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Proximal Contact Stability Adjacent to Fixed Implant Restorations

The movement of teeth adjacent to dental implant restorations is a perplexing and complicated phenomenon that may relate to normal alveolar growth, functional occlusal loading or parafunctional occlusal activities, or it may have some multifactorial etiology. Although understanding the factors that may lead to adjacent tooth movement is important, the mere fact that it occurs is an essential consideration in treatment planning, restoration and maintenance protocols. Proximal contact opening through variable relative movement has far-reaching clinical consequences. In this issue of Prosthodontics Newsletter, we will review reports of both short- and long-term clinical outcomes to gain a better understanding of this phenomenon.

Long-term Prevalence of Proximal Contact Loss

Although proximal contact loss has been reported between implant-supported fixed dental prostheses and adjacent natural teeth in 34% to 65% of cases, determining causation has proven elusive. While mesial drifting is the most common movement, distal drifting may occur. Moreover, patients receiving implants in >1 area may show proximal contact loss at one site but not another. In an attempt to shine some light on this problem, Liang et al from Chang Gung Memorial Hospital, Taiwan, reviewed evidence gathered from patients who received implant-supported fixed dental prostheses over an 18-year period.

The 317 patients were recruited from a pool of patients who had received implant-supported fixed dental prostheses at one medical center ≤ 18 years earlier and who had returned for routine follow-up care after restoration. At delivery, proximal contact was determined using dental floss; if the dental floss passed through with sufficient resistance, the contact was considered closed. At their recall appointment, all patients for the study were examined for proximal contact tightness, oral hygiene condition and periodontal health. Proximal contact

was evaluated at both the mesial and distal sides and rated tight (sufficient resistance to the passage of dental floss), loose (insufficient resistance to the passage of dental floss) or open (no resistance to the passage of dental floss).

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Long-term Prevalence of Proximal Contact Loss

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Of the mesial contacts, 27% were classified as open, compared with only 5% of the distal contacts. In a multivariate analysis, 3 factors were significantly associated with loss of mesial contact:

- food impaction
- greater frequency of using an interdental brush
- >5 years in function

Loss increased over time, with 50% of the mesial contact loss occurring by 9 years.

Comment

While the state of patients' oral hygiene did not have a major impact on proximal contact loss, the effect of food impaction and the use of interdental brushes did. Routine follow-up is recommended to check for mesial drift; an occlusal retainer may prove beneficial.

Liang C-H, Nien C-Y, Chen Y-L, Hsu K-W. The prevalence and associated factors of proximal contact loss between implant restoration and adjacent tooth after function: a retrospective study. Clin Implant Dent Relat Res 2020;22:351-358.

Proximal Contact Alteration at 1 Year

As evidence has accumulated that proximal contact between implant-supported restorations and adjacent natural teeth will alter over time, some researchers have focused on establishing which variables have the greatest influence

on this phenomenon, with the hope of finding a solution to the problem. Shi et al from Shanghai Jiao Tong University, China, designed a prospective study to track changes over a 1-year period and analyze the impact of various potential factors on proximal contact loss.

Their study included 74 patients in need of implant-supported fixed dental prostheses in the premolar and molar regions. Using dental floss, the researchers classified the proximal contact tightness between the restoration and adjacent teeth into 3 groups:

- **Tight:** definite resistance to the passage of dental floss
- **Appropriate:** minimal resistance to the passage of dental floss
- **Open:** no resistance to the passage of dental floss

Measurements were made at the time the restoration was inserted and at the 1-year follow-up. Recorded variables included

- age
- sex
- implant site
- restoration type
- retention type
- parafunction (bruxism or unilateral mastication)

At baseline, all 144 proximal contacts of the 74 restorations were judged to be either tight or appropriate. After 1 year, the great majority of tight proximal contacts had become classified as either appropriate or open (Table 1).

Fewer than half of all proximal contacts remained stable. The proximal contact loss rate was significantly lower in the tight-at-baseline group than in the appropriate-at-baseline group (12.9% and 32.9% respectively; $p = .03$). Loss rate was significantly greater in the mandible (37.2%) than in the maxilla (9.1%); no other variables demonstrated significant differences.

Comment

These results suggested that, even in the short term, alteration of proximal contact should be anticipated. Because the proximal contact rate was significantly lower in the tight group, it may be helpful to plan for a slightly tense proximal contact at the time of restoration, especially in the mandible. More studies with longer follow up are needed to confirm these conclusions.

Shi J-Y, Zhu Y, Gu Y-X, Lai H-C. Proximal contact alterations between implant-supported restorations and adjacent natural teeth in the posterior region: a 1-year preliminary study. Int J Oral Maxillofac Implants 2019;34:165-168.

Table 1. Change in proximal contact between baseline and 1 year.

	Tight	Appropriate	Open
Baseline	62	82	—
Mesial	34	40	—
Distal	28	42	—
1 year	10	99	35
Mesial	4	53	17
Distal	6	46	18

Movement Around Single Anterior Implants

Single-implant crowns in the anterior region pose a particular esthetic challenge. Frequently placed in younger patients, these restorations may be subject to infra-position due to skeletal development throughout life. Tracking long-term biologic changes in teeth and tissue surrounding single anterior implants is required to help aid practitioners in their planning and treatment choices. Winitsky et al from the Folkandvården Eastmaninstitutet, Sweden, conducted a cohort study to determine the movement of teeth adjacent to and infra-position of single, anterior maxillary implants after ≥ 14 years in function.

The cohort of 42 patients had received single implants at one referral clinic specializing in juvenile prosthetic dentistry; 30 patients remained in the study. At follow-up of between 14 and 20 years, researchers recorded a variety of patient and implant characteristics thought to be associated with tooth movement and implant crown infra-position, including

- sex
- position of the implant in the maxilla
- cause of tooth loss
- orthodontic treatment prior to implant treatment
- age at time of crown delivery
- follow-up period
- facial type
- lower anterior facial height

Table 2. Mean contact tightness.

Contact site	Baseline	3 months	1 year
Mesial contact of implant	6.70	1.79	1.14
Distal contact of implant	6.27	2.21	3.23
Contact of natural tooth (control)			2.00

Radiographs and impressions used to create 3-dimensional (3-D) models were taken, as were photographs used to determine facial dimensions. Esthetic outcome was judged independently by the patient and a trained dental examiner.

Incisal and palatal movement were the most pronounced, with 30% of patients showing an incisal movement of >1 mm. This result was significantly associated with longer lower anterior facial height. Implants with occlusion, implants in the central incisor position and lower anterior facial height of ≥ 70 mm were significant to the degree of infra-position in the incisal position. Patients reported a higher rate of esthetic satisfaction with their restorations than did the dental examiner; however, patients with central incisor implants with increased infra-position gave their restorations significantly lower esthetic scores.

Comment

Although the study population was small, the ability to track them over a lengthy period lends support to the study's findings. All patients demonstrated some 3-D tooth movement over the ≥ 14 year follow-up. Lower anterior facial height could predict of infra-position in the treatment planning for single anterior implants.

Winitsky N, Naimi-Akbar A, Nedelcu R, et al. 3-D tooth movement adjacent to single anterior implants and esthetic outcome. A 14- to 20-year follow-up study. Clin Oral Implants Res 2021;32:1328-1340.

Short-term Proximal Contact Stability

In order to protect periodontal structures, prosthetic restorations should have and maintain close proximal contact with adjacent teeth, whether the restoration is supported by natural teeth or implants. However, practitioners have noted an unfortunate tendency for proximal contact loss between fixed implant restorations and adjacent teeth. In one of the first studies to look at this issue, Ren et al from Peking University School of Stomatology, China, prospectively studied a small group of patients to investigate position changes for teeth adjacent to a fixed implant prosthesis.

The study included 18 patients without severe periodontitis who received a single mandibular first molar implant. Implants were placed in healed sites restored with a screw-retained or cement-retained definitive prosthesis 4 to 6 months later; prostheses included ceramic crowns, metal-ceramic crowns and cast metal crowns. Tightness of proximal contact was measured based on the maximum force necessary to remove a metal strip from between the restoration and the adjacent tooth. A higher score meant a tighter contact. To prevent food impaction in the long term, the initial proximal contact was designed to be tighter than that between natural teeth.



Measurements of mesial and distal contact tightness were taken immediately after crown placement, then at the 3-month and 1-year follow-up. After 3-months, contact tightness had significantly decreased in both the mesial and distal aspects to a measure similar to that of 2 adjacent natural teeth. At 1 year, the mesial measurement continued to lessen, although not significantly, while the distal measurement stabilized (Table 2).

Comment

This study suggested that deliberately increasing the proximal contact tightness between an implant and its adjacent tooth will not be effective over the short or long term. The use of dental floss, especially at the mesial proximal contact, along with regular long-term follow-up is crucial because subtle adult craniofacial growth may occur.

Ren S, Lin Y, Hu X, Wang Y. Changes in proximal contact tightness between fixed implant prostheses and adjacent teeth: a 1-year prospective study. J Prosthet Dent 2016;115:437-440.

Prevalence of Proximal Contact Loss

Proximate contact loss between implant-supported restorations and adjacent natural teeth is significantly associated with food impaction, and thus may play a negative role in maintaining the health of the periodontium, with the potential to be a factor in peri-implantitis. But restoring proximal contact is difficult, time-consuming and expensive. In an effort to understand the extent of this issue, Manicone et al from Università

Cattolica del Sacro Cuore, Italy, undertook a systematic review and meta-analysis of the literature to estimate the overall prevalence of proximal contact loss and determine its distribution and clinical features.

After the authors independently examined the literature in 4 databases (Medline, Scopus, Web of Science and Cochrane) for suitable articles published before November 11, 2020, with no start-date restriction, an additional search was conducted by hand. A standardized data extraction chart was utilized to extract the relevant information from the selected studies.

The authors found 15 studies—cohort studies, cross-sectional studies and retrospective evaluations—that looked at proximal contact loss in >11,000 single implant restorations or implant-supported fixed partial dentures. Overall proximal contact loss prevalence was

- ▶ 20% when measured by implant restoration
- ▶ 26.6% when measured by contact point

Frequency of contact loss was much greater on the mesial side than on the distal side, although this may have been due in part to the inclusion of terminal restorations, which by definition cannot have a distal contact point. Little difference was seen in incidence between the maxilla and the mandible. The rate of proximal contact loss increased with the time the restoration had been in function, but no difference in incidence was observed between implants adjacent to vital and nonvital teeth.

Comment

Overall, this review found that 29% of contact points develop proximal contact

loss. Given the relationship between contact loss and time after delivery of the restoration, the authors suggested that “the morphological changes that occur in adult patients because of continuous facial growth play a role in its development.”

Manicone PF, De Angelis P, Rella E, et al. Proximal contact loss in implant-supported restorations: a systematic review and meta-analysis of prevalence. J Prosthodont 2021; doi:10.1111/jopr.13407.

In the Next Issue

The angulated screw channel:
where do we stand?

Our next report features a discussion of this issue and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.

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