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Original research

Periodontal status of mandibular second molar after extraction of impacted mandibular third molars- a prospective clinical trial

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Purpose

Mandibular third molar (M3) extraction is the common surgical procedures carried out; however, one of the complications is development of periodontal disease in adjacent second molars (M2). Hence the purpose of this study was to evaluate the effect of extraction of M3 on the periodontal status of M2.

Materials and Methods

Study included 120 sites with mandibular M2 adjacent to the impacted M3. Plaque index(PI), gingival index(GI), probing pocket depths(PD), clinical attachment levels(CAL), Gingival recession(GR) and alveolar bone height(ABH) before and 9-12 months after surgical extraction of M3 were assessed. Patients perception was assessed using dichotomous rating. Four types of impactions(IMP) were included along with surgical cofactors like degree of impaction, flap design, bone removal, tooth sectioning.

Results

At baseline mesioangular and horizontal IMP showed greater PPD and CAL. After extraction of M3 there was significant decrease in PPD & CAL. 14% cases showed significant increase gingival recession at the distobuccal of M2. Although 10.9% of patients had an alveolar bony defect(ABD) distal to the M2, there was considerable improvement in ABH from baseline. The ABDs are mostly associated with mesioangular and horizontal IMP.

Conclusion

Extraction of impacted M3 proves to be beneficial on periodontal status of M2. However, occasionally, mesioangular and horizontal IMP are likely to develop ABD distal to M2 and hence can be followed by regenerative procedures to prevent the formation of ABD.

Keywords: *Alveolar bone defect, impacted tooth, mandibular third molar, mandibular second molar, tooth extraction*

Introduction

An impacted tooth, especially mandibular third molar (M3) which has higher impaction prevalence, requires surgical interventions more frequently (1). One common indication for surgical extraction of M3, is the prevention and/or improvement of periodontal defects in adjacent second molar(M2) (2). Several previous studies have shown that fully erupted M2 that are in close proximity to impacted M3 showed greater prevalence of periodontal disease due to colonization by periodontal pathogens (3-5). Blakey *et al.* (6) in a longitudinal study has shown that almost 25% of patients with retained and asymptomatic wisdom teeth had probing depths of at least 5 mm on the distal of the M2 and the mesial of the M3. However, surgical removal of wisdom teeth has been associated with the risk of having persistent or developing new periodontal defects at the distal aspect of the mandibular M2 (7-9).

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Conflicting reports exist regarding the influence of M3 removal on the periodontal status of the adjacent M2. Previous studies assumed the patients age, the type of impaction (IMP) and the periodontal baseline situation as the primary factors affecting periodontal healing (8,9,10). However, Coleman *et al.* (9) some have shown improvement of periodontal health distal to the M2, while others have demonstrated loss of alveolar bone with reduction of alveolar bone height(ABH) (8,10). Other studies on periodontal healing have revealed that the removal of M3 is followed by spontaneous wound healing and attachment gain even without the use of any extraneous materials (11-13).

Although several studies have addressed the problem of effect of mandibular M3 extraction, both periodontal and surgical literature lacks evidence of support to make any straight statements. The current literature calls for further studies comparing the periodontal health and extraction of M3. The hypothesis of the current study is that extraction of M3 improves the periodontal condition of adjacent M2. Hence, this study was aimed to evaluate the periodontal status of mandibular M2 after the extraction of adjacent impacted mandibular M3. The null hypothesis tested in the present study is that the removal of M3 does not affect any of the variables regarding the periodontal status of M2.

Material and Methods

Study design and ethical approval

This was a prospective clinical trial conducted at Vishnu Dental College, in accordance with Helsinki Declaration and Good Clinical Practice guidelines after obtaining ethical clearance (IEC No: IEC/VDC/MDS15 PERIO 04). Informed consent was obtained before their enrollment in the study.

Sample size estimation and study population

Sample size analysis was done using G Power 3.1 software based on an effect size of 0.67 with an alpha level of 0.05 and 20% dropout rate, it was estimated to be 154 sites. A total of 140 patients requiring unilateral (n-126) or bilateral impactions (n-14), were included after fulfilling the study requirements. Each mandibular molar was considered as a site and subjects with bilateral impactions were considered as two sites (Figure 1) 34 patients were lost to post-operative follow-up due to various reasons and hence were dropped from the study. The remaining 120 sites were assessed.

Inclusion criteria

Patient related criteria was being systemically healthy individuals in the age range of 18 to 35 years, Tooth related criteria were the presence of unilateral or bilateral impacted mandibular M3, periodontally healthy subjects (probing depths of 3mm or below and with no evidence of loss of attachment, but might be showing some signs of gingival inflammation with no bone loss confirmed by radiographs), not underwent any periodontal therapy/ use of medications in the previous 6 months

Exclusion criteria

Patient related criteria were having aggressive periodontitis, undergoing active periodontal therapy, patients undergoing orthodontic treatment, pregnancy, poor oral hygiene maintenance. Tooth related criteria were missing adjacent M2 or if the M2 is indicated for endodontic treatment, crown placement or extraction during the course of the study, presence of inflammatory changes in M3

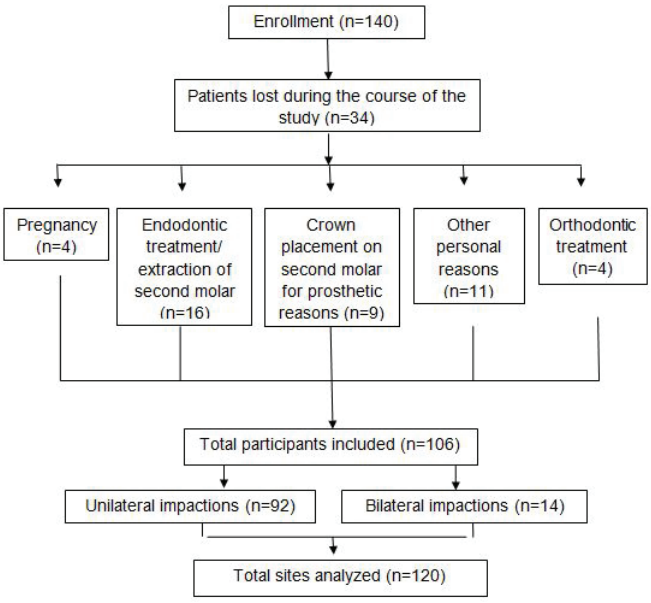

Figure 1. *Patient inclusion flowchart.*

Screening procedure

The preliminary examination included an assessment of medical and dental history including periodontal examination i.e. Plaque index (PI), Gingival index (GI), Community periodontal index (CPI), probing pocket depth (PD), Clinical attachment loss (CAL) and Gingival recession was carried out using UNC-15 probe in relation toM2 adjacent to the impacted M3 in the mandible (14,15,16). Patients perception of pain, discomfort, swelling, trismus and food lodgment were assessed as present or absent using dichotomous rating 4 weeks after M3 extraction.

Assessment of M3

A panoramic radiograph was taken at baseline to evaluate the position of the M3 (Completely or partially impacted) according to the classifications of Pell and Gregory with respect to the ascending ramus (classes I, II, and III) and with respect to the occlusal plane (types A, B, and C) (8). The difficulty index was determined with the help of Pederson's difficulty index (10).

Measurement of bone height

ABH was assessed using digital Intra Oral Periapical radiograph(IOPAR). The distance between the cemento-enamel junction (CEJ) to the crest of alveolar bone was measured using commercially available radiography measurement software AutoCAD 2015.

Surgical procedure

All the patients received scaling and oral hygiene instructions at baseline. The surgical procedure was performed by

an oral surgeon under local anesthesia with 2% lignocaine containing adrenaline (1:80,000). A triangular mucoperiosteal flap was elevated distal to the M2 providing access to the M3 from the buccal aspect using Wards or Modified Wards incision. Ostectomy was carried out with a rotary instrument followed by tooth sectioning if necessary. After extraction, the socket was inspected, curetted, and irrigated with sterile saline solution. Primary closure was achieved by placing simple interrupted sutures with 3-0 silk suture material.

0.2% chlorhexidine mouthwash (bid), Cap.Amoxicillin (500 mg, TID), Tab Diclofenac sodium (50mg, BID) were prescribedand oral hygiene instructions were reinforced. Suture removal was done 1 week after surgery. After 9 to 12 months all the clinical and radiographic parameters were evaluated. Patient perception was recorded at every follow up. Oral prophylaxis was performed one week before and 4 weeks after extraction of M3. No other periodontal procedures were performed in any of the patients.

Radiographic assessment of alveolar bone changes

Digital IOPAR were taken with long cone paralleling technique distal to M2 (17). Modified commercial film positioner Rinn XCP Instrument Kit was used to ensure the stability in the vertical and horizontal planes. An additional device was fabricated in the form of a hollow cylinder using acrylic and adapted to the positioner and the collimator to prevent unwanted movements and undesirable angulations. The measurements were done as described in a previous study (18**).**

Statistical analysis

Statistical analysis was done using SPSS 22.0 version (Armonk NY IBM, NY, USA). Student t-test for full mouth periodontal parameters at M2 region. Multiple correlation analysis between the impaction scores with other clinical parameters at M2, variables of surgical technique was done by Karl Pearson's correlation method.

Results

A total of 120 sites in 106 participants (49 males and 57 females) were taken for final data analysis. None of the patients included in the study experienced any untoward events/complications intra-operatively or post-operatively. The age of the participants in the study ranged from 18 years to 35 years with the mean age being 25.43 years. 49 males with mean age of 24.56 and 57 females with mean age of 26.32 were included.

Full mouth periodontal variables

At 9 to 12 months after M3 extraction all the clinical and radiographic parameters were evaluated. The full mouth mean PI and GI scores reduced considerably from baseline to revaluation period and the reduction was statistically significant (Table 1). A statistically significant drop in the CPI scores was observed when compared from baseline to revaluation period (Table 1).

M2 periodontal variables

For the mandibular M2 teeth there was a significant improvement in mean PD (0.87±0.67) at the distal site of M2(P<0.001) (Table 2). The PDs were observed to decrease for 54 sites (45.37%) from baseline to revaluation period. The remaining 65 sites (54.62%) exhibited no change in the PD at the end of nine months to one year after surgical extraction of impacted M3. The overall difference was seen to be statistically significant. Similarly, the CAL improved for 53 sites (44.53%) and remained unchanged for the remaining 66 sites (55.46%) post-operatively by 9-12 months which was statistically significant (Table 2).

17 sites (14.28%) showed increase in GR of which 15 sites showed 1mm increase in recession depth whereas the remaining 2 sites showed 2mm increase in recession depth. This increase was found to be statistically significant. However, no significant correlation was found between IMP and GR (Table 3).

Table 1: *Comparison between baseline (B) and 9 months to 1-year evaluation (R) in full mouth variables.*

Variables	Time period	Mean	Mean Difference	% of Mean change	P value
PI	Baseline	1.17±0.37	0.44±0.08	-37.61	<0.001*
	Re-evaluation	0.73±0.29			
GI	Baseline	1.18±0.40	0.53±0.09	-44.92	<0.001*
	Re-evaluation	0.65±0.31			
CPI	Baseline	2.66±0.90	1.43±0.43	-53.76	<0.001*
	Re-evaluation	1.23±1.33			

*Statistically significant if P<0.05.

Table 2: *Comparison between Baseline (B) and 9 months to 1-year revaluation (R) in M2 of interest variables***.**

Variables	Time period	Mean	Mean Difference	% of Mean change	P value
PI	Baseline	1.23±0.39	0.54±0.08	-43.90	<0.001*
	Re-evaluation	0.69±0.31			
GI	Baseline	1.25±0.43	0.63±0.11	-50.40	<0.001*
	Re-evaluation	0.62±0.32			
PD	Baseline	3.68±1.26	0.87±0.67	-23.64	<0.001*
	Re-evaluation	2.81±0.59			
CAL	Baseline	3.71±1.30	0.80±0.59	-21.56	<0.001*
	Re-evaluation	2.91±0.71			
GR	Baseline	0.05±0.26	0.22±0.28	440.00	<0.001*
	Re-evaluation	0.27±0.54			
ABH	Baseline	3.85±2.08	1.60±0.50	-41.56	<0.001*
	Re-evaluation	2.25±1.58			

*Statistically significant if P<0.05

The overall alveolar bone level improved at the distal aspect of M2 from before extraction to 9-12 months after extraction and this difference was statistically significant (Table 2, Figure 2,3). However, there were 13 sites (10.92%) which presented with a vertical bone defect at the distal aspect of M2, of which 7 sites were observed after extraction of mesioangular IMP (Figure 4) and 6 sites after horizontal IMP (Table 4, Figure 5).

IMP and surgical variables

The IMP was scored according to Pederson's difficulty index(DI). Out of 120 mandibular impacted M3, the spatial orientation of 50% of the M3 was mesioangular, 19% was distoangular, 17% was horizontal and 14% was vertical. The DI for the surgical extraction of the impacted molars ranged from 4-8. Higher pre-operative PD and CAL loss was seen in mesioangular and horizontal IMP followed by vertical and distoangular IMP (Table 5,6).

Multiple correlation analysis between the surgical variables including IMP, DI, presence or absence of alveolar bone defects (ABD), bone removed (BR) during extraction and tooth sectioning (TS) done or not, revealed a statistically significant correlation of ABD with BR ($P<0.05$) and TS ($P<0.05$). The sites which showed a residual alveolar vertical defect on distal aspect of M3 were associated with more bone removal and TS during the time of surgery. Also, the presence of ABD was associated only with the horizontal or mesioangular IMP among which only the latter showed statistically significant positive correlation between presence of an ABD and BR during surgery.

Table 3: *Correlation between type of impaction (IMP) and M2 of Interest variables.*

Variables	Correlation coefficient (r)	P value
IMP and B - PI	-0.158	0.147
IMP and R - PI	-0.111	0.308
IMP and B - GI	-0.169	0.119
IMP and R - GI	-0.117	0.284
IMP and B - PD	-0.329	0.002*
IMP and R - PD	-0.293	0.006*
IMP and B - CAL	-0.334	0.002*
IMP and R - CAL	-0.301	0.005*
IMP and B - GR	-0.078	0.476
IMP and R - GR	-0.134	0.220
IMP and B - ABH	-0.347	0.001*
IMP and R - ABH	-0.246	0.022*

B- Baseline; R- Revaluation *Statistically significant if $P<0.05$; IMP – Type of impaction

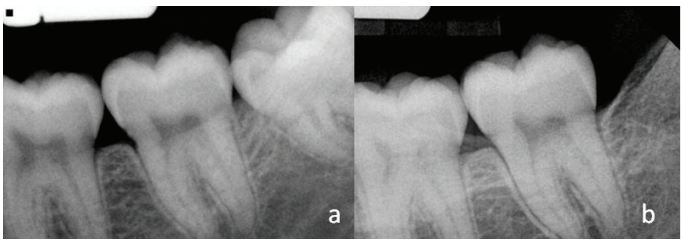

Figure 2. *Vertical IMP; a) Pre-operative radiograph; b) Post operative radiograph showing improved ABH at re-assessment period.*

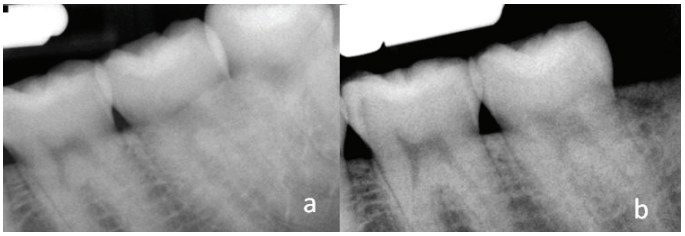

Figure 3. *Distoangular IMP; a) Pre-operative radiograph; b) Post operative radiograph showing improved ABH at re-assessment period.*

Table 4: *Multiple correlation analysis between the surgical variables.*

Variables	Correlation	IMP	DI	ABD	D	BR	TS
IMP	Pearson Correlation	1.000	0.918	0.197	0.000	-0.190	0.367
	P value		0.000*	0.069	0.997	0.080	0.001*
DI	Pearson Correlation	0.918	1.000	0.184	0.049	-0.173	0.349
	P value	0.000*		0.090	0.657	0.111	0.001*
ABD	Pearson Correlation	0.197	0.184	1.000	-0.155	-0.395	0.328
	P value	0.069	0.090		0.154	0.000*	0.002*
D	Pearson Correlation	0.000*	0.049	-0.155	1.000	0.359	-0.149
	P value	0.997	0.657	0.154		0.001*	0.172
BR	Pearson Correlation	-0.190	-0.173	-0.395	0.359	1.000	-0.598
	P value	0.080	0.111	0.000*	0.001*		0.000*
TS	Pearson Correlation	0.367	0.349	0.328	-0.149	-0.598	1.000
	P value	0.001*	0.001*	0.002*	0.172	0.000*	

*Statistically significant if $P<0.05$; IMP – Type of impaction; DI – Difficulty Index; ABD – Alveolar Bone Defect;D – Degree of impaction; BR – Bone removal;TS – Tooth sectioning

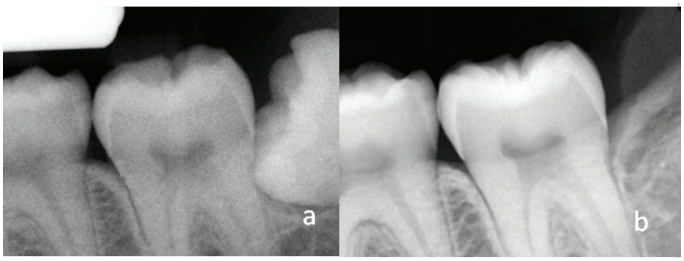

Figure 4. *Horizontal IMP; a) Pre-operative radiograph; b) Post operative radiograph showing angular defect distal to M2 at re-assessment period.*

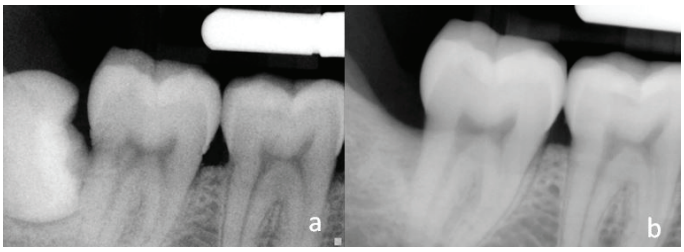

Figure 5. *Mesioangular IMP; a) Pre-operative radiograph; b) Post operative radiograph showing angular defect distal to M2 at re-assessment period.*

Table 5: *Multiple correlation analysis between the surgical variables in horizontal impaction.*

		Horizontal impaction				
		DI	**ABD**	**D**	**BR**	**TS**
DI	Pearson Correlation	1.000	-0.080	0.384	-0.283	0.423
	P Value		0.777	0.157	0.307	0.116
ABD	Pearson Correlation	-0.080	1.000	-0.185	-0.307	0.320
	P Value	0.777		0.510	0.265	0.245
D	Pearson Correlation	0.384	-0.185	1.000	0.482	-0.059
	P Value	0.157	0.510		0.069	0.834
BR	Pearson Correlation	-0.283	-0.307	0.482	1.000	-0.652
	P Value	0.307	0.265	0.069		0.008*
TS	Pearson Correlation	0.423	0.320	-0.059	-0.652	1.000
	P Value	0.116	0.245	0.834	0.008*	

*Statistically significant if P<0.05.

Patient perception

Patients perception of pain and other symptoms were assessed as presence or absence with dichotomous rating. All the M3 sites that were included were symptomatic with the patient's chief complaint mostly being pain alone (58.09%) or associated with swelling and trismus (2.85%), caries (10.47%) and food lodgment (10.47%). All patients but one reported that their symptoms had resolved completely post extraction. However, 10 patients (9.52%) out of 106 participants developed post-operative sensitivity in the region of M2 adjacent to the extraction site and 3 (2.85%) patients complained of food lodgment post operatively in the same site.

Table 6: *Multiple correlation analysis between the surgical variables in mesioangular impaction.*

		Mesioangular impaction				
		DI	**ABD**	**D**	**BR**	**TS**
DI	Pearson Correlation	1.000	-0.005	0.074	0.164	0.044
	P Value		0.975	0.638	0.294	0.779
ABD	Pearson Correlation	-0.005	1.000	-0.068	-0.346	0.209
	P Value	0.975		0.665	0.023*	0.178
D	Pearson Correlation	0.074	-0.068	1.000	0.241	-0.200
	P Value	0.638	0.665		0.120	0.197
BR	Pearson Correlation	0.164	-0.346	0.241	1.000	-0.617
	P Value	0.294	0.023*	0.120		0.000*
TS	Pearson Correlation	0.044	0.209	-0.200	-0.617	1.000
	P Value	0.779	0.178	0.197	0.000*	

*Statistically significant if P<0.05.

Among the 106, 20 patients (19.04%) felt that the surgical procedure and sequelae was very uncomfortable and 17 patients (16.19%) of them refused to undergo the same treatment again. For another 59 patients (55.23%) sequel were a bit uncomfortable but within tolerable limits.

Discussion

Fully erupted M2 that are in close proximity to impacted M3often exhibit greater prevalence of periodontal disease (9,11,19). Factors influencing the post extraction periodontal status include the patient's age, IMP, the patient's periodontal status at baseline and various surgical cofactors including flap design and technique, the amount of bone removed, suturing material (10,20,21). However, the current literature makes no clear assertion as to whether the surgical removal of an impacted wisdom tooth is beneficial or a threat to the periodontal status (7). In the present study, nine months to one year was chosen as the follow-up period considering periodontal healing process distal to the M2 is completed after a minimum period of three months (22).

In this study, multiple IMPs i.e. vertical, mesioangular, horizontal and distoangular were included. It was observed that the maximum IMP were mesioangular (50%), followed by distoangular, horizontal and vertical. Mesioangular and horizontal IMP were associated with greater preoperative PD and CAL, due to food lodgment and poor accessibility (23,24).

Extraction of impacted M3 improved both full mouth and M2, PI and GI scores from baseline to the revaluation period which are in agreement with earlier studies, where an advantage in curettage and root planing distal toM2 showed improved periodontal health (25,12). Removal of M3 provided better access for easy maintenance of oral hygiene post operatively to the distal aspect of M2 throughout the follow-up. On contrary few other studies showed no change

in PI and GI, due to failure to supervise or enhance plaque control following extraction of M3 (10, 13).

The current study demonstrated periodontal healing post extraction with reduction in PD and gain in CAL distal to M2. A previous study, showed greater reduction in PD over a post-operative period of one year (1.9 mm) which may be due greater baseline PD (22,26). If the preoperative PD was <4 mm, no therapeutic changes occurred and no further periodontal treatment was required as observed in previous randomized controlled trials (9,13,27,28). However, these were retrospective studies whereas the present study is a prospective trial. In the above mentioned retrospective studies contra lateral tooth was used as the control group which might not represent the true changes of PD and CAL, whereas the pre and postoperative measurements recorded at the same site as in the present study would give more reliable results.

Though there was a significant improvement in the CAL, around 14% of patients experienced GR post M3 extraction which could be due to ward's incision which involves a sulcular incision that does not leave intact gingival collar. No attempt was made to use any different flap technique to preserve the marginal gingiva on the buccal and distal aspect of M2 as they are not related to the flap technique (29).

ABH improved significantly distal toM2 as a result of biological tooth socket healing which is in accordance with other studies where a clinically significant bone healing was observed (30,31). On the contrary, some studies showed significant alveolar bone loss distal toM2 which was in close proximity to the extracted impacted M3 (28). Even though the follow up period of these studies was much longer (36-58 months) the fact that the same site was examined pre and postoperatively, instead of using contralateral teeth makes the present study more reliable.

In the present study, out of 120 sites 13 sites exhibited ABD post-extraction distal to M2 and were found to be associated with mesioangular and horizontal IMP as more amount of bone is removed during the extraction. The surgical removal of a fully impacted tooth usually leaves a unilateral ABD due to the removal of partial buccal wall post extraction (4,32).

Studies showing greater bone loss post extraction included a sample of wider age range (20-60) than in the present study (18-32 years old) which also may be responsible for different outcomes of the study as young patients take benefit from early surgical M3 extraction, whereas in older patients' teeth are often more angulated requiring more invasive surgery increasing the risk for bone defects (12,32). Preoperative deep pockets and older age could be independent risk factors for and residual pocket formation after M3 extraction (33).

In this study no endeavors to regenerate the alveolar bone distal to M2 were made. However, the patients were reinforced on oral hygiene habits and maintenance once a month during regular follow up visits. The present investigation demonstrated significant bone gain in majority of sites with minimal exception (11% sites). Moreover, many studies comparing regenerative procedures with spontaneous healing of sockets after extraction of M3 in young adults have reported clinically (≤2 mm) and statistically insignificant differences (33,27). However, a small benefit can be derived from the use of such regenerative interventions where the bone defect is associated with deeper mesioangular or horizontal IMP. Therefore, use of regenerative procedures such as GTR, PRP etc. should be limited to deep bone defects with severe loss of CAL of the M2, mainly in mesioangular and horizontal IMP.

Although patients had experienced discomfort during the first 5-7days after M3 extraction chemical plaque control using 0.12% Chlorhexidine Gluconate enabled efficient oral hygiene maintenance. No severe post-operative complications were reported and majority (around 88%) could perceive the benefit from the extraction of the M3. However, 16% of patients felt that the procedure was traumatic, 12% complained of sensitivity and food impaction at the extraction site due to the occurrence of gingival recession and bone defects. Careful surgical extraction with minimal trauma is essential for periodontal healing of the tissues and better patient perception.

No attempt for regeneration of bone defects was made therefore; further long term studies and randomized controlled trials using regenerative materials and different flap designs to prevent the development of alveolar bone defects and damage to the marginal soft tissue around the M2.

Conclusion

Extraction of impacted M3 proved to be beneficial to the periodontal status of the adjacent M2.Largely, the alveolar bone height improved, however sites with deeper mesioangular and horizontal impactions are at greater risk of developing alveolar bone defect postoperatively.

Türkçe özet: *Gömülü mandibular üçüncü molarların çekilmesinden sonra mandibular ikinci moların periodontal durumu- prospektif bir klinik çalışma Amaç: Mandibular üçüncü molar (M3) çekimi yaygın olarak gerçekleştirilen cerrahi işlemlerdir; ancak komplikasyonlardan biri komşu ikinci azı dişlerinde (M2) periodontal hastalık gelişmesidir. Dolayısıyla bu çalışmanın amacı, M3 ekstraksiyonunun M2'nin periodontal durumu üzerindeki etkisini değerlendirmektir. Gereç ve yöntem: Çalışma, gömülü M3'e bitişik mandibular M2'ye sahip 120 alanı içeriyordu. M3'ün cerrahi olarak çıkarılmasından önce ve 9-12 ay sonra plak indeksi (PI), dişeti indeksi (GI), sondalama cep derinlikleri (PD), klinik ataşman seviyeleri (CAL), dişeti çekilmesi (GR) ve alveolar kemik yüksekliği (ABH) belirlendi. değerlendirildi. Hasta algısı, ikili derecelendirme kullanılarak değerlendirildi. Gömüklük derecesi, flep tasarımı, kemik kaldırılması, diş kesiti gibi değişkenlerle birlikte dört tip gömük diş (IMP) çalışmaya dahil edildi. Bulgular: Başlangıçta mezioangular ve yatay IMP daha yüksek PPD ve CAL gösterdi. M3'ün ekstraksiyonundan sonra PPD ve CAL'de önemli bir düşüş oldu. Vakaların %14'ü M2'nin distobukkalinde dişeti çekilmesinde önemli artış gösterdi. Hastaların %10,9'unda M2'nin distalinde alveolar kemik defekti (ABD) olmasına rağmen, ABH'de başlangıca göre önemli bir iyileşme belirlendi. ABD'ler çoğunlukla mezioangular ve yatay IMP ile ilişkili bulundu. Sonuç: Etkilenen M3'ün çıkarılmasının M2'nin periodontal durumu üzerinde faydalı olduğu kanıtlanmıştır. Bununla birlikte, bazen, mezioangular ve yatay IMP'nin M2'nin distalinde ABD geliştirmesi muhtemeldir ve bu nedenle ABD oluşumunu önlemek için rejeneratif prosedürler takip edilebilir. Anahtar kelimeler: alveolar kemik defekti, gömülü diş, mandibular üçüncü molar, mandibular ikinci molar, diş çekimi*

Ethics Committee Approval: This was a prospective clinical trial conducted at Vishnu Dental College, in accordance with Helsinki Declaration and Good Clinical Practice guidelines after obtaining ethical clearance (IEC No: IEC/VDC/MDS15 PERIO 04).

Informed Consent: Participants provided informed constent.

Peer-review: Externally peer-reviewed.

Author contributions: SS, SNVSG, CDD participated in designing the study. SS, KSVR, GSP participated in generating the data for the study. SS, VB participated in gathering the data for the study. SS, SNVSG, KSVR participated in the analysis of the data. SS, CDD wrote the majority of the original draft of the paper. SS, SNVSG, GSP, CDD participated in writing the paper. SS, KSVR, GSP, VB have had access to all of the raw data of the study. SS, SNVSG, KSVR, CDD have reviewed the pertinent raw data on which the results and conclusions of this study are based. SS, SNVSG, KSVR, GSP, CDD, VB have approved the final version of this paper. SS, SNVSG, KSVR guarantee that all individuals who meet the Journal's authorship criteria are included as authors of this paper.

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References

1. Lima CJ, Silva LC, Melo MR, Santos JA, Santos TS. Evaluation of the agreement by examiners according to classifications of M3. Med Oral Patol Oral Cir Bucal 2012;17:281–316. [CrossRef]
2. Lieblich SE, Dym H, Fenton D. Dentoalveolar Surgery. J Oral Maxillofac Surg 2017;75:50-73. [CrossRef]
3. Santosh P. Impacted Mandibular third molars: Review of Literature and a Proposal of a Combined Clinical and Radiological Classification. Ann Med Health Sci Res 2015;5:229-34. [CrossRef]
4. Zhang Y, Chen X, Zhou Z, Hao Y, Li H, Cheng Y, Ren X, Wang X. Effects of Impacted Lower third molarextraction on Periodontal Tissue of the Adjacent M2. Ther Clin Risk Manag 2021;17:235-247. [CrossRef]
5. Lytle JJ. Etiology and indications for the management of impacted teeth. Northwest Dent 1995;74:23–32.
6. Blakey GH, Marciani RD, Haug RH, Phillips C, Offenbacher S, Pabla T, et al. Periodontal pathology associated with asymptomatic M3. J Oral Maxillofac Surg 2002;60:1227–33. [CrossRef]
7. Petsos H, Korte J, Eickholz P, Hoffmann T, Borchard R. Surgical removal of third molars and periodontal tissues of adjacent second molars. J Clin Periodontol 2016;43:453–60. [CrossRef]
8. Coleman M, McCormick A, Laskin DM. The incidence of periodontal defects distal to the maxillary second molar after impacted third molar extraction. J Oral Maxillofac Surg 2011;69:319–21. [CrossRef]
9. Dodson TB. Management of mandibular third molar extraction sites to prevent periodontal defects. J Oral Maxillofac Surg 2004;62:1213–24. [CrossRef]
10. Sammartino G, Tia M, Bucci T, Wang HL. Prevention of Mandibular third molar Extraction-Associated Periodontal Defects: A Comparative Study. J Periodontol 2009;80:389-96. [CrossRef]
11. Kan KW, Liu JK, Lo E, Corbet EF, Leung WK. Residual periodontal defects distal to the mandibular second molar 6–36 months after impacted third molar extraction. J Clin Periodontol 2002;29:1004-11. [CrossRef]
12. Kugelberg CF, Ahlstro¨m U, Ericson A, Hugoson A, Kvint S. Periodontal healing after impacted lower third molar surgery in adolescents and adults. A prospective study. Int J Oral Maxillofac Surg 1991;20:18–24. [CrossRef]
13. Krausz AA, Machtei EE, Peled M. Effects of lower third molar extraction on attachment level and alveolar bone height of the adjacent second molar. Int J Oral MaxillofacSurg 2005;34:756–60. [CrossRef]
14. Silness J, Loe H. Periodontal disease in pregnancy. Ii. Correlation between oral hygiene and periodontal condition. Acta OdontolScand 1964;22:121–35. [CrossRef]
15. Loe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. Acta OdontolScand 1963;21:533–51. [CrossRef]
16. Montero J, Mazzaglia G. Effect of removing an impacted mandibular third molar on the periodontal status of the mandibular second molar. J Oral MaxillofacSurg 2011;69:2691–97. [CrossRef]
17. White RP, Jr, Fisher EL, Phillips C, Tucker M, Moss KL, Offenbacher S. Visible third molar as risk indicator for increased periodontal probing depth. J Oral MaxillofacSurg 2011;69:92–103. [CrossRef]
18. Stephens RJ, App GR, Foreman DW. Periodontal evaluation of two mucoperiosteal flaps used in removing impacted mandibular third molar. J Oral MaxillofacSurg 1983;41:719–24. [CrossRef]
19. Ash MM. M3 as periodontal problems. Dent Clin North Am 1964;45: 51–61. [CrossRef]
20. Chin Quee TA, Gosselin D, Millar EP, Stamm JW. Surgical removal of the fully impacted mandibular third molar. The influence of flap design and alveolar bone height on the periodontal status of the second molar. J Periodontol 1985;56:625–30. [CrossRef]
21. Archer W. Oral and maxillofacial surgery. Philadelphia: Saunders; 1975.
22. Faria AI, Gallas-Torreira M, Lopez-Raton M. Mandibular second molar periodontal healing after impacted third molar extraction in young adults. J Oral MaxillofacSurg 2012;70:2732–2741. [CrossRef]
23. Ylipaavalniemi P, Turtola L, Rytomaa I, Helminen S, Jauhiainen L. Effect of position of wisdom teeth on the visible plaque index and gingival bleeding index. Proc Finn Dent Soc 1982;78:47–9.
24. Giglio JA, Gunsolley JC, Laskin DM, Short K. Effect of removing third molar on plaque and gingival indices. *J Oral MaxillofacSurg* 1994;52:584–87. [CrossRef]
25. Kruger GO. Oral & Maxillofacial Surgery. St Louis (MO): Mosby; 1984.
26. Kaldahl WB, Kalkwarf KL, Patil KD, Molvar MP, Dyer JK. Long-term evaluation of periodontal therapy: I. Response to 4 therapeutic modalities. J Periodontol 1996;67:93–102. [CrossRef]
27. Dodson TB. Is there a role for reconstructive techniques to prevent periodontal defects after third molar surgery? J Oral MaxillofacSurg 2005;63:891–96. [CrossRef]
28. Peng KY, Tseng YC, Shen EC, Chiu SC, Fu E, Huang YW. Mandibular second molar periodontal status after third molar extraction. J Periodontol 2001;72:1647-51. [CrossRef]
29. Prósper AA, Mira GB, Morón LC, Diago PM. Distal probing depth and attachment level of lower second molar following surgical extraction of lower third molar: a literature review. Med Oral Patol Oral Cir Bucal 2010;15:755-59. [CrossRef]
30. Faria AI, Gallas-Torreira M, López-Ratón M, Crespo-Vázquez E, Rodríguez-Núñez I, López-Castro G. Radiological infrabony defects after impacted mandibular third molar extractions in young adults. J Oral Maxillofac Surg 2013;71:2020-28. [CrossRef]
31. Kugelberg CF, Ahlstrom U, Ericson S, Hugoson A, Kvint S. Periodontal healing after impacted lower third molar surgery in adolescents and adults. A prospective study. Int J Oral Maxillofac Surg 1991a;20:18–24. [CrossRef]
32. Aniko-Włodarczyk M, Jaroń A, Preuss O, Grzywacz A, Trybek G. Evaluation of the Effect of Surgical Extraction of an Impacted Mandibular third molar on the Periodontal Status of the second molar -Prospective Study. J Clin Med 2021 16;10:2655. [CrossRef]
33. Passarelli, PC, Lajolo, C, Pasquantonio, G, et al. Influence of mandibular third molar surgical extraction on the periodontal status of adjacent second molar. J Periodontol 2019; 90: 847– 855. [CrossRef]