From the principle mentioned above, it can be deduced that the technique used in acquiring the images is one of the keys in controlling the radiation exposure. In view of that, a study was carried out to get an updated overview of the applications of radiographic/imaging techniques, types of dental X-ray machines, and radiation hygiene tendencies to ensure if private dental practitioners are following appropriate procedures and protocols to produce radiographs/images of excellent quality.

Materials and Methods

A random sample of 410 registered dental practitioners responded to this study. This was possible with the support of the Malaysian Private Dental Practitioners' Society. A Google Forms questionnaire (link) was E-mailed to all private practitioners who are members of the society or private message sent to their social media accounts. In addition, a printed version of the questionnaire was delivered to some private clinics that were visited by the authors and collected back after 3 days. Both online and physical surveys were conducted simultaneously.

The questionnaire was divided into several sections. The information sought comprised the following:

1. The age, year of graduation, specialist qualification (if any), place of practice (i.e. the state), and dental X-ray equipment in their clinic
2. The brand, number of years the machine has been used, reasons for taking images, and number of images taken per month for each of the modalities – intraoral dental X-ray machine, panoramic X-ray machine, and CBCT machine. Additional questions were included for the intraoral X-ray machine, namely brand name, cone type, and speed of intraoral film (if films are still used); types of intraoral radiographic techniques used, usage of receptor holders, any adjustment of exposure time, and the types of digital sensors used in their practice
3. Awareness and practice of the ALARA principle, practice of lead apron and thyroid collar, any affirmation of pregnancy, lead (or equivalent) coverage of the walls of the X-ray room, number of retakes per month, and dentists' location when performing exposure of X-rays.

The questionnaire responses were entered electronically, and data were checked, cleaned, and analyzed using the Statistical Package for the Social Sciences 26 (SPSS) IBM (Orem, Utah, USA).

Results

Demographic

Based on the Statulator calculation, the total sample size needed for this study was 392 responses from private dental practitioners in Malaysia. Within 3 months of distributing the surveys, the total number of responses received was 410. Of these, 184 (44.9%) were within the age range of 21–30 years, followed by 169 (41.2%) respondents which were between 31 and 40, and the least were received from private practitioners between the age of 61 years and above which accounts for only 10 (2.4%) [Figure 1].

Since the majority of the respondents were from a younger generation, they mostly graduated within the year of 2011–2022. Twenty (4.9%) of the respondents have a master's degree, whereas 390 (95.1%) of the respondents identified themselves as general dental practitioners. Table 1 shows a list of specialties the participants had mentioned.

The largest number of samples was received from the most populous state in Malaysia which is Selangor that accounted for 116 (28.3%) respondents, followed by Federal Territory of Kuala Lumpur, 75 (18.3%).

Radiographic modalities used

From the survey, almost all the dentists had access to radiographic modalities in their clinic. Majority of them indicated that they owned at least an intraoral radiographic machine (90.9%, $n = 338$), followed by panoramic machines (76.1%, $n = 283$), and the least number was CBCT machines (42.5%, $n = 158$). Among those that claimed having X-ray machines in their clinic, 261 (70.2%) respondents received help from their DSAs in acquiring the images, whereas the other 115 (29.8%) took X-ray images/scans by themselves. Upon asking about their DSA qualification, only 104 of the dentists (28.0%) had sent their DSAs for any formal training in dental imaging procedures. Interestingly, more than half of them agreed (94.4%, $n = 351$) that sending the DSAs for a formal training would be beneficial to the practice.

Intraoral radiographic machine

As indicated earlier, 338 respondents reported having an intraoral radiographic machine in their private clinics. The most used brand is Vatech (33.7%), followed by Planmeca (13.9%),

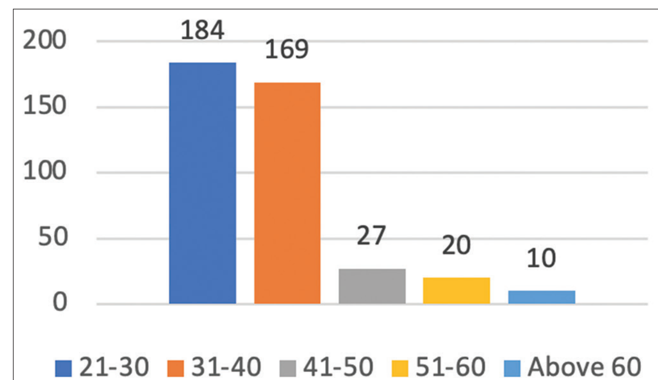

Figure 1: Age distribution of the respondents

Belmont (9.2%), MyRay (5.9%), NewTom (5.6%), and other various brands. Twenty-seven respondents (8%) avoided providing the brand name of their machine. Only one clinic reported using the machine for more than 30 years, and the majority of the respondents (60.7%, *n* = 205) reported using the machine for <5 years. The reasons for acquiring intraoral images in private dental clinics are outlined in Figure 2.

Approximately a third of the practitioners (34.3%, *n* = 116) acquired intraoral images at a rate of 11–20 per month, whereas only 13.6% (*n* = 46) acquired more than 50 images per month. Short cones were used by 39.9% (*n* = 135) of them, and only 7.7% (*n* = 26) used long cones. Strangely, a considerable proportion of respondents (37.6%, *n* = 127) were uncertain about the type of cone being used.

Among 338 respondents who owned an intraoral radiographic machine, 81 (23.9%) of them were using self-developing films, namely Hanshin (*n* = 20, 24.7%) and Dentalfilm (*n* = 17, 21.0%), whereas 31 (38.3%) of them have no idea on the brand of the film they are using. Interestingly, 21 respondents' findings were canceled as they provided the brand name of digital sensors for their brand of films, which indicated that they were unaware of what they were using for image acquisition.

There were 337 (99.7%) respondents with regard to the acquisition of intraoral radiograph/images, 184 (54.4%) do acquire bitewings, and 64 (18.9%) acquired occlusal images in their daily practices. With regard to periapical radiographic techniques, 129 (38.2%) practiced paralleling technique, whereas only 27 (8.0%) practiced bisecting angle technique. One-hundred and seventy-eight (52.7%) of the practitioners practiced both the techniques, whereas there were 4 (1.2%) of them who had no idea about different radiographic/acquisition techniques. Most of the respondents, 263 out of 338 (77.8%), indicated using receptor holders, whereas 75 (22.2%) of them did not use any holder during radiographic techniques.

Two-hundred and thirty-three out of 316 (73.7%) respondents were using digital sensors in their practice. Figure 3 shows the type of digital sensors used by private dental practitioners in Malaysia. It was evident that most respondents preferred photostimulable phosphor plates (PSPs) rather than the solid-state sensors.

Table 1: List of specialties among respondents

Field of specialty	Frequency (*n*)
Endodontic	1
Restorative dentistry	2
Orthodontic	5
Prosthodontic	3
Periodontology	2
Implantology	1
Oral surgery	3
Family dentistry	1
Pediatric dentistry	1
Master in psychology	1

Panoramic machine

Interestingly, approximately more than 50% of the respondents (*n* = 283) had a panoramic machine. The survey results indicate that Vatech is the most popular brand among dental practitioners, with 40.3% (114 respondents) using it. Following Vatech, Planmeca is used by 14.8% (42 respondents) and NewTom by 9.6% (27 respondents). Other brands with fewer users include Dentsply Sirona, Morita, LargeV, HDX WILL, and Owandy. Nineteen of the respondents (6.7%) avoided providing the brand name of the machines used in their clinic. The majority of the respondents (68.2%, *n* = 193) have been using the panoramic machine for <5 years. However, 69 (24.4%) of them have used it for 5–10 years, whereas 2 (0.7%) have been using it between 16 and 20 years and another 2 (0.7%) more than

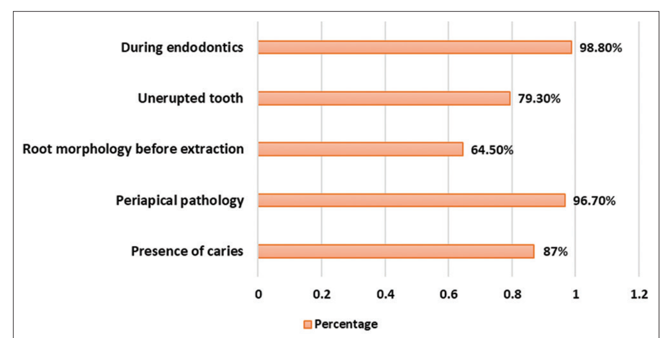

Figure 2: The reasons for acquiring intraoral images (multiple reasons allowed to be chosen)

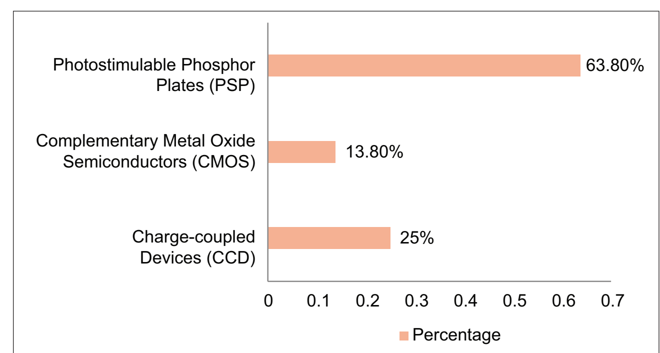

Figure 3: Type of digital sensors used by general practitioners

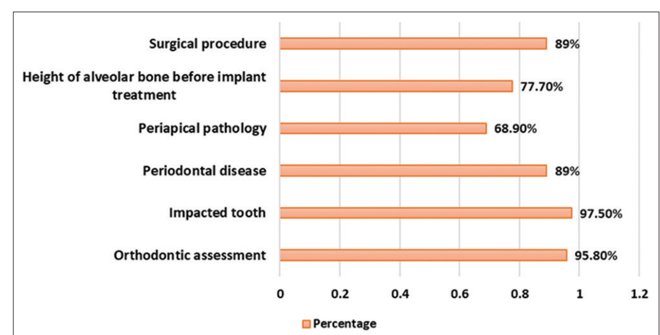

Figure 4: Reasons for acquiring panoramic images (multiple reasons were permitted)

20 years. Figure 4 shows the reasons for acquiring panoramic images.

The question of asking if the dental practitioners acquired a panoramic image for every new patient was included in the study and 17 (6%) of them said "yes." The number of panoramic images acquired per month is shown in Table 2.

Cone-beam computed tomography machine

Among 372 respondents, 158 (42.5%) of them have a CBCT machine in their clinic. Fifty-five (34.8%) clinics were using Vatech, 20 (12.7%) using Planmeca, 18 (11.4%) using NewTom, and the remainder various other brand names. Ten practitioners (6.3%) avoided providing the brand of the CBCT machine they are using. Most of the clinics involved in the study own a CBCT machine for less than 5 years (69.0%, *n*=109), while only one clinic reported having it for more than 15 years.

Figure 5 shows the distribution of the reasons for acquiring CBCT scans.

According to the chart in Figure 5, private practitioners acquired CBCT scans the most for implant placement (91.1%), followed by impacted teeth (86.7%), and in cases of endodontic problems (80%). Interestingly, there were 109 out of 158 (69.0%) practitioners who employed CBCT scans for jaw pathologic conditions.

Finally, there were 95 (60.1%) practitioners who took <10 CBCT scans per month. Thirty-seven (23.4%) of them took 11–20 scans, whereas 11 (7.0%) took 21–30 scans, and 15 (9.5%) of them took more than 30 CBCT scans.

Table 2: Number of panoramic images acquired per month

Number of images	Frequency (%)
<10	67 (23.7)
11–20	98 (34.6)
21–20	64 (22.6)
31–40	16 (5.7)
41–50	8 (2.8)
>50	30 (10.6)

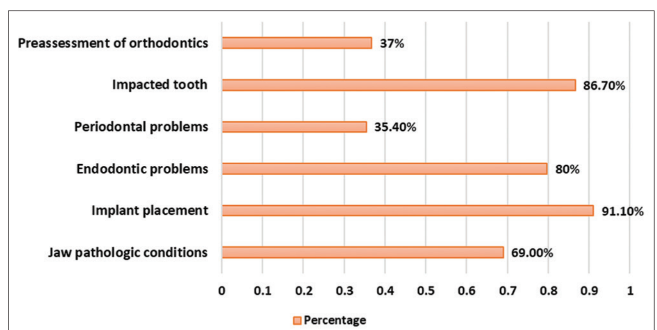

Figure 5: Reasons for acquiring cone-beam computed tomography scans (multiple reasons were permitted). CBCT: Cone-beam computed tomography

Radiation exposure

The participants were asked about their understanding of the guiding principle of radiation safety – the ALARA principle. Surprisingly, 56 (15.1%) out of 372 of them were not aware of it. When asked about the utilization of lead apron and thyroid collar, majority of them said affirmatively with a total of 366 (98.4%) and 219 (58.9%), respectively. However, 6 (1.6%) did not use the lead apron and 153 (41.1%) did not use thyroid collar for radiation protection. For additional measures on female patients, 356 (95.7%) claimed that they usually asked whether their patients were pregnant before any radiographic techniques.

As for X-ray room design, around 320 (86%) had lead-lined X-ray rooms, whereas the other 52 (14%) responded negatively. Some of them, however, mentioned that they used a lead equivalent material as an alternative, which is acceptable by the X-ray radiation regulators. The highest number of retakes of images in a month reported was between 0 and 5 times (89.5%, *n* = 333), followed by 6–10 times (6.72%, *n* = 25), and more than 10 retakes had the lowest frequency (3.8%, *n* = 14).

When asked whether the operator leaves the room when the machine is switched on for exposure, 353 (94.9%) of them answered positively while another 19 (5.1%) did not, which was indeed surprising. Finally, they were asked about the position and distance rule of the operator (2 m from the patient, at 90°–135°) in the X-ray room during exposure. Almost 256 (68.8%) were aware of this rule.

Discussion

Demographic status

The respondents who participated in this survey were mostly between the age range of 20s until early 50s which is a mix of elderly and young dentists. The replies were from all the states in Malaysia with the largest number of participants from Kuala Lumpur and Selangor which has the largest number of dental practitioners. We only received one reply from the states of Perlis and Terengganu.

It is heartening to report that 90.9% (*n* = 338) of the respondents have at least one X-ray machine in their private clinics, and this evidently showed that dental X-ray machines are viewed as an essential device for early detection, diagnosis, monitoring, and planning of treatment. Furthermore, it must be reiterated here that the number of panoramic and CBCT machines has also increased, especially with younger practitioners. In addition, the results of this study found that an inadequate number of DSAs are trained in handling X-ray machines. This will not only benefit the practitioners but also the patients; moreover, well-trained DSAs may reduce the number of retakes required in the clinics.

Intraoral radiographic machine

The fact that only one clinic reported using the dental intraoral machine for more than 30 years suggested that this technology had become more prevalent in recent times. In

addition, the data showed that most private dentists acquired a moderate number of intraoral images per month (11–20), with relatively a few acquiring more than 50 images. The prevalence of short cones compared to long cones indicated a preference for a more convenient and efficient approach to acquiring intraoral images/radiographs. However, this could also be due to a lack of knowledge on projection geometry where long cones (16 inch or 40 cm) produce less enlarged images.[4] Lee reported that the use of short-cone technique in dental radiography substantially increases X-ray dosage exposure to skin, mandibular marrow, eye, and thyroids than long-cone technique.[5]

With regard to the three types of intraoral radiographic techniques, periapical images were the most preferred images compared to bitewing and occlusal images. This could be due to the useful informative value of periapical images as it provided specific and clearer features in the region of interest, namely the crown and the periapical area. Surprisingly, the number of bitewings which should be taken as the first choice images to evaluate the interproximal surfaces of 3–4 upper and lower teeth for detecting interproximal caries is relatively less.[6]

For the different intraoral techniques, there are the paralleling and bisecting angle techniques in intraoral radiography. Both techniques could be useful in different situations. For example, the paralleling technique was useful in normal mouth-opening patients and favorable intraoral structure, whereas the bisecting angle was indicated in the case of limited mouth opening, easy gag reflex, and shallow floor of mouth or palate. For both the techniques, the receptor holder minimizes radiological errors, and it therefore minimizes retakes which in turn minimizes patient exposure to radiation[7] Most of the practitioners in this study preferred the paralleling technique which produced better geometrically accurate images when compared to the bisecting angle technique. However, a sizable number of them did use both techniques as Malaysians with Mongoloid ancestry have low palatal vaults.

An interesting fact from this study was that we found that most respondents preferred PSP rather than the solid-state sensors. According to a study by Anissi and Geibel, they found that the total amount of dental images taken during 1 work week for CCD systems was significantly higher than for film-based systems ($P = 0.007$), whereas no significant difference was noticed using PSP systems. They revealed that CCD system users named difficulties in detector positioning and retakes were required because of bad images. PSP system users mentioned fast image generation, lower radiation dosage, and excellent diagnostic value.[8]

Panoramic machine

The distribution of the duration of use of panoramic machines among the respondents suggested that the majority of dental professionals have been using this technology for a relatively short period of time (<5 years). This may indicate that the use of panoramic machines was becoming more widespread in private dental clinics or the older machines were being replaced by newer ones. Impacted tooth is the most common reason for acquiring a panoramic image as it helps the dental practitioners to ascertain root morphology, the relation of the roots toward the mandibular nerve, and the direction of impaction of the tooth that eventually aids in treatment planning to extract the tooth. Gupta *et al*. indicated that panoramic images were reliable for the evaluation of impacted teeth.[9] Sedaghatfar *et al*. reported that the surgeon's overall estimate of risk based on the panoramic images (darkening of the tooth root, narrowing of the tooth root, interruption of the white lines, and diversion of the canal) was statistically associated with an increased risk of inferior alveolar nerve exposure.[10] Panoramic images were also a must as a diagnostic aid during orthodontic assessment. Periodontal disease can be classified according to the panoramic image as we can observe the remaining bone level. We can calculate the amount of bone loss per year to classify the degree of periodontal disease in accordance with the 2017 classification of periodontal disease.[11] Kweon *et al*. reported that 64.1% of the subjects were diagnosed to have marginal bone loss on evaluating panoramic images, whereas the furcation involvement rate was 38.4%.[12] Both of these were significant findings to confirm periodontal disease which were hardly detected clinically. According to the number of panoramic images taken per month, it was suggested that these images were not a routine part of their clinical practice, or that they were used selectively for certain specific conditions. Studies of Rushton *et al*. and Rushton *et al*. stated that there was no evidence to support the practice of routine panoramic images of all new adult patients.[13,14] Although the majority of practitioners took relatively few images, it was notable that a significant minority (10.6%) took more than 50 per month. This may indicate that certain practitioners rely heavily on diagnosis, treatment planning, or monitoring patient progress using these images. The distribution of radiographic imaging frequency may also be due to factors such as paying capability of their patients, professional experience or training, or personal clinical preferences.

Cone-beam computed tomography machine

It is delightful to know that there are 42.6%, which is almost half of the respondents practicing in a clinic equipped with CBCT machines and utilizing this modality in their practice. This indicated that the private dental clinics and dentists in Malaysia were advancing with the most recent developments. The top 3 brands used in Malaysia are Vatech (34.8%), Planmeca (12.7%), and NewTom (11.4%). After discussion with some of our respondents, we found that the reason Vatech dominated the Malaysian market is affordability and its superior quality of image.

Most of the private dental clinics (69.0%) owned a CBCT machine <5 years; this was due to the recently raised awareness of practitioners in Malaysia on the importance of this advanced imaging modality as the three-dimensional images are excellent diagnostic aids and facilitate virtual treatment planning.

Expectedly, implant placement was the strongest indication for CBCT scan acquisition followed by impacted tooth investigations and endodontic problems. Surprisingly, the detection of jaw pathologic conditions also showed outstanding findings as high as 69%. Finally, more than half of the respondents took <10 CBCT scans per month which indicated that they were upholding the principle of "ALARA" when using this machine.

Radiation exposure

With regard to patient radiation protection, a significant number of them used lead aprons on patients. Nonetheless, a small number of them (1.6%, n = 6) admitted to not use any lead protection. As for thyroid collar, quite a number of them reported that they are not using thyroid collar for radiation protection as there have been many discussions and debates about its use. For most patients, thyroid will not be placed within the primary beam area; therefore, some of them may have decided to opt out the use of thyroid lead collar.[15] Despite that, a number of studies have proven that the use of it will significantly reduce the radiation exposure and benefit the patient, especially for machines that are associated with higher patient dose like CBCT.[15]

When enquiring about pregnant women, a great number of them stated that they asked about their pregnancy status before acquiring any images. According to the American Dental Association and the American Pregnancy Association, the amount of radiation released by dental X-ray is low and not enough to cause harm to the baby.[16] Regardless of that, it may be better to avoid exposing pregnant mothers as a reassurance of X-ray hygiene, provided it is not an emergency case.

With regard to the protection of room walls, many of them have lead-lined X-ray rooms with a few of them choosing lead equivalent material as their choice. In accordance with the guidelines of the Atomic Energy Licensing Act 1984, X-ray room walls must be lined with 1.0 mm or 1.5 mm thick lead equivalent material, according to the machine used.[17]

Interestingly, the number of retakes per month recorded was amazingly low among the private practitioners. This indicated that the techniques used were acceptable and only a smaller number of patients were being exposed to unnecessary radiation.

Limitations and recommendations for future studies

While doing this research, few limitations and hindrances were faced that might affect the accuracy and validity of the result. First is recall bias, where participants might not precisely remember the details of the radiograph machines, technique used, or number of retakes per month. Results might also not be reliable as the respondents might answer in such a way that is only socially acceptable rather than giving a truthful answer. Lack of previous studies on this topic, especially in Malaysia is also a limitation as we were not able to compare our results coherently. This research emphasizes only private dental practitioners, and the results are lacking of the findings among dental practitioners working in the government agencies. Thus, if similar studies were to be done in future, we suggest to include dentists from government clinics to get nationwide reliable data. This kind of research may serve in future to determine and strengthen guidelines for dental imaging applications. Indeed, Friedlander-Barenboim *et al*. recommended that the publication of evidence-based guidelines will help the clinician and radiologist on the best use of dental imaging in clinical practice.[18]

Conclusion

Intraoral images/radiographs were acquired by private dental practitioners at a rate of 11–20 per month (34.3%, n = 116), with only 13.6% (n = 46) acquiring more than 50 per month. Two hundred and eighty-three respondents (76.1%) had a panoramic radiographic machine, and 68.2% of them were using the machines for <5 years. CBCT machines were owned by 42.5% of the respondents, and 69% of the practitioners used them for <5 years. With regard to panoramic and CBCT imaging, most of them took between 1 and 30 panoramic images and 1–20 CBCT scans, respectively, in a month. A sizeable number of participants practiced the "ALARA" principle, whereas 95.7% of them asked whether the female patient is pregnant before image/radiograph acquisition. Most respondents (320) had lead-lined X-ray rooms in the clinic, whereas few others chose lead equivalent material.

The findings showed that the dental education programs organized by the Ministry of Health Malaysia to streamline the practice of dental radiology in the country by informing the practitioners about the latest recommendations, guidelines, and legislative requirements were effective. By implementing practical radiographic technique procedures and radiation protection measures, both patients and practitioners can ensure that high-quality images are always produced while also promoting radiation safety.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Original Article

The Prevalence of Systemic Diseases and Its Association with Periodontal Disease among Patients Referred to a Government Periodontal Specialist Clinic in Melaka, Malaysia

Koh Carmen, Arlene Khaw Bee Hong

Klinik Pergigian Seri Tanjung, Ministry of Health, Melaka, Malaysia

Abstract

Aim: The aim of the study was to identify the prevalence of systemic diseases among patients referred to a newly established government periodontal specialist clinic and to analyze the association between the severity (staging) and the rate of progression (grading) of periodontitis with the presence of these systemic diseases. **Materials and Methods:** Records of all new patients within the first 5 years of the clinic's operation were reviewed, and their periodontitis status was classified according to the 2017 World Workshop Classification system. The association between the severity of periodontitis and the presence of systemic diseases was analyzed using the Chi-square test, whereas Fisher's exact test was used to determine the association between the rate of progression and the presence of systemic diseases. **Results:** A total of 489 dental records were reviewed. We found that 40.1% of our patients suffered from systemic diseases. The two most common systemic diseases were cardiovascular disease (CVD) (11.4%) and diabetes mellitus (9.4%). No significant association was found between the severity of periodontitis and the presence of systemic diseases ($P = 0.376$). However, we found a significant association between the rate of progression of periodontitis and systemic diseases ($P = 0.004$). There was also a significant association between the rate of progression of periodontitis and CVDs ($P = 0.001$). **Conclusion:** The rate of progression of periodontitis is significantly associated with the presence of systemic diseases and CVDs. This highlights that periodontitis is not a stand-alone disease. Instead, it reaches across a spectrum of other noncommunicable diseases. The collaboration between medical and dental practitioners can further improve the management of this group of patients.

Keywords: Cardiovascular disease, diabetes mellitus, grading, periodontitis, staging

Introduction

Periodontal disease causes inflammation to occur in the tissues surrounding the teeth in response to bacterial accumulations, or dental plaque, on the teeth. The bacterial accumulations illicit an inflammatory response from the body. Chronic and progressive bacterial infection of the gums will then lead to alveolar bone destruction and loss of tissue attachment to the teeth.[1] Characteristics of the disease include gingivitis, loss of periodontal attachment, resorption of alveolar bone, and eventually, tooth loss.[2]

Severe periodontal disease was the 11th most prevalent condition in the world, according to the Global Burden of Disease Study done in 2016. Around the world, the prevalence of periodontal disease was reported to range from 20% to 50% and is the most common cause of tooth loss.[3] In Malaysia, the National Oral Health Survey for Adults in 2010 reported that 30.3% of adults had moderate periodontitis, whereas 18.2% had severe periodontitis.[4]

Many studies have suggested an association between periodontitis and certain systemic diseases. A range of systemic diseases were associated with periodontitis, including diabetes, cardiovascular diseases (CVDs), and respiratory diseases. The mechanisms which link periodontitis and CVDs have been explained by the entry of periodontal bacteria into the vascular system (bacteremia) and by the

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Address for correspondence: Dr. Koh Carmen, Klinik Pergigian Seri Tanjung, Ministry of Health, Melaka 76400, Malaysia. E-mail: carmenkoh@moh.gov.my

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increased levels of systemic inflammation resulting from periodontitis.[5]

An international workshop was done in 2012, where consensus statements for periodontitis and atherogenic CVD, periodontitis and diabetes, and periodontitis and adverse pregnancy outcomes were developed, it was found that daily activities such as eating and toothbrushing upon low-grade systemic inflammation, through acute-phase (C-reactive protein [CRP]) and neutrophil oxidative stress responses have an impact on periodontal bacteremia. In periodontitis patients with diabetes, hyperglycemia is linked to an increased risk and severity of periodontitis and poorer periodontal outcomes following periodontal therapy.[6]

A Malaysian study has shown that the prevalence of systemic diseases in patients with periodontal disease was 30.5%, comprising mostly hypertension and diabetes mellitus.[7] They also found that systemic diseases were significantly associated with chronic periodontitis. This study was based on a review of 370 records of patients treated in a university hospital setting in Kelantan.

CVDs are a group of disorders of the heart and blood vessels, which include coronary heart disease, congestive heart disease, and cerebrovascular disease. CVD and periodontitis are both chronic diseases that share the same risk factors, including age, male gender, lower socioeconomic status, smoking, and psychosocial factors such as stress.[8] Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia associated with defective insulin production, insulin action, or both. According to Malaysia's National Health and Morbidity Survey in 2019, the prevalence of diabetes has risen from 13.4% in 2015 to 18.3%. The association between diabetes mellitus and periodontitis is well established and considered bidirectional.[9]

The aim of this study is to identify the prevalence of systemic diseases among patients referred to a newly established government periodontal specialist clinic in Melaka. In addition, we also analyzed the association between the severity (staging) and the rate of progression (grading) of periodontitis in the presence of these systemic diseases. An understanding of this matter is not only important from a clinical perspective but also from a public health planning position with implications for human resource planning and health-care worker training.

Materials and Methods

Data source

Data included in this retrospective study were obtained from the Periodontic Specialist Treatment Card (LP12) and confidential medical questionnaire (BK27), which is a part of the recording system used in all periodontal specialist clinics under the Ministry of Health (MOH), Malaysia. The LP12 contains demographic data and periodontal records of patients, including complete periodontal charting, diagnosis, and records of radiographic investigations. Self-reported medical and smoking history were obtained from the BK27. Patients' identifiers were not extracted from their medical records, and the data of each patient were linked to a study identification number for the purpose of this research. As the dataset comprised de-identified secondary data, the requirement to obtain informed consent was waived.

All data were entered into a password-protected computer. On completion of the study, data in the computer were copied to a secured online database and the data in the computer erased. The data are stored and maintained for a minimum of 3 years after the completion of the study. The data will be destroyed after that period of storage.

The sample size was calculated using the formula suggested by Daniel in 1999.[10] Based on a previous study done in Kelantan, Malaysia, the prevalence of systemic diseases was found to be 30.5%.[7] After calculation, a minimum number of 326 samples were required to be included in this study.

The total number of new patients within the first 5 years (July 15th, 2015–July 14th, 2020) of our Periodontal Specialist Clinic's operation was 571. After considering the inclusion and exclusion criteria, 489 patient records were included in the study [Figure 1].

Study design

The diagnosis of periodontitis was based on the 2017 World Workshop Classification system for periodontal and peri-implant diseases and conditions. According to this classification, the framework for the diagnosis of periodontitis comprises a staging and grading system. Staging is largely dependent on the severity of the disease at presentation as well as on the complexity of disease management, whereas grading provides information about the biological features of

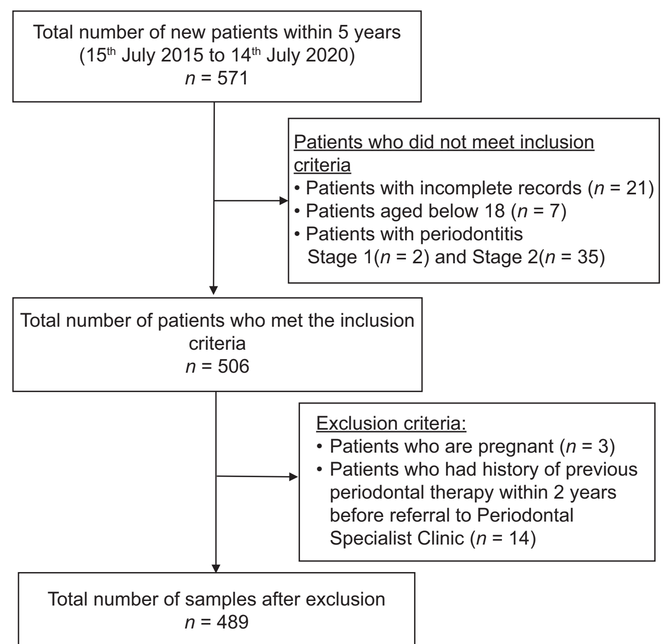

Figure 1: Flow chart of sample selection

the disease, including the rate of progression. Staging involves four categories (Stages 1 to 4) and is determined using a simplified stage grid based on radiographic bone loss. Bone loss is taken as the worst value at any site in the mouth, where the bone loss has arisen due to periodontitis. Grading includes three levels (Grade A – low risk, Grade B – moderate risk, and Grade C – high risk for progression) and was determined using the ratio of the percentage of bone loss/age.[2]

During the study duration of 5 years, a total of 571 patients attended the Periodontal Specialist Clinic at Klinik Pergigian Seri Tanjung, Melaka. This clinic is located at Tanjung Kling, Melaka Tengah district. Patients who have incomplete periodontal records were not included in this study ($n = 21$). Other patients who did not meet the inclusion criteria were patients who are <18 years old ($n = 7$) and patients with periodontitis Stage 1 (bone loss <2 mm from cementoenamel junction, $n = 2$) and Stage 2 (bone loss up to coronal third of root, $n = 35$).

The exclusion criteria for this study were pregnant women ($n = 3$) and patients who underwent any form of periodontal therapy within 2 years before referral to the clinic ($n = 14$). After considering the inclusion and exclusion criteria, 489 patients were included in this study [Figure 1].

Statistical analysis

The Statistical Package for the Social Science version 23.0 (International Business Machines Corporation IBM® SPSS® Statistics 23.0. Armonk, New York, United States of America) software was used for data analysis. Descriptive statistics of this study, such as mean, frequency, and percentages, were calculated. The Chi-square test was used to determine the association between the severity (staging) of periodontitis and systemic diseases, whereas Fisher's exact test was utilized to determine the association between the rate of progression (grading) of periodontitis and systemic diseases. $P < 0.05$ was considered statistically significant.

Ethical approval

This study has been approved by the National Medical Research Register (NMRR), with the implementation of the National Institute of Health guidelines on the conduct of research in the MOH Malaysia. Ethical clearance was also obtained from the Medical Research Ethics Committee through NMRR. The registration number of this research paper is NMRR-19-1554-4582.

Results

Demographic, classification of periodontitis, referral information, and treatment status of patients

A total of 489 dental records were reviewed. The mean age of the patients was 43.37 years. The age range was from 18 to 75 years. More than half of the patients were female (58.6%), and the majority of them were Malay (74.6%). Other patients were Chinese (21.5%), Indian (3.3%), and other races (0.6%), which included Portuguese and Bumiputera of Sabah. Most of the patients were working in the government sector (40.9%), followed by the private sector (38.2%). The remaining patients were either unemployed (19.2%) or students (1.6%).

Table 1: Demographic, classification of periodontitis, referral information, and treatment status of patients

Variables	Frequency (%)
Age (years), mean (SD)	43.37 (10.54)
18–29	39 (8.0)
30–59	419 (85.7)
60 and above	31 (6.3)
Gender	
Male	203 (41.5)
Female	286 (58.6)
Race	
Malay	365 (74.6)
Chinese	105 (21.5)
Indian	16 (3.3)
Others	3 (0.6)
Occupation	
Government	200 (40.9)
Private/self-employed	187 (38.2)
Unemployed	94 (19.2)
Student (diploma/degree/master/PhD)	8 (1.6)
Purpose of referral	
Chronic periodontitis	484 (99.0)
Others	5 (1.0)
Source of referral	
Internal	270 (55.2)
External	219 (44.8)
Staging	
Stage 3	224 (45.8)
Stage 4	265 (54.2)
Grading	
Grade A	4 (0.8)
Grade B	99 (20.2)
Grade C	386 (78.9)
Extent and distribution	
Generalized	420 (85.9)
Localized	69 (14.1)
Smoking	
Yes	65 (13.3)
No	424 (86.7)
Treatment status	
Nonsurgical	230 (47.0)
Surgical	5 (1.0)
SPT	254 (52.0)

SPT: Supportive periodontal therapy, SD: Standard deviation

The main purpose of referral was chronic periodontitis (99.0%), whereas the remaining patients were referred for crown lengthening and implant consultation (1.0%). Internal referrals, which make up more than half of the cases, were cases referred from the Primary Care Department at Klinik Pergigian Seri Tanjung (55.2%), whereas external referrals included cases referred from other government and private clinics around Melaka (44.8%).

The prevalence of Stage 4 periodontitis (54.2%) is higher than Stage 3 periodontitis (45.8%). A large proportion of patients showed rapid periodontitis progression and were categorized under Grade C (78.9%). Generalized periodontitis (85.9%) was predominant in this study. Smoking habit was reported by 13.3% of patients.

Regarding the treatment status of patients, more than half of them were in the supportive periodontal therapy phase (52.0%) at the time of data collection. The rest of the patients were in the active phase of nonsurgical (47.0%) and surgical (1.0%) treatment [Table 1].

Prevalence of systemic diseases

From this study, it was found that 40.1% of our patients suffered from systemic diseases. The two most common systemic diseases were CVD (11.4%) and diabetes mellitus (9.4%). A combination of both diseases was found in a number of study subjects (12.3%). Other systemic diseases found among the patients were hyperlipidemia, hyperuricemia, and asthma (7.0%) [Table 2].

Table 2: Prevalence of systemic diseases

Types of medical problems	n (%)
Healthy	293 (59.9)
Systemic diseases	196 (40.1)
CVD	56 (11.4)
DM	46 (9.4)
CVD + DM	60 (12.3)
Others	34 (7.0)
Total	489 (100.0)

CVD: Cardiovascular disease, DM: Diabetes mellitus

Association between the severity (staging) and rate of progression (grading) of periodontitis with the presence of systemic diseases

The association between the severity (staging) of periodontitis and the presence of systemic diseases was analyzed using Chi-square test, whereas Fisher's exact test was used to determine the association between the rate of progression (grading) and the presence of systemic diseases.

No significant association was found between the severity of periodontitis (staging) and the presence of systemic diseases ($P = 0.376$). There was also no significant association between the severity of periodontitis and the presence of CVDs ($P = 0.503$), diabetes mellitus ($P = 0.340$), and the combination of both diseases ($P = 0.335$) [Table 3].

Table 3: The association between severity (staging) of periodontal disease and systemic diseases

Variable	n	Stage 3, n (%)	Stage 4, n (%)	χ^2 (df)	P
Systemic conditions					
Yes	196	85 (43.4)	111 (56.6)	0.785 (1)	0.376
No	293	139 (47.4)	154 (52.6)		
DM					
Yes	46	18 (39.1)	28 (60.9)	0.912 (1)	0.340
No	443	206 (46.5)	237 (53.5)		
CVDs					
Yes	56	28 (50.0)	28 (50.0)	0.448 (1)	0.503
No	433	196 (45.3)	237 (54.7)		
Combination of DM and CVDs					
Yes	60	24 (40.0)	36 (60.0)	0.929 (1)	0.335
No	429	200 (46.6)	229 (53.4)		

*Chi-square test for independence, P-value <0.05 is considered statistically significant. CVDs: Cardiovascular diseases, DM: Diabetes mellitus

The rate of progression (grading) of periodontitis and systemic diseases showed a significant association ($P = 0.004$). No significant association was found between the rate of progression of periodontitis and the presence of diabetes mellitus ($P = 0.626$) and the combination of both diseases ($P = 0.341$) [Table 4]. However, a significant association was found between the rate of progression of periodontitis and CVDs ($P = 0.001$).

Discussion

The mean age of patients in this study was 43.37 years in the range of 18–75 years old. Another study conducted in Brisbane, Australia, reported that the mean age of their periodontitis patients was 53.26 years and in the range of 20–79 years old.[11] It appears that although the age range between both study population was somewhat similar, the mean age of our periodontitis patients was a decade lower than those in the Brisbane study.

With regard to gender, the majority of our periodontitis patients are females (58.6%). This finding is consistent with the findings in the Brisbane study (female = 53.6%),[12] as well as a study at a university hospital in Kelantan (female = 63.8%).[6] The reason for this may be due to the inequalities in oral health-care utilization in Malaysia. According to the National Health and Morbidity Survey 2019, females (odds ratio [OR] = 1.57), younger adults (OR = 1.64), those who were married (OR = 1.65), those with higher education (OR = 2.21), those who had medical checkup in the past 12 months (OR = 1.86), and those with higher income (OR = 1.43) were more likely to utilize oral health care.[13]

In this study, the severity and rate of progression of periodontitis were measured using the most recent 2017 World Workshop Classification system for periodontal and peri-implant diseases and conditions.[14] From the years 2015 to 2019, periodontitis patients who were referred to our clinic were diagnosed based on the previous 1999 International Workshop for Classification of Periodontal Diseases and Conditions. For the purpose of this study, all patients from the years 2015 to 2019 (531 or 93% of our total patients) were reclassified using the latest periodontal classification.

We found that the majority of our patients were referred at the worst severity of disease (Stage 4 = 54.2%) and the worst rate of progression (Grade C = 78.9%). This demonstrates the

Table 4: The association between rate of progression (grading) of periodontal disease and systemic diseases

Variable	*n*	Grade A, *n* (%)	Grade B, *n* (%)	Grade C, *n* (%)	χ^2	*P*
Systemic conditions						
Yes	293	2 (0.7)	46 (15.7)	245 (83.6)	9.665	0.004*
No	196	2 (1.0)	53 (27.0)	141 (71.9)		
DM						
Yes	46	0	7 (15.2)	39 (84.8)	0.760	0.626
No	443	4 (0.9)	92 (20.8)	347 (78.3)		
CVDs						
Yes	56	2 (3.6)	20 (35.7)	34 (60.7)	14.005	0.001*
No	433	2 (0.5)	79 (18.2)	352 (81.3)		
Combination of DM and CVDs						
Yes	60	0	16 (26.7)	44 (73.3)	1.791	0.341
No	429	4 (0.9)	83 (19.3)	342 (79.7)		

*Fisher's exact test for independence, *P*-value <0.05 is considered statistically significant. CVDs: Cardiovascular diseases, DM: Diabetes mellitus

need for primary oral health-care clinics to detect and refer periodontitis as early as possible.[12] Previous studies measured the severity of periodontitis using radiographs alone[12] and probing depths alone.[6] Therefore, a direct comparison cannot be made between all three studies. However, the university hospital study in Kelantan found that the majority of their periodontitis patients were in the mild category (mild = 48.6%, moderate = 37.3%, and severe = 14.1%).[6] This may be attributed to their younger study population (mean age = 39.25).

This study demonstrated that the prevalence of systemic diseases among periodontitis patients was 40.1%. This is slightly higher compared to the Kelantan study where the prevalence was found to be 30.5%.[7] In a separate study done in Brisbane, Australia, 60% of periodontitis patients reported at least one systemic disease.[11] Difference in the awareness and disease screening practice between Malaysia and Australia could be attributed to this difference in reported systemic diseases.

In this study, it was found that the two most common systemic diseases present among periodontitis patients were CVD (11.4%) and diabetes mellitus (9.4%). Similar results were reported in studies done elsewhere in Kelantan[7] and Suva, Fiji.[15] We also found that 7% of our periodontitis patients have other systemic diseases such as hyperlipidemia, hyperuricemia, and asthma. The study in Brisbane, Australia also reported allergies, hepatitis, tumors, and rheumatoid arthritis among their periodontitis patients.[11]

With regard to the association between the severity (staging) of periodontitis with the presence of systemic diseases, no significant association was found in our study. This finding is consistent with the Kelantan study which also found no significant association between the severities of chronic periodontitis (mild, moderate, and severe) and all systemic diseases identified.[6]

However, we found a significant association between the rate of progression (grading) of periodontitis with the presence of systemic diseases ($P = 0.004$) and CVD ($P = 0.001$). Currently, there is limited scientific evidence that CVD is a risk factor for the onset and progression of periodontitis.

However, a joint workshop held between the European Federation of Periodontology (EFP) and the American Academy of Periodontology in 2012 concluded that there was consistent and strong epidemiological evidence that periodontitis imparts an increased risk for future atherosclerotic CVD. It also concluded that the impact of periodontitis on CVD was biologically plausible, through translocated circulating oral microbiota, which may directly or indirectly induce systemic inflammation that impacts upon the development of atherothrombogenesis, and while *in vitro*, preclinical, and clinical studies supported the interaction and associated biological mechanisms, intervention trials were not sufficiently adequate to draw further conclusions at that time.[16]

More recently, the evidence base from the 2012 workshop was updated in a workshop jointly organized by the EFP and the World Heart Federation to include global experts in both periodontal and cardiovascular disciplines.[17] A systematic review, which was updated, has identified new studies published in the last 5 years demonstrating an increased risk of a first coronary event, as well as the first cerebrovascular event in patients with clinically diagnosed periodontitis or more severe periodontitis compared to patients without periodontitis or less severe periodontitis.[18]

Evidence from past intervention studies showed that the progression of atherosclerotic CVD may be influenced by successful periodontal treatment independent of traditional CVD risk factor management[16] (Tonetti *et al*. 2013), and new evidence in this area would not be feasible due to important ethical, methodological, and financial considerations. There is also moderate evidence for reduction of low-grade inflammation as assessed by serum levels of CRP, IL-6, and improvements in surrogate measures of endothelial function (flow-mediated dilatation of the brachial artery).[19]

With regard to cardiovascular risks and complications of periodontal therapeutic interventions, the workshop concluded that delivering periodontal treatment is safe with regard to cardiovascular risk at both the population level and in patients with established CVD.[17] However, the operator should be

aware of the perioperative bleeding risk when performing periodontal therapy in patients undergoing antiplatelet, anticoagulant, and novel/direct anticoagulant therapy.

This study has some limitations. Due to the retrospective nature of this study, incomplete or illegible documentation as well as difference in the quality and location of the information recorded by different clinicians were noted. Second, our study participants were recruited by convenience sampling and are thus, not representative of the general population and prone to selection bias. Finally, the self-reported nature of our data for systemic diseases and smoking habits can be a potential source of bias. A Malaysian study found that the elderly, less-educated, employed individuals, individuals not covered by health insurance, and smokers were less likely to have health screening.[20] A separate study in the United Kingdom showed a substantial degree of disagreement between the diagnoses recorded in self-reported data and administrative hospital records.[21] They found that older, cognitively impaired men are more prone to both underreporting and overreporting. With regard to the self-reported nature of smoking history, it was largely dependent on variables such as the time since completely quitting smoking among former smokers, the number of cigarettes smoked per day, and the number of years of daily smoking among former smokers.[22]

Apart from these limitations, our study had several strengths. First, we were able to analyze the first 5-year data of a newly established periodontal specialist clinic since it started operation in July 2015. This information may be helpful in planning capital and human resources for periodontal specialist clinics in future. Second, we were able to re-classify all our periodontitis patients according to the 2017 World Workshop Classification system for periodontal and peri-implant diseases and conditions.[13] Therefore, data from our study may be used to compare the prevalence of periodontitis according to their staging and grading with studies using this new classification. Furthermore, this new classification is currently being used by all periodontal specialists in the MOH, Malaysia.[23]

Conclusion

Within the limitations of this study, it appears that the rate of progression (grading) of periodontitis is significantly associated with the presence of systemic diseases and CVDs. This highlights that periodontitis is not a stand-alone disease. Instead, it reaches across a spectrum of other noncommunicable diseases. Therefore, the collaboration between medical and dental practitioners can further improve the management of this group of patients.

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Conflicts of interest

There are no conflicts of interest.

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Abstracts for MDA SCATE 2024

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Evaluation of Weakened Endodontically Treated Teeth Restored with Fibre-reinforced Composite: Open Apex and Flared Root Canals

D. S. D. Alshetiwi[1], N. A. Abdul Muttlib[2], H. M. El-Damanhoury[3], R. Alawi[4], N. Abd Rahman[5], N. A. Elsahn[6]

[1]Department of Oral and Craniofacial Health Sciences, College of Dental Medicine, University of Sharjah, Sharjah, United Arab Emirates, [2]Prosthodontics Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kelantan, Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia, [3]Department of Preventive and Restorative Dentistry, College of Dental Medicine, University of Sharjah, Sharjah, United Arab Emirates, [4]Conservative Dentistry Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kelantan, Malaysia, [5]Dental Public Health Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kelantan, Malaysia, [6]Department of Clinical Sciences, College of Dentistry, Ajman University, Ajman, United Arab Emirates

Introduction: Endodontically treated teeth (ETT) with compromised root canals are at high risk of fracture. The use of intra-radicular posts in these teeth is accompanied by a large resin cement layer due to the discrepancy in the size and shape between the post and root canal, which may cause failure in future. **Objectives:** This study aimed to assess the combination of different forms of fibre-reinforced composites (FRC) used to enhance mechanical behaviour of compromised ETT. **Methodology:** Eighty human premolar teeth were randomly allocated to five experimental groups (n = 16). Groups were divided according to canal preparation methods and intra-radicular restoration with either a standard prefabricated fibre post or anatomically customized relined fibre post. Fracture resistance and push-out bond strength tests were then carried out through a universal testing machine after artificial aging, followed by failure analysis via a stereomicroscope and scanning electron microscope. **Results:** Results of fracture resistance test showed the highest fracture resistance (1796 N) in Group 5, while Group 2 showed the lowest mean fracture resistance (758 N). The values are significant when compared with the other groups. For push-out bond strength test, Group 5 and Group 4 demonstrated a significantly higher bond strength at all root thirds ($p < 0.05$) than Group 3, Group 2, and Group 1. The most frequently observed failure occurred between the resin cement and radicular dentin for all the groups. **Conclusion:** In conclusion, the use of short fibre-reinforced composite (SFRC) to reline the prefabricated FRC post has been proven to have superior fracture resistance with favourable failure patterns and increased push-out bond strength values compared to standard prefabricated FRC posts.

Persistent Lip Ulcer in an Elderly Diabetic Patient as a Presenting Sign of Plasma Cell Cheilitis: A Case Report and Literature Review

N. A. Awang Hasyim, S. Ismail

Department of Oral and Maxillofacial Surgery, Unit of Oral Pathology and Oral Medicine, Hospital Sultan Abdul Halim, Sungai Petani, Malaysia

Background: Plasma cell cheilitis (PCC) is a rare inflammatory disorder of non-neoplastic plasma cell disease affecting the lip. Diagnosis of PCC can be delayed as it is often mistaken for traumatic ulcer, actinic cheilitis, and discoid lupus erythematosus. The objective of this study was to report a case of PCC with emphasize in diagnostic work up and management of this rare entity. A case of PCC seen in our Oral Medicine clinic is reported. A concise review of the literature is also conducted. **Case Presentation:** A 76-year-old male rubber tapper initially presented to our Oral Medicine clinic with a chronic ulcer on the lip of more than two months in duration. He had hypertension, diabetes mellitus, benign prostate hyperplasia and was compliant to medication. Extraoral examination showed an ulcer on the lower lip measuring 2 × 1 cm with well-defined border, soft in consistency which is tender and bleeds upon manipulation. He was fully edentulous and wears upper and lower complete denture for more than 20 years. Incisional biopsy reveals an ulcerated mucosa with subepithelial dense band-like inflammatory cells of mainly plasma cells, lymphocytes, and histiocytes. Collections of plasma cells are also observed in the deeper connective tissue, particularly in perivascular arrangement. These findings consistent with a diagnosis of PCC. The patient was treated with topical triamcinolone acetonide 0.1% three times daily and chlorhexidine mouthwash. At 5-week follow-up, a complete resolution of the ulcer with mild scar tissue is observed. **Conclusion:** Diagnosis of PCC is challenging as this entity may mimic other conditions in clinical and histopathological examination. The chronicity of the lesion implies a plausible underlying immune mediated process, which warrant a histopathological confirmation through biopsy. Our case displayed substantial improvement and complete resolution of PCC with only topical steroid application, which may not work in every case, hence contributes to complexity of its management.

Translation and Validation of Questionnaires for Perceived Usefulness and Ease of Use of Electronic Payment Systems on Healthcare Services Payment among Hospital Clients

M. Mhd Zain, B. Ahmad, A. Ariffin, M. Z. Sinor

Department of Dental Public Health, School of Dental Sciences, University Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia

Introduction: Healthcare electronic payment system (EPS) integration started in October 2022 as one of the efforts to drive digital transformation in healthcare services. Its usefulness and ease of use from the user’s perspective for healthcare services in Malaysia are still unclear. However, the perceived usefulness and ease of use of EPS can be evaluated through a single questionnaire, but no Malay translation instrument

exists to evaluate the domains with hospital clients yet. **Objectives:** The study aimed to adapt the perceived usefulness and ease of use of the EPS instrument into the Malay language and assess its reliability. **Methodology:** Perceived usefulness (PU) and ease of use (PEU) were adapted, followed by forward, and backwards translations to the Malay language. The instruments then underwent a content validation process with two experts for the item-level content validity index (I-CVI) and face validation with ten raters for the item-level face validity index (I-FVI). Finally, test-retest reliability was conducted with 40 samples. **Results:** EPS's PU and PEU on healthcare services payment for the translated Malay versions showed an I-CVI of 0.95, which met a satisfactory relevance level. An I-FVI was obtained from 10 raters of 0.93, showing that the items were clear and comprehensible. A test-retest reliability assessment was conducted on 40 samples, showing that acceptable Cronbach's alpha values and intra-class correlation coefficient ranged more than 0.70 and more than 0.8, respectively. **Conclusion:** This study showed good I-CVI, I-FVI, consistency, and reliability in the adapted Malay-translated version. The instrument was valid and thus reliable for assessing the perceived usefulness and ease of use of healthcare service payments among hospital clients.

A Retrospective Study on the Prevalence of Impacted Premolars and Its Association with Premature Loss of Deciduous Molars in Paediatric Dental Patients, Hospital Serdang

S. Subramanyan[1], S. D. Subramaniam[2], I. B. Mohamad Jaafar[1]

[1]Orthodontic Unit, Seri Kembangan Dental Clinic, 43300 Seri Kembangan, Selangor, [2]Department of Paediatric Dentistry, Hospital Sultan Idris Shah, Serdang, Malaysia

Introduction: Impacted premolars are premolars which fail to erupt within the expected date of eruption and can no longer be expected to do so. When deciduous molars are lost early before their natural exfoliation, mesial migration of permanent molars leading to space loss and impaction of premolars may occur. **Objectives:** i) To determine the prevalence of impacted premolars among patients with early loss of deciduous molars and retained deciduous molars. ii) To determine the age of early loss of deciduous molars among patients with impacted premolars. iii) To investigate the association between impacted premolar and early loss of deciduous molar. iv) To describe the mean age of patients according to the position of premolar impaction. **Methodology:** A total of 401 patients with Premature Loss of Deciduous Molars (PLDM) were screened in this cross-sectional retrospective study and this includes all impacted premolar tooth case records and radiograph from the year 2017-2019. Demographic data, the age of PLDM, prevalence and position of premolars impaction on orthopantomograms were collected. **Results:** Among 401 cases, 23 presented with impacted premolars. Mean age of PLDM among patients with impacted upper premolar was 4.8 years, whereas those without impacted premolars was 5.7 years. Chi-square test was performed and there was no significant association between impacted premolar and PLDM. Impacted maxillary second premolars were classified into seven types of positions, in which the group with PLDM having a tendency to fall into types IV & VII. The other premolars were described as vertical, horizontal and angular and the group with PLDM were observed in the vertical position. **Conclusion:** Although no significant association were observed between PLDM and impacted premolars, impacted premolars were seen in the earlier age group at which the deciduous molars were lost.

Calcifying Fibroblastic Granuloma: A Case Report in a 14-year-old Boy

N. I. Ismail, Y. P. Chan

Department of Paediatric Dentistry, Hospital Kuala Lipis, Kuala Lipis, Pahang, Malaysia

Background: Growths on the gingiva can be reactive or neoplastic in nature. Many lesions appear similar clinically and can only be identified through histopathological examination. It is hypothesized that calcifying fibroblastic granuloma is a reactive gingival growth arising from periodontal ligament fibres. **Case Presentation:** A 14-year-old boy presented with a mass over the palatal region. The boy who has learning difficulties was unaware of the painless growth and denies any history of trauma. The lesion did not resolve with antibiotics prescribed by a general medical practitioner and gradually increased in size. Clinically, a lobulated and pedunculated mass was present on the palate with a thin stalk attached interdentally to tooth 21 and 22, measuring approximately 20 mm x 24 mm x 10 mm. The surface of the lesion appeared reddish-pink with speckles of white, and a tendency to bleed. Radiographically, no bony pathology was seen although the adjacent teeth showed increased mobility. MRI findings were suggestive of a benign gingival vascular tumour. Excisional biopsy was performed under general anesthesia and scaling was done to remove any local irritants. Histopathological examination showed a fibrocellular stroma and fibrovascular connective tissue with some trabeculae and spherules of metaplastic calcifications, consistent with calcifying fibroblastic granuloma. Histological studies suggest that the lesion may be confused with pyogenic granuloma in early stages when areas of dystrophic calcification are less apparent, and the lesion has yet to undergo fibrous maturation with ossification. Controversy exists over the nomenclature of this lesion, with several terms being used to describe it, such as peripheral ossifying fibroma. **Conclusion:** Reactive gingival lesions in children may show exuberant growth rates in a short period. Early detection can prevent alveolar erosion or tooth displacement. Due to high recurrence rates, close follow-up is advised in addition to complete surgical excision and elimination of local irritants.

Dental Rehabilitation of a Child with Chronic Idiopathic Thrombocytopenic Purpura: A Multidisciplinary Approach

A. Amran[1], S. S. B. Sinnumu Naidu[1], T. Vijayakumar[1], Z. Mohd Kasim[2]

[1]Department of Paediatric Dentistry, Hospital Kajang, Kajang, Malaysia, [2]Department of Paediatric, Hospital Kajang, Kajang, Malaysia

Background: Idiopathic Thrombocytopenic Purpura (ITP) is characterized by increased autoimmune platelet destruction and inhibition of platelet production. Dental rehabilitation under general anesthesia (GA) poses a risk of bleeding, due to thrombocytopenia, and infection, due to immunosuppressive treatments. The literature has advocated various methods to lower the risk of bleeding, including platelet transfusion, antifibrinolytics, desmopressin, prednisolone, strict local precautions, and minimally invasive techniques. **Case Presentation:** A six-year-old boy was presented with severe toothache and multiple dental caries. The child was recently diagnosed with chronic ITP with an average platelet count of 15 x 109 L-1 and a history of non-responsive IV immunoglobulin (IVIg) transfusion. The treatments aimed to eradicate infection sources, restore decayed teeth, alleviate pain, improve oral hygiene, and educate the patient's parents about general and oral health. Following consultation with the patient's physician, a full-mouth rehabilitation with nine teeth extractions was performed, utilizing platelet transfusions pre-, intra-, and post-operatively, as well as antifibrinolytics, local measures, and antibiotics. During the recall visit, good oral hygiene and caries-free teeth were obtained. This case highlights the management of dental rehabilitation in a child with chronic ITP and platelet counts below conventional thresholds. It's essential to have an in-depth grasp of medical disorders, the importance of a multidisciplinary approach involving medical subspecialties, and the appropriate timings to achieve successful outcomes. **Conclusion:** This case highlights the management of dental rehabilitation in a child with chronic ITP and platelet counts below conventional thresholds. It's essential to have an in-depth grasp of medical disorders, the importance of a multidisciplinary approach involving medical subspecialties, and the appropriate timings to achieve successful outcomes.

Oral Cancer Awareness amongst Dental Patients in the District of Kinta, Perak

K. M. Yuen, K. M. Hema, E. J. Liau, G. Stephen Joseph

Department of Oral and Maxillofacial Surgery, Hospital Permaisuri Bainun, Ipoh, Malaysia

Introduction: Oral cancer is a major health problem in Malaysia, sadly most people are not aware of the fact that if detected early, the survival rate of oral cancer is very high. As of the year 2020 oral cancer was ranked as the 19th most prevalent cancer in Malaysia by the Global Cancer Observatory. **Objectives:** The objective of this study was to examine the level of awareness concerning oral cancer, including knowledge of its signs, symptoms, risk factors. Additionally, attitudes toward oral cancer screening would be appraised among individuals visiting government dental clinics in the Kinta District. **Methodology:** A cross sectional study using self-administered questionnaire on patients attending government dental clinics across the Kinta district. **Results:** Of 404 patients completing the survey, 59.4% were female, Malay (62.9%) with 93.1% having at least secondary education. Twenty-five respondents reported family history of oral cancer. Around 19.4% responds to have at least one high risk habit, with 78.5% of individuals having general awareness of oral cancer and the most common source of information was from the media (57.2%). A total of 310 patients affirm that screening is mandatory, however only 20.6% had attended full mouth examination ($p < 0.05$). Non-healing ulcers (88.6%), white/red patches (82.7%) and abnormal mass (88.9%) were the top three signs and symptoms identified. Around 56.9% had been educated by their dentist before and majority trusts information on the official Ministry of Health webpage. There is a significant difference between level of education with respondents of at least one high risk habit ($p = 0.28$) and awareness of the need for oral examination ($p < 001$). **Conclusion**: Awareness levels, knowledge of risk factors and identifying early signs and symptoms of oral cancer necessitate the need for more structured preventive programs using media. Health workers should do more because they have a pivotal role in early diagnosis through oral cancer screening, raising levels of knowledge and rectifying misconceptions about oral cancer.

The Effect of Using Fluoridated Toothpaste with Miswak and Conventional Nylon Toothbrush

M. H. Mohd Rosmi[1], B. Baharin[1], L. Ponnuthurai[1], M. A. Abdul Razak[2], M. Z. Kassim[1]

[1]Department of Restorative Dentistry, Faculty of Dentistry, Universiti Kebangsaan Malaysia, Bangi, Malaysia, [2]Department of Restorative Dentistry, Faculty of Dentistry, Universiti Malaya, Kuala Lumpur, Malaysia

Introduction: The miswak toothbrush was created to emulate the functionality of the traditional miswak stick in a toothbrush form. The original recommendation by the manufacturer is to use miswak toothbrushes without any toothpaste. Nevertheless, its abrasiveness remains unexplored especially when it is used with fluoridated toothpaste of different abrasiveness. **Objectives:** To compare the commercially available miswak toothbrush and the conventional toothbrush in terms of their potential to cause tooth wear on enamel and dentin surfaces when used with fluoridated toothpaste containing different abrasive levels. **Methodology:** Human enamel and dentin specimens were brushed with either novel miswak (Al-Abyad Miswak) or conventional toothbrush (Oral-B™), using either water (control), low abrasive or high abrasive fluoridated toothpaste. A total of 72 samples with 12 sample groups ($n = 6$) were subjected to a cycle of erosion, remineralization, and abrasion for five days. The step height loss (tooth wear) on the surface of each sample was analyzed using a non-contact profilometer (Alicona 3D scanner). **Results:** Samples that were brushed with distilled water (no toothpaste) showed the highest degree of tooth wear, followed by high abrasive toothpaste and low abrasive toothpaste, but with no statistically significant difference. In addition, there was no statistically significant interaction between toothbrush type and toothpaste type. **Conclusion:** The use of fluoridated toothpaste with different abrasive content does not significantly influence tooth wear caused by toothbrushing. However, the presence of fluoride helps to lower the degree of tooth wear caused by the combination of abrasion and erosion.

Digital Shade Guide Evaluation: Comparing Color Accuracy of Smartphone and Mirrorless Camera Images against Spectrophotometer

S. T. Chew, I. M. Tew, S. Y. Soo, M. Z. Kassim

Department of Restorative Dentistry, Faculty of Dentistry, University Kebangsaan Malaysia, Bangi, Malaysia

Introduction: The color mismatch in conventional shade matching method is a common issue caused by subjective interpretation of colors. Studies on shade matching with objective communication method using digital shade guides are lacking. **Objectives:** To compare the color differences between spectrophotometer and two digital shade guides developed from images of shade tabs taken using mirrorless and smartphone cameras. **Methodology:** Two digital shade guides were developed from 29 images of Vita Linearguide 3D-Master shade tabs. These images were taken using two types of cameras: (a) a mirrorless camera with 100 mm macro lens, wireless external twin flash (TF), and cross polarizing filter (CPF); (b) smartphone camera with light correcting device and CPF. All images of shade tabs were captured in a dark controlled room with pre-determined parameters and transferred to Adobe Photoshop software for shade analysis using an 18% gray reference card. The L*, a*, b* values of middle third of each digital shade tab were measured. For reference and comparison, the middle third of every shade tab was measured by a spectrophotometer. Intraclass correlation (ICC) of two consecutive measurement periods was calculated for reliability assessment. The differences among groups were tested using the one-way ANOVA, following by Bonferroni post hoc test with significance level set at 0.05. **Results:** Both digital shade guides exhibited excellent reliability with ICC exceeding 0.9 in colour measurements. The a* values obtained from mirrorless camera were significantly higher than those obtained from spectrophotometer (p = 0.013). The mean âˆ†E of smartphone-based digital shade guide was significantly lower than mirrorless camera-based digital shade guide (p < 0.001). The L, a, and b values obtained from both tested digital shade guides exhibited a significant correlation with the corresponding values obtained from spectrophotometer (p < 0.001). **Conclusion:** The color measurement of both digital shade guides demonstrated good correlation to those measured by spectrophotometer. The digital shade guide developed using the images of smartphone camera may serve as a potential tool for tooth shade assessment due to its remarkable accuracy and high reliability with minimal color difference (âˆ†E = 2.35).

Acceptability and Usability of a Shared Care Protocol for Managing Periodontitis Patients with Diabetes Risk: A Scoping Review

S. K. Rajinder Singh, S. Mohd Said, N. M. Nik Azis

Department of Restorative Dentistry, Faculty of Dentistry, University Kebangsaan Malaysia, Bangi, Malaysia

Introduction: Periodontitis serves as a valuable risk indicator, and dental offices are effective places for early diabetes screening. Collaborative efforts between medical and dental healthcare professionals are crucial, as strong evidence indicates that early detection and timely referrals significantly enhance patient care and their overall quality of life. Despite these findings and recommendations, both dental and medical professionals frequently report low rates of referrals and follow-up. This review focuses on the available shared care protocol for managing periodontitis patients with diabetes risk. **Case Presentation:** To systematically review literature specific to shared care protocols for managing periodontitis patients with diabetes risk that are acceptable and usable by general dental practitioners. **Methodology:** The review was conducted based on scoping review techniques using the PRISMA 2020 protocol, searching literature in PubMed, SCOPUS, Web of Science, Science Direct, and other sources like Google Scholar, and reference citations. Articles published and written in the English language were included. **Results:** The review listed the shared care protocols that involved the dental and medical teams in the management of periodontitis patients with diabetes. Only a few of the studies discussed referrals and follow-up communication by the dentist to their medical counterparts. Out of which not many discussed its acceptability and usability. **Conclusion:** This further indicates the need for better communication between the medical and dental teams, which can affect the screening of diabetes in the dental clinic and indirectly the management of periodontitis.

Venous Malformation of the Tongue

M. Kehayan, H. D. Singh

Department of Oral Maxillofacial Surgery, Hospital Slim River, Slim River, Perak, Malaysia

Background: Venous malformation (VM) is a rare type of a vascular anomaly that can occur anywhere on the body but often it is found in the head and neck region. Vascular anomalies encompass a wide array of lesions, including vascular malformations and vascular tumours, both of which are clinically distinct. Vascular malformations can be defined as congenital lesions that become apparent later in life, formed by dysplastic vascular channels, with no endothelial proliferation or involution. Vascular malformations can be further classified into low-flow, mixed and high-flow malformations. VMs are the most common type of low-flow congenital vascular malformations. VMs can be challenging to diagnose and are often confused with haemangioma. **Case Presentation:** This is a case report of a VM of the tongue in a 63-year-old male patient, presented with a well-defined bluish-purple lesion on the left lateral border of the tongue. The lesion was excised, and the histopathological features were indicative of vascular anomaly and suggestive of venous malformation. **Conclusion:** In conclusion, smaller vascular anomalies can be safely treated by excision.

Mechanical Properties of Rice Husk Nano Hybrid Dental Composite Incorporated with Kenaf Cellulose Nano Crystals Treated via Silane Hybridization

N. Ab Rasid[1], R. Alawi[1], M. H. Hussin[2], Y. Johari[1], N. A. Abdul Muttlib[1]

[1]School of Dental Sciences, Universiti Sains Malaysia, Health Campus, 16150, Kubang Kerian, Kelantan, Malaysia, [2]School of Chemical Sciences, Universiti Sains Malaysia, Gelugor, Pulau Pinang, Malaysia

Introduction: Natural fibres such as kenaf fibres have enormous potential in replacing synthetic fibre used for composite reinforcement. **Objectives:** This study aimed to investigate the mechanical properties of rice husk nano hybrid dental composite after addition of kenaf cellulose nano crystals treated with silane hybridization. **Methodology:** Kenaf cellulose nanocrystals (CNCs) were treated with silane hybridization using tetraethyl orthosilicate (TEOS) sol gel and γ-Methacryloxypropyltrimethoxysilane (γ-MPS) with different ratio of TEOS: γ-MPS (0:1, 1:1, 1:2 and 1:3) which was later incorporated into composite resin mixture. Six samples from each group were prepared for compressive and flexural tests. Data was analysed using one-way ANOVA test. **Results:** The means compressive and flexural strength of composite reinforced with treated kenaf CNCs were increased compared to non-reinforced composite even though the means strength were lower than the commercial composite tested. **Conclusion:** With further modifications, the addition of treated kenaf CNCs via silane hybridization has potential to improve the mechanical strength of rice husk nano hybrid dental composite.

Impact Absorption on the 3D Printed Mouthguard Material in Selected Printing Angulations

S. S. Idris[1], C. Y. Li[2], T. Aung[2], S. T. Kaung[2], Q. S. Zhu[2], Y. Tsuchida[3], H. Churei[4]

[1]Klinik Pergigian Cheras, WP Kuala Lumpur and Putrajaya, Kuala Lumpur, Malaysia, [2]Department of Masticatory Function and Health Science, Graduate School of Medical and Dental Science, Tokyo Medical and Dental University, Bunkyo, Tokyo, Japan, [3]Department of Digital Dentistry, Graduate School of Medical and Dental Science, Tokyo Medical and Dental University, Bunkyo, Tokyo, Japan, [4]Masticatory Function and Health Science, Clinic for Sports Dentistry, Graduate School of Medical and Dental Science, Tokyo Medical and Dental University, Bunkyo, Tokyo, Japan

Introduction: Nowadays, mouthguards can be produced based on digital impression using intraoral scanners. However, the relationship between printing angulations and material properties during printing has not been fully investigated. **Objectives:** To assess the impact absorption on 3D printed mouthguard material in selected printing angulations. **Methodology:** A standard tessellation language (STL) file of a circle mouthguard sheet with 50mm diameter and 2mm thickness was used to design the samples using the Cara® Print 4.0 software (Kulzer Japan) at the selected printing angulation at 0°,10°, 20°, 30°, 40° and 50° and 18 samples produced using the Dima® Print Soft Splint (Kulzer Japan) blue. All samples were stored for 24 hours at 23°C before testing. Impact force was generated by releasing the stainless-steel ball from 600 mm above each sample using a modified IM-201 impact testing machine (Tester Sangyo Co., Saitama, Japan). **Results:** The lowest maximum force was 403.5N (samples at 10°angulations) and the highest maximum force was 491.2N (samples at 50° angulations). The highest maximum impact force time was 0.91ms (samples at 10° angulations) and the lowest maximum impact force time was 0.40ms (sample at 0° angulations). Printing angulations had significant influence on the impact absorption of 3D mouthguard sheet material. There is a significant result in between groups reported for selected printing angulation. The lowest impact absorption with the longest impact force time is preferred to prevent the oral injuries due to impact during sports. **Conclusion:** The relationship between printing angulations and impact absorption properties was investigated for 3D printed soft material of mouthguard. Printing angulations has significantly influenced the impact of absorption properties.

Evaluation of Adaptation and Fracture Properties of Zirconia Post Fabricated using CADCAM Technology in Restoring Root Treated Teeth

N. F. Abdul Rahim[1], N. A. Abdul Muttlib[1], R. Alawi[2], N. Abd Rahman[3], A. Ariffin[1]

[1]Prosthodontics Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia, [2]Conservative Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia, [3]Dental Public Health Unit, School of Dental Sciences, Universiti Sains Malaysia, Health Campus, Kubang Kerian, Kelantan, Malaysia

Introduction: Root treated teeth often have extensive loss of tooth structure which may be indicated for placement of post for retention of coronal restoration. Different types of post have different properties and may affect the teeth differently. **Objectives:** The purpose of this study is to compare adaptation, fracture resistance and fracture pattern of root treated teeth restored with three different systems, namely cast metal post, zirconia post and everStick post. **Methodology:** In this study, 24 premolar teeth were randomly allocated into four groups. Group 1 and group 2 were prepared for objective 1, in which all teeth were prepared to receive cast metal post (CMP), zirconia and everStick posts. The samples were then submitted for adaptation evaluation using polyvinyl siloxane (PVS). After objective 1 was achieved, Group 1 and group 2, together with group 3 and 4 were prepared to achieve objective 2 and 3. Samples in group 1 were prepared to receive zirconia post, group 2 to receive CMP and group 3 to receive everStick post. Teeth in group 4 were the control group where no post space preparation done. The samples were then subjected to fracture resistance test via universal testing machine. Finally, fracture pattern analysis was carried out. **Results:** The assessment showed that there was statistically significant difference ($p < 0.005$) in the mean weight of the PVS material between the groups. Group 2 (CMP) has the lightest weight, followed by group 3 (everStick) and group 1 (zirconia). Fracture resistance tests revealed that there was statistically significant difference ($p < 0.005$) between groups. Group 4 (control) has the highest fracture resistance, followed by group 2 (CMP), group 1 (zirconia) and group 3 (everStick). There was no significant difference in the fracture pattern between zirconia, CMP and everStick posts. **Conclusion:** In conclusion, this study showed that zirconia post was inferior compared to CMP in terms of adaptation and fracture resistance.

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