RESEARCH

The Effects of Orthognathic Surgery on Periodontal Status

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ABSTRACT

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Background: The aim of this study was to investigate the effects of orthognathic surgery on periodontium in the 3rd and 6th months after the operation.

Methods: In a total of 10 orthognathic surgery patients (7 females, 3 males, mean age 23.2 ± 4.83), full mouth clinical periodontal measurements such as plaque index (PI), gingival index (GI), probing depth (PD), bleeding on probing (BOP), clinical attachment level (CAL), and mobility (M) were performed before the surgical procedure (T_0) at all teeth except the third molars. Six of these patients underwent double jaw orthognathic surgery, 2 patients sagittal split ramus osteotomy, and 2 patients Le Fort I osteotomy. The same full mouth clinical periodontal measurements were repeated in the 3rd (T_1) and 6th (T_2) months after surgery.

Results: There was no statistically significant difference between the T_0 and T_1 and T_2 values in any of the parameters (PI, GI, PD, BOP, CAL, and M) at any of the regions measured (maxillary teeth, mandibular teeth, or full mouth).

Conclusion: Within the limits of this study, it has been observed that orthognathic surgical treatments do not have a significant effect on periodontal status. However, further studies are needed before final conclusions can be provided.

KEYWORDS

Malocclusion, Orthognathic Surgery, Periodontal Attachment Loss, Periodontal Index

ÖZ

Ortognatik Cerrahinin Periodontal Durum Üzerine Etkileri

Amaç: Bu çalışmanın amacı ortognatik cerrahinin periodonsiyum üzerine etkilerini ameliyattan sonraki 3. ve 6. aylarda araştırmaktır.

Gereç ve Yöntemler: Toplam 10 ortognatik cerrahi hastasında (7 kadın, 3 erkek, ortalama yaş 23,2 ± 4,83), plak indeksi (Pİ), gingival indeks (Gİ), sondalama derinliği (SD), sondalamada kanama (SK), klinik ataşman seviyesi (KAS) ve mobilite (M) gibi tüm ağız klinik periodontal ölçümler cerrahi işlemden önce (T_0) üçüncü büyük azı dişler hariç tüm dişlerde gerçekleştirildi. Bu hastaların 6'sına çift çene ortognatik cerrahi, 2 hastaya sagital split ramus osteotomisi ve 2 hastaya Le Fort I osteotomisi uygulandı. Ameliyat sonrası 3. (T_1) ve 6. (T_2) aylarda aynı tüm ağız klinik periodontal ölçümler tekrarlandı.

Bulgular: Ölçülen bölgelerin hiçbirinde (maksiller dişler, mandibular dişler veya tüm ağız) herhangi bir parametrede (Pİ, Gİ, SD, SK, KAS ve M) T_0 ile T_1 ve T_2 değerleri arasında istatistiksel olarak anlamlı bir fark yoktu.

Sonuç: Bu çalışmanın sınırları dahilinde ortognatik cerrahi tedavilerin periodontal durum üzerine anlamlı bir etkisinin olmadığı görülmüştür. Bununla birlikte, nihai sonuçlara varılmadan önce daha fazla çalışmaya ihtiyaç vardır.

ANAHTAR KELİMELER

Maloklüzyon, Ortognatik Cerrahi, Periodontal Ataşman Kaybı, Periodontal İndeks

INTRODUCTION

Orthognathic surgical treatments are attempts to eliminate skeletal incompatibilities and to provide an appropriate anatomical, aesthetic, and functional relationship in patients with congenital or acquired skeletal deformities. Orthognathic surgical treatments in adults enable rapid changes in jaw functions such as facial appearance, breathing, chewing, swallowing, and speech.[1]

Periodontal disease is a chronic inflammatory disease caused by the interaction between bacterial dental plaque and host response.[2] During the wound healing process after orthognathic surgery, patients have complaints of pain, swelling, and limited mouth opening. However, in order to ensure intact bone healing in osteotomy areas and to create immobility between the jaws, interocclusal splints are administered to patients. All these conditions can lead to the impaired oral hygiene of the patients, increased bacterial dental plaque, and/or change of microbial content, resulting in periodontal disease. In addition to these possible side effects of orthognathic surgery, the periodontium of teeth close to osteotomies performed during surgery tend to be affected by damage and scar tissue.[3-5]

Correction of malocclusions with orthognathic surgery may reduce the risk of periodontal disease. Malocclusion increases the risk of periodontal disease

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by complicating plaque control and causing excessive forces on the teeth through occlusal trauma.[6,7] There are studies showing that occlusal trauma does not cause periodontal disease but increases its severity.[8,9]

Another issue that concerns orthognathic surgery and periodontal status is mouth breathing. There has been a long-standing perception that mouth breathing exacerbates marginal gingivitis.[10] While mouth breathing is so important in terms of periodontal condition, orthognathic surgical treatments affect the state of mouth breathing by changing the upper airway volume.[11,12]

Considering all these interactions, the aim of this study was to investigate the effects of orthognathic surgery on the periodontal condition in the 3rd and 6th months after the operation.

MATERIAL AND METHODS

Due to the deformities in the upper and lower jaws, the patients who were admitted to Necmettin Erbakan University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery were informed about this study. In a total of 10 patients (7 females, 3 males, mean age 23.2 ± 4.83) who agreed to participate to this study (Table 1), full mouth clinical periodontal measurements such as plaque index (PI),[13] gingival index (GI),[14] probing depth (PD), bleeding on probing (BOP), clinical attachment level (CAL), and mobility (M)[15] were performed before the surgical procedure (T_0) at 6 sites (mesio-buccal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual, and disto-lingual) of all teeth except the third molars. Six of these patients underwent double jaw orthognathic surgery, 2 patients sagittal split ramus osteotomy, and 2 patients Le Fort I osteotomy (Table 1). After surgeries, the same full mouth clinical periodontal measurements were repeated in the 3rd (T_1) and 6th (T_2) months.

Table 1.

Demographic information of the patients, applied surgical methods, and amounts of movement.

Patient No	Age	Gender	Skeletal anomaly	Maxillary LF-I	Mandibular SSRO
1	19	F	Class-III	8 mm advancement	6 mm set-back
2	21	M	Class-III	5 mm advancement	4 mm set-back
3	22	F	Class-III	5 mm advancement	4.5 mm set-back
4	20	F	Class-III	3 mm advancement	3 mm set-back
5	30	M	Class-III	7 mm advancement	7 mm set-back
6	18	F	Class-II	-	14 mm advancement
7	17	F	Class-III	6 mm advancement	-
8	28	F	Class-III	5.5 mm advancement	4 mm set-back
9	20	F	Class-II	-	7.5 mm advancement
10	20	M	Class-III	5.5 mm advancement	-

F: Female, M: Male, LF-I: Le Fort I, SSRO: Sagittal Split Ramus Osteotomy

All of the patients were kept in intermaxillary wire fixation with 0.022-inch slot MBT orthodontic brackets (Dentaurum, Ispringen, Germany) bonded to teeth for a period of 2 weeks after surgery. Participants were prescribed a 0.12 % chlorhexidine digluconate mouthwash to use twice a day during this period. Cefaclor 1000 mg effervescent tablet was also prescribed to be used twice a day for 10 days, postoperatively. Dexketoprofen, a nonsteroidal anti-inflammatory, was used as a pain medication. A dressing was applied to the entire mouth with pressurized sterile saline, once every two days during the intermaxillary fixation period. After the completion of intermaxillary fixation for 2 weeks, patients were instructed that they could start brushing, gently and carefully.

There were orthodontic brackets and arch wires on the teeth of the patients as a part of their orthodontic treatment at all measurements performed at T_0, T_1, and T_2. Patients whose orthodontic treatments ended within 6 months after the operation were not included due to

the deterioration in the standardization of measurements between the presence and absence of fixed orthodontic appliances.

In addition, the following conditions were determined as exclusion criteria because they may cause complications in orthognathic surgical procedures and may affect the periodontal status:

- Systemic diseases,
- Drugs that will affect mucosal healing and bone structure,
- Immunosuppressive or psychiatric medications,
- Symptoms of acute illness,
- Patients under the age of 18,
- Pregnancy, breastfeeding and smoking.

For calibration, the same observer (ÇE) performed all periodontal measurements using a conventional manual periodontal probe (Kohler, Kohdent Medizintechnik, Stockach, Germany) with Williams markings. All surgical procedures were performed by the same surgeon (AE). The orthodontic preparations for orthognathic surgery and the orthodontic treatments before and after surgery were performed by two orthodontists (AES, EAE).

This study was approved by The Ethical Committee of Nevsehir Hacı Bektaş Veli University with n. 2019.17.128 and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000. An informed consent form was obtained from all to use their data in this study.

Whether the samples in the study conformed to the normal distribution was determined by Shapiro Wilk test. If the samples showed normal distribution, One Way ANOVA was used, if the samples did not show normal distribution, the Kruskal-Wallis test was used. Tukey test after One Way ANOVA and Bonferroni (Dunn) method after Kruskal-Wallis were used as multiple comparison test. All analyses were conducted using statistical software (SigmaPlot 12.5, Systat Software Inc., San Jose, CA, USA) and corrected p values are presented. The level of significance was set to $p<0.05$.

RESULTS

In the study, the data were evaluated as before surgery (T_0), 3 months after surgery (T_1), and 6 months after surgery (T_3). Data obtained from maxillary, mandibular and full mouth periodontal measurements were analyzed separately. There was no statistically significant difference between T_0 and T_1 and T_2 values in any of the parameters (PI, GI, PD, BOP, CAL, and M) and at any of the region (maxillary teeth, mandibular teeth or full mouth) (Table 2).

Table 2.

Maxillary teeth, mandibular teeth and full mouth periodontal measurements at T_0, T_1, and T_2.

Measurement region	Periodontal measurements	T0 MV ± SD	T1 MV ± SD	T2 MV ± SD	p value
Maxillary teeth	PI	0.91 ± 0.33	0.94 ± 0.22	0.86 ± 0.26	p=0.330
	GI	1.22 ± 0.29	1.22 ± 0.21	1.09 ± 0.26	p=0.093
	PD	1.87 ± 0.41	2.02 ± 0.49	1.86 ± 0.38	p=0.558
	BOP	0.38 ± 0.15	0.39 ± 0.14	0.29 ± 0.11	p=0.258
	CAL	0.24 ± 0.25	0.31 ± 0.31	0.31 ± 0.31	p=0.252
	M	0.02 ± 0.06	0.03 ± 0.07	0.03 ± 0.07	p=0.830
Mandibular teeth	PI	1.29 ± 0.46	1.56 ± 0.33	1.41 ± 0.37	p=0.321
	GI	1.31 ± 0.29	1.41 ± 0.23	1.28 ± 0.24	p=0.504
	PD	1.63 ± 0.33	1.89 ± 0.35	1.70 ± 0.29	p=0.125
	BOP	0.46 ± 0.22	0.54 ± 0.20	0.41 ± 0.19	p=0.354
	CAL	0.26 ± 0.32	0.32 ± 0.34	0.35 ± 0.35	p=0.492
	M	0.02 ± 0.07	0.05 ± 0.08	0.06 ± 0.09	p=0.397
Full mouth	PI	1.09 ± 0.38	1.25 ± 0.26	1.12 ± 0.28	p=0.536
	GI	1.26 ± 0.27	1.31 ± 0.21	1.18 ± 0.22	p=0.165
	PD	1.75 ± 0.33	1.95 ± 0.40	1.78 ± 0.32	p=0.120
	BOP	0.42 ± 0.16	0.46 ± 0.16	0.35 ± 0.13	p=0.260
	CAL	0.25 ± 0.20	0.31 ± 0.23	0.33 ± 0.23	p=0.474
	M	0.02 ± 0.04	0.04 ± 0.06	0.05 ± 0.06	p=0.444

MV ± SD: Mean values ± standard deviation
T_0: before surgery, T_1: 3 months after surgery, and T_2: 6 months after surgery.
PI: plaque index, GI: gingival index, PD: probing depth, BOP: bleeding on probing, CAL: clinical attachment level, M: mobility.

DISCUSSION

Controversial results have been reported by previous studies on whether orthognathic surgery has an effect on periodontal tissues. In one of these previous studies, Weinspach et al.[5] observed gingival recession more frequently in areas adjacent to osteotomies after maxillary Le Fort I and mandibular sagittal split ramus osteotomies, and they attributed this to surgical trauma and postoperative scar formation. In the same study, the probing depth was determined to be higher than the periodontal measurements after the procedure. In another study in which short-term effects of orthognathic surgery on periodontal tissues were reported, it was notified that orthognathic surgery caused a statistically significant increase in the occurrence of gingival recession.[4] Supporting the results of these studies, Schultes et al.[3] found that the incidence of periodontal lesions in teeth adjacent to the osteotomy sites in patients who underwent segmental osteotomy was higher than the average prevalence of periodontal lesions in the general population.

However, there are studies suggesting that orthognathic surgery does not cause changes in the

periodontium, similar to our study. In one of these studies, in which patients with class III malocclusion were treated with inferior subapical osteotomy, periodontal status was reported to be stable in the regions adjacent to the osteotomy site.[16] Likewise, Ari-Demirkaya et al.[17] did not report a significant difference between the plaque and gingival index scores they performed before orthognathic surgery (double jaw surgery: Le Fort I and bilateral sagittal split ramus osteotomies) and after an average of 7.4 months. They also reported no significant difference in alveolar bone height and sulcus depth except for only one surface of a tooth.

Malocclusion makes plaque control difficult and increases the excessive forces on the teeth.[6-9] It would not be wrong to think that the correction of malocclusion with orthognathic surgery would improve periodontal health. Although it was not statistically significant, all measurements (PI, GI, PD, and BOP) except CAL and M showed a trend of worsening in the third month and an improvement in the sixth month. Perhaps this non-statistical result in our study may be due to the short period of 6 months to evaluate the effect of correct occlusion after orthognathic surgery on periodontal status. In a 10-year follow-up study comparing the periodontal status of two groups of patients with skeletal deformities who received orthodontic treatment alone and combined orthodontic treatment with Le Fort I osteotomy, Carrol et al.[18] reported that there was no significant difference between the groups in plaque index, gingival index, attachment level and mobility.

To the best of our knowledge, there is no conventional dental hygiene and postoperative care procedure after orthognathic surgery in the literature. In fact, there are not enough studies on this subject. The results of a controlled clinical trial which tested different hygiene methods after reconstructive maxillofacial surgery with intermaxillary fixation afterwards showed that the group employing only a water flosser had less inflammation in the attached gingiva than the group using a chlorhexidine digluconate mouthwash and less plaque accumulation and papillary inflammation than the group using the sulcus brush.[19] In fact, this result is not very surprising because there are current studies showing that water flosser is more effective in removing plaque and preventing gingival inflammation than methods known to be very effective such as dental floss and interdental brush.[20,21] However, we observed that the postoperative care procedure of the participants in this study did not cause a significant increase in dental plaque and gingival inflammation indices. One reason for this may be the dressing procedure performed with pressurized sterile saline during intermaxillary fixation, similar to the function of water flosser.

We planned this study considering that an operation of this scale, which causes intraoral wounds very close to the periodontal structures, disrupts the chewing pattern and oral hygiene routine for a considerable time, changes occlusion, and affects mouth breathing status by altering the upper airway volume may have reversible or irreversible effects on the periodontium. However, within the limits of our study, we did not observe a significant effect of orthognathic surgery on periodontal status. Therefore, it may be thought that there is no point in avoiding orthognathic surgery by worrying about the possible negative effects of the healing process on periodontal health when the correct care and hygiene practices are applied after the operation, and this surgical treatment may even have long-term benefits to the periodontium.

CONCLUSIONS

Within the limitations of the present study, we observed that orthognathic surgery did not have any significant effect on periodontal tissues during the 3- or 6-month periods. However, further studies are needed before final conclusions can be provided.

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