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Influence of periodontal susceptibility on the periodontal healing of adjacent second molars after surgical extraction of impacted mandibular third molar

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Abstract

Objective: To compare bone level changes and probing depths at the adjacent mandibular second molar (M2) 6 months after impacted mandibular third molar (M3) extraction between patients with and without periodontitis.

Material and Methods: Patients referred for extraction of M3 were recruited. Patients were categorized as periodontally susceptible (PSP) or healthy patients (PHP). Six months after surgical extraction of M3 (T1), periodontal probing depths (PPD) and radiographic bone level at M2 were compared between the two groups. Regression analyses were performed to identify factors associated with PPD and bone level changes.

Results: 42 patients completed the study, and the mean follow-up duration was 6.7 months. There was no significant difference in radiographic bone gain at M2 between PSP and PHP patients (1.26mm vs 1.13 mm). Every 1% increase in full mouth bleeding score at T1 was associated with 2.64mm less bone gain at M2. The PSP group was 6.43 times more likely to have PPD ≥ 5 mm at T1.

Conclusions: Second molars in patients with periodontitis were not associated with less bone level gain 6 months after extraction of impacted M3. However, second molars in patients with higher gingival inflammation were associated with less bone gain.

Keywords: Periodontal healing. Alveolar bone. Periodontal pocket.

Introduction

Impacted mandibular third molars (M3) are associated with inadequate plaque control, leading to multiple pathologies including dental caries, pericoronitis, cystic lesion, external root resorption and periodontal attachment loss of the adjacent mandibular second molar (M2) (Sarica *et al*., 2019; Wang *et al*., 2017; Ye *et al*., 2021). Among them, dental caries was reported to be the most prevalent pathology (Altan and Akbulut, 2019; Ye *et al*., 2021). Periodontal pathologies were reported to range from 4.9% to as high as 44.4% (Altan and Akbulut, 2019; Sarica *et al*., 2019). Bone loss was reported at the distal of M2 with the presence of M3 over three years (Krausz, Machtei, and Peled, 2005).

The clinical effect of surgical extraction of M3 on the periodontal health of the adjacent M2 has been extensively investigated. Several studies have demonstrated a beneficial effect. An early study on 15 young adult patients reported a mean sulcus depth reduction of 1.51-1.66 mm and 1.88-2.04 mm at the distal and disto-buccal sites respectively of the M2 (Stephens, App, and Foreman, 1983). Similarly, other studies have reported improvement in periodontal parameters of the M2, including reductions of periodontal probing depth (PPD) and clinical attachment level gains at least 3 months post-surgery (Faria *et al.*, 2012; Montero and Mazzaglia, 2011; Petsos *et al.*, 2016; Tabrizi, Arabion, and Gholami, 2013). On the other hand, a number of studies provided a more cautious view (Krausz *et al*., 2005; Pons-Vicente *et al.*, 2009). In a split-mouth retrospective study, Krausz *et al*. (2005) reported radiographic bone gain at the distal of the second molar after third molar extraction. However, they failed to demonstrate a significant improvement in periodontal pocket depth reduction. Similarly, in another retrospective study, a mean residual PPD of 5.4 mm was noted on the distal of the M2 6-36 months after the surgical extraction of M3 (Kan *et al.*, 2002).

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Factors such as quality of plaque control, compliance to regular dental prophylaxis, age, impaction angle and position and baseline PPD of the M2 were found to influence the periodontal healing of the M2 (Kaminishi *et al*., 2006; Montero & Mazzaglia, 2011; Passarelli *et al*., 2019). Information about the influence of periodontal susceptibility on the periodontal healing of the M2 after M3 extraction is limited. Peng *et al*. (2001) studied a group of periodontally susceptible patients and found that a history of third molar extraction in this population was associated with significantly more loss of bone and periodontal attachment at the M2, as compared to patients with congenital missing third molars. A recent prospective study reported that patients with history of periodontitis were 41 times more likely to present PPD ≥ 4 mm at the M2 (Passarelli *et al*., 2019).

To date, there is no study comparing periodontal bone healing of the adjacent second molar after mandibular third molar extraction between periodontally healthy (PHP) and periodontally susceptible (PSP) patients. As such, the objective of the present prospective cohort study was to compare the PPD and bone level changes between patients with and without periodontitis at the distal of adjacent mandibular second molars (M2), based on radiographic information at least 6 months after the mandibular third molar (M3) extraction.

Materials and Methods

The study protocol was submitted and approved by the Singhealth Centralized Institutional Review Board in Singapore (2020/2357).

Study population

In this prospective cohort study, patients who were referred to the National Dental Centre Singapore (Singapore) (NDCS) for extraction of impacted M3 were screened by dental officers or a study investigator (TKW). The reasons for extracting M3 were to prevent peri-coronitis of impacted M3 and improve periodontal health of M2. The presence and status of the dental pulp of the adjacent M2 were confirmed. Patients who fulfilled the inclusion criteria were invited to participate in the study, and a summary of the study design was conveyed to the patients by the screening dental officer or study investigators (HC, TKW). Informed consent was taken by HC or TKW.

Patients were enrolled in this study from Oct 2020 to March 2022. The inclusion criteria were medically healthy adults (ASA classification I-II) with presence of partially or fully impacted M3 with adjacent M2. Patient should be asymptomatic or only mildly symptomatic, with at least 20 remaining teeth. Patients who were medically compromised (ASA classification III-V), presenting medical condition that could interfere with bone healing (ongoing or history of oral/intravenous anti-resorptive medication; history of head-and-neck radiotherapy) or pregnant were excluded. Patients who did not have adjacent second molar or have adjacent molar with endo-perio lesion were excluded as well.

Based on the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, subjects who were periodontally healthy or diagnosed with Stage I periodontitis were grouped under periodontally healthy patient group (PHP). The rest (Stage II - IV) of subjects were grouped as periodontally susceptible patients (PSP) (Tonetti *et al*., 2018). The PSP group completed initial periodontal therapy prior to the extraction of impacted mandibular third molar.

Data collection and surgical procedure

Demographic information (age, gender, ethnic group) and pre-operative clinical parameters were recorded by one investigator (HC) within 3 months prior to surgery (T0). The clinical measurements recorded included:

1. Periodontal pocket depth (PPD) at disto-buccal (DB) and disto-lingual (DL) of the adjacent M2 with a UNC-15 periodontal probe, rounded off to the nearest 1 mm.
2. Bleeding on probing: 6 sites per teeth, measured for full-mouth bleeding score (FMBS T0).
3. Periodontal pocket depth (PPD) and gingival recession (GR) of all individual teeth other than M2, at 6 sites (mid-, mesio- and disto- buccal and lingual) with a UNC-15 periodontal probe, rounded off to the nearest 1 mm

The PSP group completed initial periodontal therapy prior to the extraction of impacted mandibular third molar.

At T0, periapical radiographs (PA) of M2 were taken. Putty material was used to register the relative position of the film holder and the tooth, to ensure consistency in the angle of the periapical films at T0 and at the 6 months review (T1). PAs were taken with long-cone paralleling technique by trained radiographers at NDCS. If the radiograph was deemed unreadable (wrong angulation, incomplete capture of target teeth), another radiograph was taken. The films were all digitized. Interpretation of relevant reference points of alveolar bone was done with a software program (MiPACS Dental Enterprise Viewer Software, LEAD Technologies, Inc.) Radiographic parameters at T0 that were recorded by one investigator (TKW) included:

1. Distal bone level at M2 (D0), measured by the distance between M2 apex and M2 distal bone to tooth contact (Fig. 1).
2. Pell and Gregory impaction classification (Pell, and Gregory, 1933).

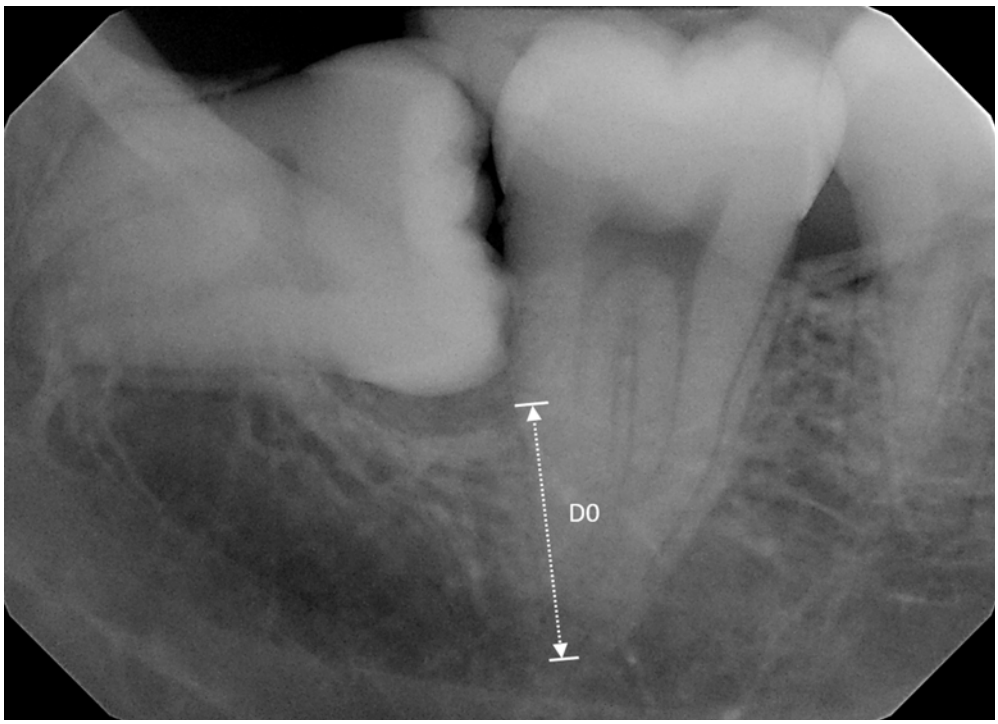

Figure 1. Periapical radiograph of M2 taken at T0. D0 = distal bone level at M2.

Consent for extraction of mandibular third molar was taken before surgery. Local anesthesia was administered as a standard inferior alveolar nerve block and infiltration using two cartridges (4.4 ml) of 2% mepivacaine with 1:80.000 adrenaline. A sterile surgical field was created. A full thickness muco-periosteal envelope flap extending from the mesiobuccal aspect of M2 towards ascending ramus was elevated. Reflection of the flap was achieved with an Austin Retractor for access and flap protection. Sterile handpiece at 40,000 rpm and sterile saline solution were used for ostectomy and odontosection when necessary. Based on Pell and Gregory's classification of impaction, bone guttering was performed only at the buccal aspect of third molars for Class I impactions, while bone guttering was performed at both buccal and distal aspects of third molars for Class II and Class III impactions (Pell and Gregory, 1933). M3 was elevated afterwards.

Remnant follicular tissue was removed and alveolar sockets irrigated with sterile saline solution. Scaling and root surface debridement were done on the distal aspect of M2, to remove any residual calculus. Flaps were re-approximated anatomically in all procedures and sutured with interrupted 4-0 vicryl sutures. Postoperative medications included Eterocoxib 120mg once in the morning for 7 days, Paracetamol 1g 4 times a day for 7 days, and 0.2% chlorhexidine mouth rinse 3 times a day for 7 days. In case of drug allergy to nonsteroidal anti-inflammatories (NSAIDs) , 2 tablets of Panadeine (500mg Paracetamol, 8mg Codeine) 3 times a day for 7 days was prescribed. No antibiotics was prescribed routinely after surgery. Written postoperative instructions were explained and given to the patients.

At least 6 months after the extraction of M3 (T1), a second periapical radiograph was taken with the prefabricated putty material, and radiographic parameters were recorded by one investigator (TKW):

1. Distal bone level at M2 (D1), measured by the distance between M2 apex and M2 distal bone to tooth contact (Fig. 2).
2. Angulation (Δ1) between distal root surface of M2 and its distal crestal bone.

At T1, clinical parameters were recorded by one investigator (HC):

1. Periodontal pocket depth (PPD) at disto-buccal (DB) and disto-lingual (DL) of the adjacent M2, using a UNC-15 periodontal probe, rounded off to the nearest 1mm.
2. Bleeding on probing: 6 sites per teeth, measured for full-mouth bleeding score (FMBS T1).
3. Width of keratinized gingiva at disto-buccal of M2, dichotomized as <1mm OR ≥1 mm, using a UNC-15 periodontal probe, rounded off to the nearest 1mm.

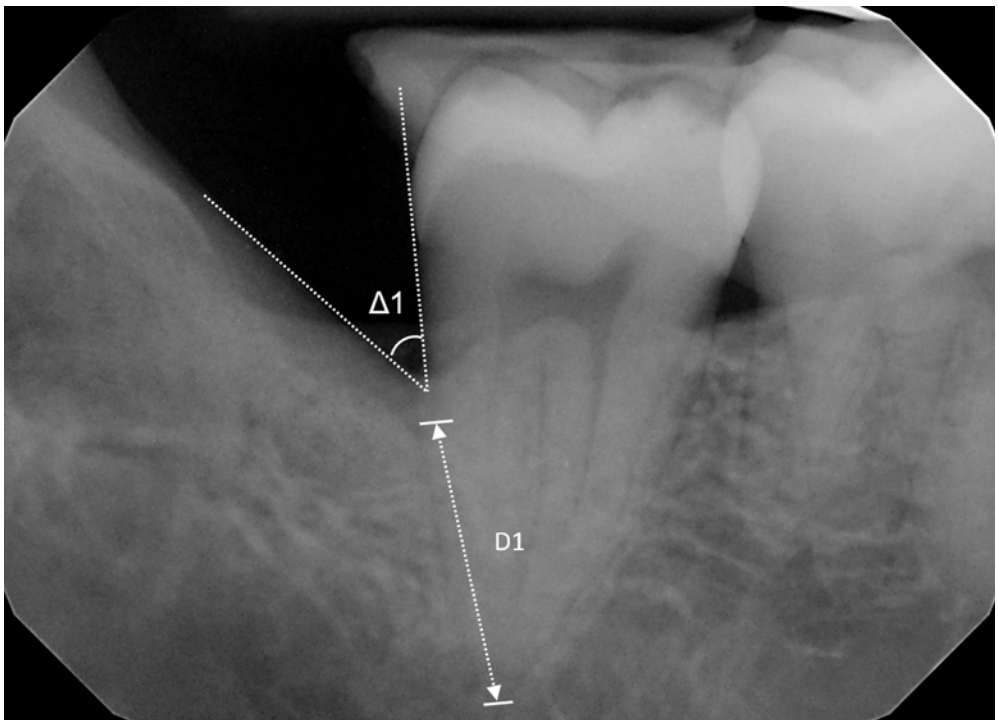

Figure 2. Periapical radiograph of M2 taken at T1. D1 = distal bone level at M2. Δ1 = Angulation (Δ1) between distal root surface of M2 and its distal crestal bone.

Statistical analysis

Baseline characteristics were presented as mean, standard deviation (SD) and range for age variable; and as frequency and percent for categorical variables. Changes in the periodontal pocket depth (PPD) were evaluated by comparing the number of pockets with PPD ≥ 4 mm and PPD ≥ 5 mm, as well as average PPD at M2 distal. The T0 average PPD at M2 was calculated as mean of PPD at DB and DL sites, while the T1 average PPD was calculated as mean of PPD at DB, MID and DL sites.

Baseline demographics, clinical and radiographic parameters were compared between the two groups (PSP vs PHP) using two-sided two-sample *t*-test or Mann-Whitney U test (depending on the normality assumption) for continuous variables (reported as mean ± standard deviation, or median and interquartile); and Chi-square test for categorical variables (reported as frequency and percentage). Univariate linear regression analysis was performed to investigate the association between demographics and clinical features with bone level gained at distal of M2, and the results were reported as beta coefficient and 95% confidence interval (CI) and *p*-value. Multivariable logistic regression analysis was performed to evaluate the impact of clinical and radiographic parameters on the two groups (Number of sites with PPD ≥5 mm vs number of sites with PPD <5 mm at M2, and change in mean PPD at M2) at T1, adjusting for the PPD of M2 at T0. Gender, ethnic group, age group, impaction classification, presence of keratinized tissue, angulation between ascending ramus and M2 and presence of BOP were included in the regression analysis as well. Significance level was set at $p < 0.05$. Data analysis was performed in SAS version 9.4 for Windows (Cary, NC: SAS Institute. Inc.).

This study was powered for its primary endpoint. Group sample sizes of 14 in PSP group and 14 in PHP group achieved >80% power to reject the null hypothesis of equal bone level changes in the two groups when the difference in population bone level changes was assumed to be 1 mm (=3mm in PHP – 2mm in PSP), with a standard deviation for both groups of 1 mm. Type I error was fixed at 10%, using a two-sided two-sample equal-variance t-test. Final sample size was at least 19 per group, after adjusting for 25% dropout rate.

Results

Of the 50 subjects who were enrolled in the study, 8 were lost to follow-up. Of the 42 individuals who completed the study, 13 were female and 29 male. They had a mean age of 35.9 years (SD = 12.9; range 21 to 70). Demographic and clinical features of the study population are presented at Table 1. The PSP patients had a higher mean age as compared to PHP patients (40.9 ± 12.4 vs 30.9 ± 11.6 years). All surgeries went uneventfully. The mean follow-up duration after the surgery was 6.7 months (range 6 to 9 months).

Among the recruited patients, 19 patients were categorized as PHP patients and the other 23 patients were categorized as PSP patients (Fig. 3). Pre-operatively, PHP patients had a higher radiographic mean bone level at distal side as compared to PSP patients (7.76 ± 2.68 mm vs 6.49 ± 1.82 mm) (Fig. 4). However, the difference did not reach statistical significance (p=0.153). At T1, an average of 1.19 mm of bone gain was observed at M2 distal. The difference in bone gain at T1 between patients from PSP group (1.26 ± 1.39 mm)

Table 1. Subject demographic findings.

Age (years)	
Mean ± SD; range	35.9 ± 12.9; 21 to 70
Age ≤ 25 years (n)	11 (26.2%)
Age > 25 years (n)	31 (73.8%)
Gender (n)	<0.001*
Female	13 (31.0%)
Male	29 (69.0%)
Race (n)	0.002*
Chinese	31 (73.8%)
Non-Chinese	11 (26.2%)
History of periodontitis[†] (n)	<0.001*
PSP	23 (54.8%)
PHP	19 (45.2%)
Impaction classification (n)	
Pell and Gregory I	12 (28.6%)
Pell and Gregory II	28 (66.7%)
Pell and Gregory III	2 (4.8%)
Total sample size	42

	PHP	**PSP**	**P-value**
Age (years)			
Mean (SD)	30.9 (11.6)	40.9 (12.4)	0.00273
Age group			
≤ 25 years	8 (38.1%)	3 (14.3%)	0.0701
> 25 years	13 (61.9%)	18 (85.7%)	
Gender	0.002*		
Female	9 (42.9%)	4 (19.0%)	0.182
Male	12 (57.1%)	17 (81.0%)	

[†] PSP = periodontally susceptible patients; PHP = periodontally healthy patients.

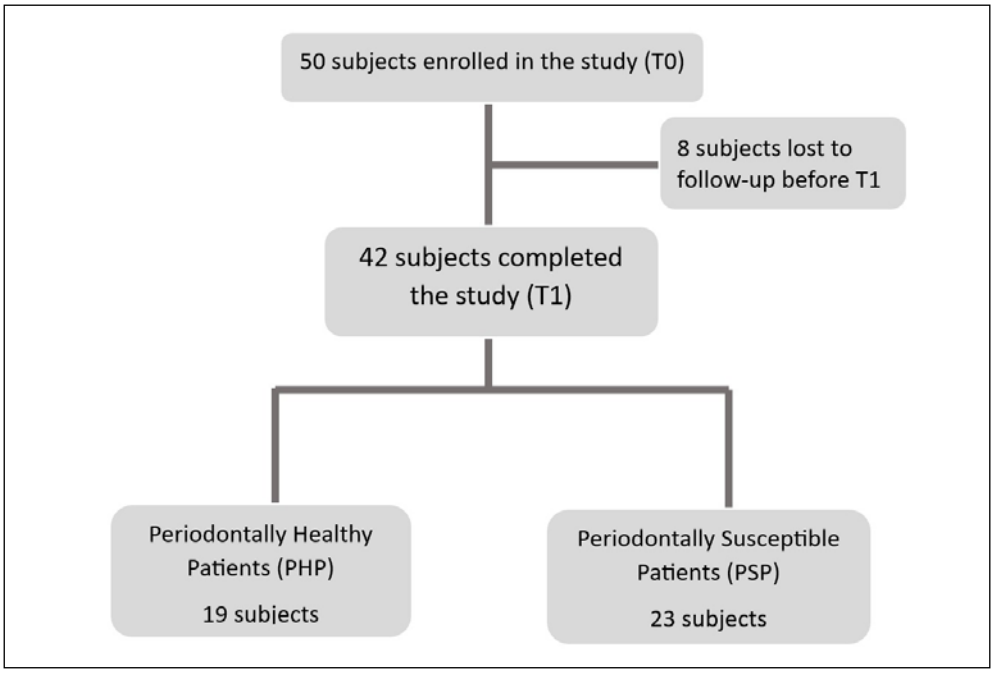

Figure 3. Subject recruitment flow chart.

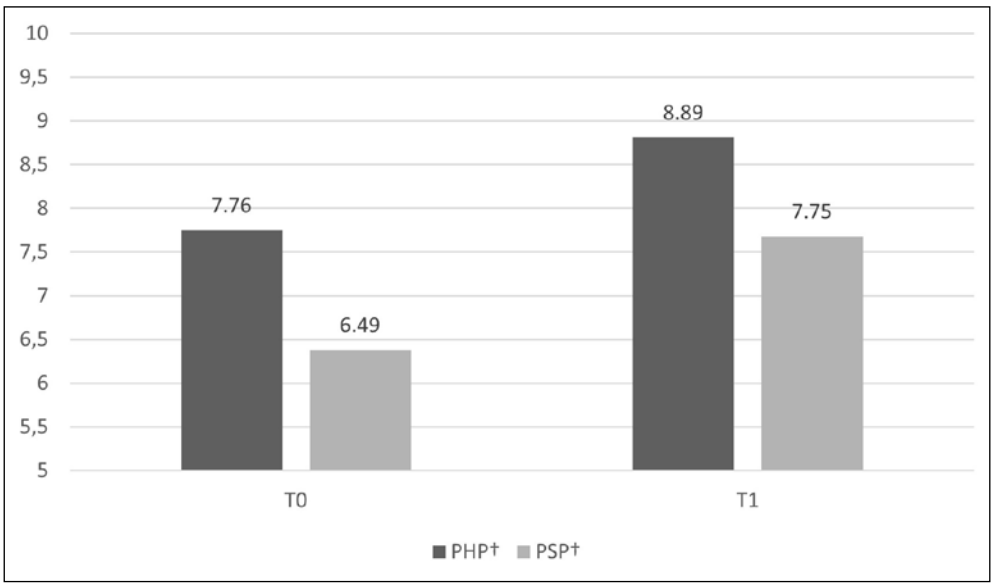

Figure 4. Radiographic mean bone level (mm) at distal side of M2. † PSP = periodontally susceptible patients; PHP = periodontally healthy patients.

and PHP group (1.13 ± 1.38 mm) did not reach statistical significance (p=0.850). Factors that were associated with the bone gain at distal of M2 were analyzed with univariate linear regression (Table 2). Each 1% increase in the FMBS at T1 was associated with 2.64 mm less bone gain at distal of M2 (p=0.0474) at T1. M2 in patients who were more than 25 years old were found to have less bone gain at T1 (1.08 mm ± 1.33 mm) as compared to those younger than 25 years old (1.51 mm ± 1.51 mm). However, the difference did not reach statistical significance (p=0.397).

At baseline (T0), M2 from PSP group had a significantly deeper mean PPD (6.85±1.98 mm vs 3.61±1.04 mm) at distal surface, as compared to those from PHP group (p<0.001) (Fig. 5). Univariate linear regression demonstrated that, at T1, M2 from PSP group had 1.96mm more mean PPD reduction as compared to those from PHP group (2.43 mm ± 2.04 mm vs 0.47 mm ± 0.87 mm; p=0.0004). Patients older than 25 years had 1.41 mm more PPD reduction as compared to younger patients (1.88 mm vs 0.47 mm, p=0.0376). At T1, all 23 M2 (100.0%) from PSP group had at least one pocket with PPD ≥ 4 mm and 11 out of 19 M2 (57.9%) from PHP group had at least one pocket with PPD ≥ 4 mm (p=0.001). Similarly, a higher proportion of M2 (17 out of 23, 73.9%) from PSP had at least one pocket with PPD ≥ 5 mm, as compared to those from PHP (2 out of 19, 10.5%). The difference was found to be statistically significant (p<0.001). Multivariable logistic regression with adjustment of baseline PPD of M2 showed that second molars in patients from PSP group were 6.43 times more likely to have PPD ≥ 5 mm at least 6 months after extraction of M3, although the difference did not reach statistical significance (p=0.0786) (Table 3). In addition, older subjects (>25 years old) had significantly higher chances (18 out of 32, 56.3%) to present at least one M2 pocket with PPD ≥ 5 mm at T1, as compared to younger subjects (1 out of 10, 10.0%) (p=0.013).

Table 2. Univariate linear regression: bone level gained at distal of M2 (mm).

Effect	Comparison	Unadjusted Beta	P-value
History of periodontitis	PSP vs PHP†	-0.13 (-1.00, 0.74)	0.7603
Age group	>25 vs ≤25	-0.43 (-1.43, 0.58)	0.3974
Pell and Gregory	2 vs 1	0.75 (-0.19, 1.70)	0.1160
	3 vs 1	0.70 (-1.40, 2.80)	0.5040
Keratinized gingiva	≥ 1mm vs <1mm	-0.33 (-1.25, 0.60)	0.4841
Angulation (T1)	continuous	-0.01 (-0.04, 0.02)	0.7209
FMBS‡ (T0)	continuous	-0.28 (-1.61, 1.06)	0.6802
FMBS‡ (T1)	continuous	-2.64 (-5.26, -0.31)	0.0474*

† PSP = periodontally susceptible patients; PHP = periodontally healthy patients.
‡ FMBS = full mouth bleeding score.

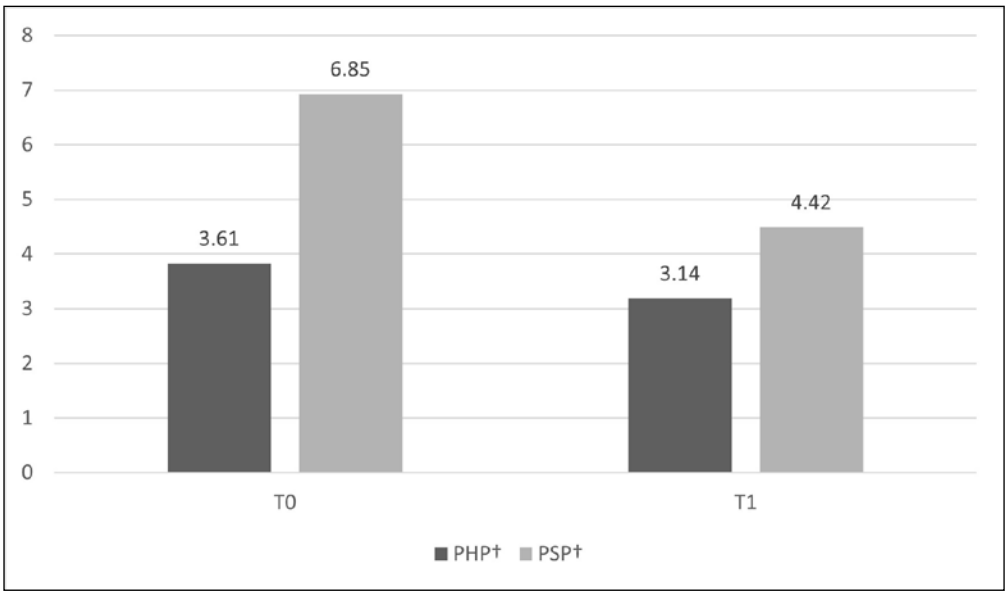

Figure 5. Mean periodontal pocket depth (mm) at distal side of M2. † PSP = periodontally susceptible patients; PHP = periodontally healthy patients.

Table 3. Multivariable logistic regression: PPD§ (number of sites with PPD ≥5 mm vs number of sites with PPD <5 mm) at T1; Univariate Linear Regression: change in PPD§.

Effect	Comparison	Outcome = PPD≥5mm Multivariable Logistic Regression		Change in PPD Univariate Linear Regression	
		Adjusted Odds Ratio (95% CI)	P value	Unadjusted Beta (95% CI)	P value
History of periodontitis	PSP vs PHP†	6.43 (0.81, 51.2)	0.0786	1.96 (0.94, 2.98)	**0.0004**
Age group	>25 vs ≤25	4.04 (0.46, 35.3)	0.2069	1.41 (0.09, 2.73)	**0.0376**
Pell and Gregory	2 vs 1	0.76 (0.15, 3.74)	0.8675	-0.93 (-2.20, 0.34)	0.1482
	3 vs 1	0.84 (0.01, 52.4)	0.9853	-2.79 (-5.61, 0.03)	0.0521
Keratinized gingiva	≥ 1mm vs <1mm	1.15 (0.23, 5.80)	0.8652	0.50 (-0.78, 1.78)	0.4341
Angulation T1	continuous	1.02 (0.97, 1.08)	0.4285	-0.01 (-0.05, 0.03)	0.6716
FMBS‡ (T0)	continuous	5.70 (0.25, >99)	0.2756	3.22 (1.68, 4.75)	**0.0001**
FMBS‡ (T1)	continuous	2.86 (0.01, >99)	0.7241	2.46 (-1.24,6.16)	0.1859

§ PPD = periodontal pocket depth.
† PSP = periodontally susceptible patients; PHP = periodontally healthy patients.
‡ FMBS = full mouth bleeding score.

Discussion

The current prospective clinical study compared the difference in healing of mandibular M2 between patients with and without periodontitis. In general, the study showed that the surgical extraction of impacted M3 was associated with both bone gain (1.19mm) and PPD reduction (3.08mm) at adjacent M2 after an average of 6.7 months of healing. These findings are in agreement with previous studies. Kausz et al. (2005) reported a mean bone gain of 0.66 mm after extraction of impacted M3, as compared to a mean bone loss of 0.176 mm if the M3 was left alone after 3 years. Other studies demonstrated that the extraction of M3 was associated with a reduction in the PPD at the adjacent M2 (Faria *et al*., 2012; Montero & Mazzaglia, 2011; Passarelli *et al*., 2019; Petsos *et al*., 2016; Tabrizi *et al*., 2013). Microbiologically, this improvement in periodontal status was associated with a reduced level of gram negative and spirochetes at M2 after extraction of partially erupted M3 (Rajasuo, Meurman, & Murtomaa, 1993).

The current study reported no statistically significant difference in radiographic bone gain at M2 between PSP and PHP patients (1.26 mm vs 1.13 mm, p=0.850) at least 6 months after surgical extraction of impacted M3. Within the limitations of the current study design, including small sample size and short follow up duration, this findings demonstrated that PSP patients presented the same hard tissue regenerative potential as compared to PHP patients. In addition, the current study reported that lower FMBS was significantly associated with more bone gain at distal of M2 (p=0.0474). It also showed that

a reduced gingival inflammation status may positively influence the tissue healing, including alveolar bone regeneration. Leung et al. (2005) demonstrated that M2 in patients who received pre-operative oral hygiene instructions and prophylaxis had a better periodontal healing after extraction of impacted M3.

Prior to extraction of M3, a deeper mean PPD (6.85 mm vs 3.61 mm) around M2 in PSP patients was found, as compared to PHP group. A significantly higher mean PPD reduction after extraction of M3 (2.43 mm vs 0.47 mm) was observed at PSP group, as compared to PHP group. It would be due to the fact that all PSP patients completed comprehensive non-surgical periodontal therapy prior to surgical extraction of M3, and thorough root surface debridement of M2 was performed during the extraction of impacted M3. Pockets with deeper PPD were found to have more probing depth reduction after non-surgical therapy (Cobb, 1996). Nevertheless, despite the greater PPD reduction, six months after extraction of M3, the current study reported a significantly higher percentage of residual deep PPD ≥ 4 mm (100.0% vs 57.9%) and PPD ≥ 5 mm (73.9% vs 10.5%) in M2 from the PSP group. With adjustment of baseline PPD at M2, M2 from PSP groups were 6.43 times more likely to present PPD ≥ 5 mm at T1. However, the difference did not reach statistical significance (p=0.0786). This finding seemed to be less robust as compared to another prospective study reporting that subjects with history of periodontitis were 41 times more likely to present PPD ≥ 4 mm after extraction of M3 (Passarelli *et al*., 2019). This was likely due to the fact that baseline PPD at M2, as a significant confounding factor, was not adjusted in the regression analysis that was run in that study. Nevertheless, in view of the higher risk for patients with history of periodontitis having deep residual pockets at M2, it would be beneficial to identify and remind this group of patients about the need to careful monitoring periodontal health of M2 even prior to the surgery. A customized approach with comprehensive periodontal therapy prior to and a thorough root surface debridement of M2 during surgical extraction of M3 should be recommended. The importance of regular maintenance and plaque control must be highlighted to the patient.

The current study included 11 patients who were less or equal to 25 years old. This subjective age was chosen as previous studies reported a higher risk of complications of M3 extraction (Chuang, Perrott, Susarla, & Dodson, 2007) and higher occurrence of residual intrabony defects >4 mm (Kugelberg, 1990) when patients were older than 25 years old. It has been reported that 4 years after M3 extraction, nearly half (44.4%) of M2 in patients older than 25 years old were associated with intrabony defects greater than 4 mm, as compared to 4.2% of younger patients (Kugelberg, 1990). It has been hypothesized that the inferior hard tissue healing at M2 in older patients was associated with a decreasing immune response to bacterial invasion with increasing age (Church & Dolby, 1978). In contrast, the current study failed to identify that patients who were younger than 25 years old had more bone gain at M2 (p=0.397). This might be due to the relatively short follow up duration (6.7 months), as it was found that intrabony defect in older patients continued to deteriorate even 2 years after the M3 extraction (Kugelberg, 1990). On the other side, the current study demonstrated 1.41 mm more PPD reduction at M2 in the older group (p=0.0376) (Table 3). This could be due to a higher percentage of older patients in the PSP group and influence from age might be overridden by the deeper baseline PPD in the older group. Univariate logistic regression with adjustment of baseline PPD showed that older patients were 4.04 times more likely to have PPD ≥ 5 mm at M2. Although, the difference did not reach statistical significance (p=0.2069). In view of the conflicting evidence, more well-designed studies that compare the periodontal hard and soft tissue healing of M2 with adjustments of other influencing factors are needed.

Conclusion

The current prospective clinical trial demonstrated that surgical extraction of impacted M3 was associated with periodontal benefits, including reduction in PPD and gain in alveolar bone at adjacent M2. Within the limitations of the current study, no difference was found in the alveolar bone gain at M2 between patients with or without periodontitis 6 months after extraction of impacted M3. However, second molars in patients with higher gingival inflammation were associated with less bone gain. In addition, patients with periodontitis and older age seemed to be associated with more PPD reduction but deeper residual PPD after extraction of impacted M3.

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