The Effectiveness of Occlusal Adjustment Procedures for the Treatment of Food Impaction: Nine Clinical Cases

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ABSTRACT

The purpose of this study was to determine whether dynamic occlusal contacts can cause food impaction and the effectiveness of occlusal adjustment in the treatment of food impaction in the molar area as an alternative to restorative or prosthetic treatment. Occlusion and the periodontal condition were analyzed in nine patients complaining of food impaction in their molar areas. The obtained data included mobility, pocket depth, fremitus, proximal contact status, working or balancing interference, and bone resorption. Nine patients complaining of food impaction at posterior molar area were treated through the occlusal adjustment and examined every other week for about 3 months. An occlusal adjustment procedure to change from group function to canine guidance or partial group function eliminated food impaction in all but one mandible. The deep pocket depth of the molars gradually decreased, and the mobility of each molar decreased to normal in three of the nine cases with abnormal mobility. The results of this study suggest that occlusal interference and heavy working contacts on the molars can cause food impaction in the molar area and that a simple occlusal adjustment could be the optimal choice for treating food impaction.

Key words : Food impaction, Occlusal interference, Occlusal adjustment, Mobility, Proximal contact

INTRODUCTION

There has been considerable controversy over the relationship between occlusion and periodontal destruction throughout the history of dentistry. Some researchers have stated that trauma from occlusion (TFO) can play a causative role in periodontal disease[1-7], where others have strongly advocated that there is no relationship between occlusal force control and periodontal treatment[8-13]. Resolving this argument requires an understanding of whether occlusal force can exacerbate the progression of periodontitis and the importance of occlusal force control in periodontal treatment.

TFO can damage the periodontium in a similar way to orthodontic force, with the changes to the surrounding periodontium varying with the force level[14]. Clinical signs induced by TFO include bone resorption around the affected teeth, periodontal ligament (PDL) necrosis, tooth mobility and movement of the tooth[3,15-18]. Especially, mobility is caused by TFO in the presence of occlusal interference[16,19], Mühlemann stated that pathologic mobility is induced by occlusal malfunction, and defined TFO as "submicroscopic or microscopic periodontal membrane injury caused by reversible pathological mobility"[20]. However, this study did not conclusively show the association between tooth mobility and periodontal destruction.

Most dentist often face the problem of food impaction,

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which is defined as the forceful wedging of food through occlusal pressure into interproximal spaces[21]. This is one of the most frequent complaints of patients, and can be a psychological irritant. The symptom is similar to radiating pain, and the initiation and progression of periodontal disease[21-23].

The etiology of food impaction has been discussed in various ways. According to existing research, the uneven marginal ridges, plunger cusps, an excessive anterior overbite, open contacts and defective restorations are the predisposing factors of food impaction[19]. Uneven adjacent marginal ridges reportedly create a step that encourages food impaction, with cusps that tend to forcibly wedge food interproximally being referred to as "plunger cusps" that must be reduced to prevent food impaction[22,25-28]. Also, the effects of proximal tooth contacts as the etiology of food impaction have also been studied. The prevalence of food impaction has been reported to be clinically observed in both open and tight contacts[9,15,19,22,24,26,29]. Food impaction in areas of tight contact can be caused by an inadequate food escape groove, uneven marginal ridge and an overcontoured occluding cusp[15,22,24,26]. Newell et al. introduced a technique of occlusal adjustment for food impaction in the presence of a tight proximal contact to correct anatomical abnormalities such as marginal ridge relationships, occlusal anatomy and plunger cusp[30].

The treatment modality of the present study was based on the hypothesis that undesirable tooth contacts such as guiding contacts on maxillary second molars or balancing interferences can cause changes to the contact status between teeth during chewing, especially mandibular lateral chewing, which can provoke food impaction. There have been few reports on the relationship between food impaction and occlusal discrepancies. The purpose of this study was to elucidate whether occlusal discrepancies could be a causative factor of food impaction and whether simple occlusal adjustment for removing occlusal discrepancies could be the optimal choice for treating food impaction.

MATERIALS AND METHODS

Nine patients who visited Yonsei University Dental Hospital between January and July 2008 complaining of food impaction between the molar area with local periodontal problems at the corresponding site were included in this study. Dental records were reviewed to obtain data on their treatment procedures and results retrospectively. All patients were 38~54 years old and had no specific oral habits that might have affected the oral conditions. They had no systemic disease, temporomandibular disease, missing teeth or history of orthodontic treatments. Eight of the nine cases were related to maxillary molars, with only one case involving mandibular molars. Table 1 lists the occlusal status of the involved teeth on oral examinations performed prior to the treatment.

The dental history-taking showed no indication of bruxism, but flat occlusal surfaces and wear facets on molars were noticed in routine clinical oral examinations. All the patients whose problem sites were maxillary teeth had group function guided from the canine to the second molar, and suffered from food impaction between the first and second molars, and fremitus (i.e., palpable deflection of teeth during either mandibular closure or excursion movement)

Table 1. *Occlusal status and periodontal condition prior to treatment*

Case	Age (yr)	Sex	Sites	Fremitus	Pocket depth (mm)	Balancing interference	Working guidance	Contact at rest	Mobility	Bone loss
1	46	M	#26, 27	Yes	6~7	No	Group function	Tight	++(#27) + (#26)	Yes
2	46	M	#16, 17	Yes	3~7	No	Group function	Tight	+ (#17)	Yes
3	54	F	#47, 48	No	4	Yes	Group function	Loose		No
4	52	M	#26, 27	Yes	5	No	Group function	Tight		No
5	41	F	#16, 17	Yes	4~5	No	Group function	Tight		No
6	49	M	#16, 17	Yes	2~6	No	Group function	Loose		Yes
7	50	M	#15~17	Yes	5	No	Group function	Tight		No
8	42	M	#26, 27	Yes	7	Yes	Group function	Loose	++(#27)	Yes
9	38	M	#16, 17	Yes	5	No	Group function	Tight		No

Tight contact: resistance felt in flossing, with a click sound
Loose contact: low resistance felt, but no open gap
Bone loss: Considering gingival swelling, the initial periodontal pocket depth up to 5 mm is considered as bone loss "no"

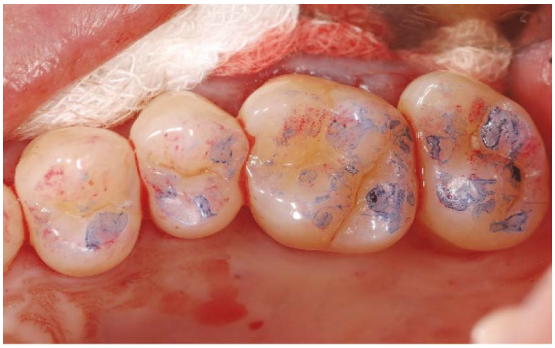

Figure 1a. Occlusal view before occlusal adjustment in case 1. Note the heavy and wide working guidance in the first and second molars. Red color indicates lateral guidance contact; blue color indicates centric contact.

Figure 1b. Occlusal view after occlusal adjustment in case 1. Note all occlusal contacts were removed except the centric contacts on the first and second molars.

that gradually escalated posteriorly, so that the tension of the fremitus was greatest at the second molar[31]. However, balancing interferences on the lingual incline on the buccal cusp were noticed in one mandibular case, but fremitus could not be verified because the maxillary molars overlapped the mandibular molars.

The proximal contacts between the adjacent teeth in the rest state were normal or tight in all but three cases involving the mandible and two maxillary molar cases showing loose contact states. The presence of adequate occlusal grooves, uneven marginal ridges and prominent cusp opposing the contact were examined. But these factors appeared to be unrelated to the food impaction in these cases. Treatments included occlusal adjustment to eliminate undesirable occlusal contacts as well as periodontal treatment to remove the local inflammation at the same time.

Routine periodontal treatments started with scaling and subsequent subgingival curettage, and we simultaneously changed the occlusion scheme by completing occlusal adjustments from group function to mutually protected occlusion where possible, if those procedures required the excessive reduction of the teeth materials to induce structural destruction or hypersensitivity, our goal was to change the occlusal status to partial group function.

The removal of the minimal amount of tooth material necessary to achieve the goal treatment was performed without inducing hypersensitivity with stone points under water coolant. Wide centric contacts were corrected into point contacts and working guidance on the first and second molars in the maxilla were removed, and any balancing interferences on the mandibular molar were also eliminated followed by surface polishing with rubber points (Fig 1a, 1b). All these procedures required multiple appointments and each patient was reevaluated 1~2 weeks later and questioned about the food impaction condition. Additional occlusal corrections were applied if the symptoms like food impaction or fremitus remained. The patients were examined three or four times every other week.

RESULTS

All patients reported that the condition of food impaction improved after two or three periodontal treatments and occlusal adjustments without correction of the contact status. During about the 3 months each patient was re-evaluated with 2-week interval after occlusal adjustment on the food impaction, hypersensitivity, and any symptom related TMD. According to the overall oral examination, in maxillary cases the original mobility of each molar decreased to 0 degree. In addition, the deep pocket depths of the second and first molars gradually reduced. No fremitus was found by tactile examination and interproximal bone level appeared to be improved according to the periapical radiographs (Fig 2a, 2b).

The effects of removing occlusal discrepancy might be less in mandibular cases than that in maxillary cases. Contacts that were originally not tight in the maxilla improved to being tight, but in one mandibular case a slightly loose contact persisted resulting in a residual food impaction tendency. Table 2 lists the oral presentations after the occlusal adjustment procedures.

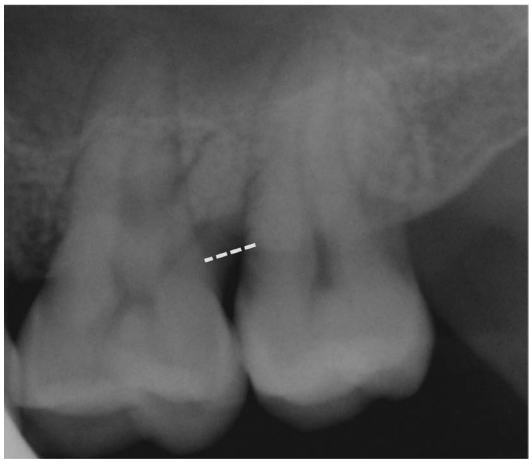

Figure 2a. Radiographic view before treatment in case 1. Note the interproximal bone resorption. The bone height may be slightly different depending on the radiographic angle. In Fig 2a and 2b, the improvement of bone height was evaluated by the ridge line of the interdental septum paralleling the line between the cement-enamel border of adjacent teeth.

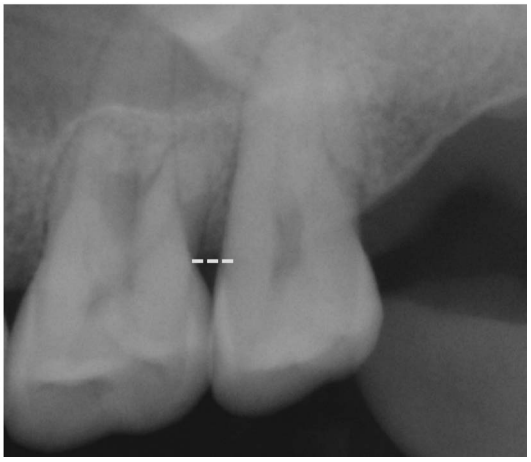

Figure 2b. Radiographic view at 3 months later after treatment. It shows the healing state of the interproximal bone. The bone height may be slightly different depending on the radiographic angle. In Fig 2a and 2b, the improvement of bone height was evaluated by the ridge line of the interdental septum paralleling the line between the cement-enamel border of adjacent teeth.

Table 2. Results of the occlusal adjustment procedure

Patient No.	Sites	Disappearance of food impaction	Pocket depth (mm)	Contact at rest	Mobility
1	#26, 27	Yes	3~4	Tight	–
2	#16, 17	Yes	3~4	Tight	–
3	#47, 48	Incomplete	3	Slightly loose	–
4	#26, 27	Yes	3	Tight	–
5	#16, 17	Yes	2~3	Tight	–
6	#16, 17	Yes	3	Tight	–
7	#15~17	Yes	2~3	Tight	–
8	#26, 27	Yes	5	Tight	–
9	#16, 17	Yes	3	Tight	–

DISCUSSION

Food impaction can occur when the contact between teeth is either tight or loose. If a loose or open contact is present, it is generally considered that treatment should focus on restoring the contacts with a new restoration. On the other hand, if a tight contact is present, other factors such as the occlusal status and anatomical factors should be considered. Various treatments for food impaction have been reported. Hirschfeld proposed factors that prevent interproximal wedging[21]. He believed that the interproximal wedging of food can normally be prevented by (1) the contour of the marginal ridge and developmental groove, and (2) the integrity and location of the proximal contact. Prichard stated that food impaction can be prevented by creating a food escape groove with selective grinding, and reported 38 female patients who showed good proximal contact relationships after occlusal adjustment[26,27]. Pilcher and Gellin reported as 41-year-old female patient whose chief complaint was food impaction in a right mandibular molar with open contact on the distal surface of an old crown, which was treated with new restoration and subsequent periodontal treatment[1]. The technique of Newell et al. for correcting the marginal ridge level, forming a food escape route and occlusal reduction of the opposing plunger cusp[30] would allow food to escape buccally and lingually from the occlusal surfaces rather than

being forced over marginal ridges between the contacts by an opposing cusp. Prominent opposing cusps, if present, could also be reduced. The use of only two occlusion adjustments resulted in the complete disappearance of food impaction in 13 of 14 patients (93%)[26,28].

We used an occlusal adjustment procedure under the diagnosis of TFO on molars that caused food impaction accompanying an abnormal periodontal apparatus. It is necessary to decide which procedure among periodontal treatment, occlusal adjustment and a restorative procedure should be selected for this problem. Based on the occlusal status showing TFO, since there were no food impactions on the other parts of the arch in each patient and the periodontal condition of the involved sites was worse than on the other part of the arch, the treatment in this study focused on occlusion rather than the periodontal aspect.

The distinct clinical signs of TFO include increased tooth mobility, radiographic widening of the PDL space and fremitus[3,8,17,30-35]. In our eight maxillary cases, fremitus and tooth mobility were detected not on centric occlusion but during lateral excursion movement, especially at the working side.

We noticed group function from the canine to the maxillary second molar with heavy guiding contacts on the palatal incline of the buccal cusp of the maxillary molars, and palpable fremitus on the involved side. Because tight proximal contact between the molars was present on centric occlusion, it was suspected that during chewing heavy working guidance of the involved teeth caused tooth mobility and induced open contacts between the adjacent teeth followed by food impaction, which would lead to deterioration of the surrounding periodontium, abnormal pocket depth, bleeding tendency and bone resorption. This is consistent with studies suggesting that occlusal discrepancies can be causative or risk factors for periodontal disease[3,19,22,36]. Actually, Ishigaki et al. developed a test under the hypothesis that occlusal interferences during mastication cause pathological tooth mobility, and in 73 adults aged 20~29 years it revealed an increased mobility when the normal chewing pattern was deviated[16].

Bone resorption on the mesial side of the second and first molars or mobility of the involved teeth were found in four of our nine cases, and also radiographic findings showed widening of the PDL space, which infers that abnormal forces caused necrosis of PDL tissues including cell lysis, disruption of blood vessels and hyalinization of collagen fibers under inflammation by food[1-3,8,9,18,22,23,25,32,43]. However, no bone resorption was found in the remaining five cases, despite them having the same occlusal status as the other four cases. This indicates that not all occlusal problems significantly affect the periodontal condition. Many researchers have reported that occlusal disharmony and periodontal findings are not related[34,37-39], but there remains considerable controversy on the relationship between TFO and periodontal destruction[40].

Pihlstrom examined the maxillary first molars of 300 patients, and concluded that periodontitis was no more severe in teeth with occlusal contact in centric relation in working, non-working or protrusive positions than in teeth without these contacts[39]. Slightly positive or no differences in the effect of occlusal therapy have been reported in initial tooth mobility and initial periodontal disease[35,37,41].

The above studies were performed with the teeth in a static condition and only examined the occlusal status of each tooth without considering functional occlusal mechanics. All of the teeth examined might have been well adapted to their mandible function. If the position of any tooth had changed dues to periodontal disease, periodontal treatment combined with occlusal correction might have been more effective. As Ishigaki et al. proposed, occlusal evaluation should be performed not only using border and tapping movement but also during chewing movement in order to evaluate the periodontal condition[16].

In our study, all of the teeth associated with food impaction in the maxilla were second molars, the nearest ones to the hinge axis connecting both condyles. Dawson suggested that the maxillary second molar can be firm vertically but hypermobile buccolingually[42], since the posterior cusp incline can interfere if any part of the incline is steeper than the corresponding part of the lateral jaw movement, with interferences on posterior teeth inducing progressively larger stresses as they get closer to the condyle fulcrum, so that a slight interference on a second molar would induce larger stresses than a more noticeable interference on a canine. This viewpoint could be used to answer several questions, including why only second molars are involved and why they appear to be under TFO even though the lateral guidance formed evenly from the canine to the second molar.

Why would the maxillary second molar induce larger stresses than any other tooth? Dawson used the principles of leverage to explain this. Ishigaki et al. stated that the first premolar and the first second molar were more susceptible to occlusal interference[16]. This is supported by Mohamed et al., who reported that generally the first molar, the first premolar, the second premolar and the canine erupt in that

order in the maxilla from about 6 years of age[36]. These teeth then guide the lower teeth during lateral excursion. After the canine erupts, the lateral guidance system completes and then the second molar tends to erupt in transposition and come into contact irregularly with antagonists, with the possibility of an eventual misdirected occlusal force producing chronic TFO and increasing tooth mobility[36].

The present study did not aim to determine the correlation between occlusal discrepancies and periodontal disease, which is still controversial. However, this study has shown that (1) a preservative procedure to minimize occlusal interferences positively affects the progress and treatment of periodontal destruction, even though occlusal interference is not the causative factor but could be a risk factor for periodontal disease, and (2) a minute occlusal correction rather than reconstruction of the proximal contact by prosthetic or restorative treatments could be an effective treatment modality for food impaction between posterior teeth.

CONCLUSION

The occlusal discrepancies or undesirable occlusal contacts could be a causative factor of food impaction, which can be resolved by the occlusal adjustment to avoid or distribute stress on teeth.

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REFERENCES

1. Philcher ES, Gellin RG. Open proximal contact associated with a cast restoration-progressive bone loss: a case report. Gen Dent 1998;46:294-7.
2. Harrel Sk. Occlusal forces as a risk factor for periodontal disease. Periodontal 2000 2003;3:111-7.
3. Lindhe J, Nyman S, Ericsson I. Trauma from occlusion. In: Lindhe J, ed. Textbook of clinical periodontology. Copenhagen: Munksgaard; 1983. pp. 219-34.
4. Macapanpan LC, Weinmann JP. The influence of injury to the periodontal membrane on the spread of gingival inflammation. J Dent Res 1954;33:263-72.
5. Ramfjord SP, Ash MM Jr. Significance of occlusion in the etiology and treatment of early, moderate, and advanced periodontitis. J Periodontal 1981;52:511-7.
6. Stillman PR. The management of pyorrhea. Dent Cosmos 1917; 59:4085-414.
7. Stillman PR. What is traumatic occlusion and how can it be diagnosed and corrected. J Am Dent Assoc 1926;12:1330-8.
8. Carranza FA, Camargo PM. Periodontal response to external forces. In: Newman MG, Takei HH, Carranza FA, eds. Carranza's clinical periodontology, 9th edn. Philadelphia: Saunders; 2002. pp. 371-83.
9. Jernberg GR, Bakdash MB, Keenan KM. Relationship between proximal tooth open contacts and periodontal disease. J Periodontal 1983;54:529-33.
10. McCall J. Traumatic occlusion. J Am Dent Assoc 1939;26:519-26.
11. Nunn ME, Harrel SK. The effect of occlusal discrepancies on treated and untreated periodontitis. I. Relationship of initial occlusal discrepancies to initial clinical parameters. J Periodontal 2001;72:485-94.
12. Harrel SK, Nunn ME. The effect of occlusal discrepancies on periodontitis. II. Relationship of occlusal treatment to the progression of periodontal disease. J Periodontal 2001;72:495-505.
13. Waerhaug J. The infrabony pocket and its relationship to trauma from occlusion and subgingival plaque. J Periodontal 1979;50: 355-65.
14. Kuwahara T, Bessette RW, Maruyama T. Chewing pattern analysis in TMD patients with and without internal derangement: Part I. Cranio 1995;13:8-14.
15. Goldman HM, Schluger S, Fox L. Periodontal therapy. St Louis: CV Mosby; 1956. pp. 477-9.
16. Ishigaki S, Kurozumi T, Morishige E, Yatani H. Occlusal interference during mastication can cause pathological tooth mobility. J Periodont Res 2006;41:189-92.
17. Svanberg G, Lindhe J. Vascular reactions in the periodontal ligament incident to trauma from occlusion. J Clin Periodontal 1974;1:58-69.
18. Youdelis RA, Mann VW Jr. The prevalence and possible role of nonworking contacts in periodontal disease. Periodontics 1965; 3:219-23.
19. Carranza FA Jr. Clickman's clinical periodontology, 8th edn. Philadelphia: WB Saunders; 1996. pp. 164-5.
20. Mühlemann HR. Tooth Mobility: A review of clinical aspects and research findings, J Periodontology 1967;38 Suppl:686-713.
21. Hirschfeld I. Food impaction. J Am Dent Assoc 1930;17:1504-28.
22. Hancock EB, Mayo CV, Schwab RR, Wirthlin MR. Influence of interdental contacts on periodontal status. J Periodontal 1980;51:

445-9.
23. Nielsen IM, Glavind L, Karring T. Interproximal periodontal intrabony defects. Prevalence, localization and etiological factors. J Clin Periodontal 1980;7:187-98.
24. Goldman HM, Schluger S, Fox L. Periodontal therapy. St Louis: CV Mosby; 1956. p. 390.
25. Gould MSE, Picton PCA. The relationship between irregularities of the teeth and periodontal disease. Br Dent J 1966;121:20-3.
26. Prichard JF. Advanced periodontal disease: surgical and prosthetic management, 2nd edn. Philadelphia: WB Saunders; 1972. p. 827.
27. Prichard JF. Advanced periodontal disease: surgical and prosthetic management, 2nd end. Philadelphia: WB Saunders; 1972. p. 821.
28. Mosteller JH. The etiology of periodontal disease: a review of current literature. J Periodontal 1950;21:168-78.
29. Kepic TJ, O'Leary TJ. Role of marginal ridge relationships as an etiologic factor in periodontal disease. J Periodontal 1978;49: 570-5.
30. Newell DH, John V, Kim SJ. A technique of occlusal adjustment for food impaction in the presence of tight proximal contacts. Oper Dent 2002;27:95-100.
31. American Academy of Periodontology/ Glossary of periodontal terms, 4th edn. Chicago: American Academy of Periodontology; 2001. p. 20.
32. Clickman I, Smulow JB. Adaptive alterations in the periodontium of the rhesus monkey in chronic trauma from occlusion. J Periodontal 1968;39:101-5.
33. McGuire MK, Nunn ME. Prognosis versus actual outcome. II. The effectiveness of clinical parameters in developing an accurate prognosis. J Periodontal 1996;67:658-65.
34. McGuire MK, Nunn ME. Prognosis versus actual outcome. III. The effectiveness of clinical parameters in accurately predicting tooth survival. J Periodontal 1996;67:666-74.
35. Jin LJ, Cao CF. Clinical diagnosis of trauma from occlusion and its relation with severity of periodontitis. J Clin Periodontal 1992;19:92-7.
36. Mohamed SE, Christensen LV, Harrison JD. Tooth contact patterns and contractile activity of the elevator jaw muscles during mastication of two different types of food. J Oral Rehab 1983;10:87-95.
37. Burgett FG, Ramfjord SP, Nissle RR, Morrison EC, Charbeneau TD, Caffesse RG. A randomized trial of occlusal adjustment in the treatment of periodontitis patients. J Clin Periodontal 1992;19:381-7.
38. Shefter GJ, McFall WT Jr. Occlusal relations and periodontal status in human adults. J Periodontal 1984;55:368-74.
39. Pihlstrom BL, Anderson KA, Aeppli D, Schaffer EM. Association between signs of trauma from occlusion and periodontitis. J Periodontal 1986;57:1-6.
40. Harrel SK, Nunn ME, Hallmon WW. Is there an association between occlusion and periodontal destruction: YES - occlusal forces can contribute to periodontal destruction. J Am Dent Assoc 2006;137:1380-92.
41. Harrel SK, Nunn ME. The effect of occlusal discrepancies on gingival width. J Periodontal 2004;75:98-105.
42. Dawson PE. Functional Occlusion from TMJ to Smile Design.
43. Abrams L, Potashnick SR, Rosenberg ES, Evian EI. Role of occlusion in periodontal therapy. In: Rose LF, ed. Periodontics: medicine, surgery, and implants. St Louis: Mosby; 2004. pp. 745-71.