Analysis of proximal contact loss between implant-supported fixed dental prostheses and adjacent teeth in relation to influential factors and effects. A cross-sectional study

The optimal proximal contact between adjacent teeth is important to prevent food impaction, tooth migration, and periodontal complications (Hancock et al. 1980; Jernberg et al. 1983). Hence, the degree of proximal contact is one of the clinical criteria used in evaluating the quality of restorations (Ryge 1980). Proximal contact strength between teeth is regarded as a physiological entity of multifactorial origin because it is significantly influenced by location, tooth type, chewing, and time of day variation (Dorfer et al. 2000). Proximal contact tightness between teeth can be maintained during follow-up after class II restorations (Prakki et al. 2004; Loomans et al. 2007), whereas the proximal contact loss between implant-supported fixed dental prostheses (FDP) and adjacent teeth is frequently observed at follow-up visits, especially at the mesial aspects of the FDP (Wei et al. 2008; Koori et al. 2010; Wat et al. 2011). Mesial drifting of the teeth adjacent to the osseointegrated implant is assumed to be a reason for the proximal contact loss at the mesial aspect (Heij et al. 2006; Wat et al. 2011). The high occlusal force on the natural tooth adjacent to the implant-supported FDP has been suggested as one of the factors enhancing the mesial migration of the adjacent tooth (Wei et al. 2008). In addition, age, condition of the opposing dentition, vitality of the adjacent teeth, and the state of splinting of the adjacent teeth affect the proximal contact loss rate at the mesial aspect of the implant-supported FDP (Koori et al. 2010). However, distal aspects of the FDPs as well as the cluster-correlated data in the same patient were not...
considered during the statistical analysis (Begg 2009).

Based on the finding that the open contacts between teeth are related to food impaction and periodontal complications, the proximal contact loss between implant-supported FDPs and adjacent teeth has also been suggested as a factor inducing food impaction and an adverse effect on the peri-implant tissues (Hancock et al. 1980; Jernberg et al. 1983; Koori et al. 2010). However, no information is available concerning whether the proximal contact loss between implant-supported FDPs and adjacent teeth affects food impaction and/or peri-implant tissue conditions in the proximal embrasure.

The aims of the present cross-sectional study were to analyze potential factors influencing the proximal contact loss between implant-supported FDPs and adjacent teeth and to evaluate the effects of the proximal contact loss on the food impaction and periodontal/peri-implant tissue conditions in the proximal embrasure.

Material and methods

Subjects were consecutively recruited from patients who had been provided with implant-supported FDPs bordered by adjacent teeth and scheduled for the regular recall examination with an interval of 3–12 months at the Department of Periodontology, Chonbuk National University Dental Hospital, Jeonju, South Korea, from September 2010 to April 2013.

Implants were placed according to the manufacturer manuals, and the implant-supported FDPs were fabricated after 3–6 months of healing. At the time of delivery of the each prosthesis, a prosthodontist (S-G. A.) from the Department of Prosthodontics adjusted the proximal contact surfaces between the FDP and teeth until dental floss could be passed through the interproximal contacts with heavy resistance (Kim & Suh 2007).

The study subjects consisted of 50 males and 44 females, with a mean age of 56 years (range: 27–83 years). Among the 135 FDPs supported by 188 implants, 90 FDPs were supported by single implant, 38 FDPs by two implants, six FDPs by three implants, and one FDP by four implants (Table 1). A majority of the 191 proximal contacts between the implant-supported FDP and teeth were in the posterior region (Fig. 1). The mean follow-up period after FDP delivery was 57 months (range: 3–156 months).

Table 1. Description of the study samples

<table>
<thead>
<tr>
<th>Description</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>94</td>
</tr>
<tr>
<td>Mean age (range)</td>
<td>56 (27–83)</td>
</tr>
<tr>
<td>Sex ratio (male/female)</td>
<td>50/44</td>
</tr>
<tr>
<td>Mean follow-up month (range)</td>
<td>57 (3–156)</td>
</tr>
<tr>
<td>No. of implants</td>
<td>188</td>
</tr>
<tr>
<td>No. of fixed dental prostheses (FDPs)</td>
<td>135</td>
</tr>
<tr>
<td>No. of FDPs supported by single implant</td>
<td>90</td>
</tr>
<tr>
<td>2 implants</td>
<td>38</td>
</tr>
<tr>
<td>3 implants</td>
<td>6</td>
</tr>
<tr>
<td>4 implants</td>
<td>1</td>
</tr>
<tr>
<td>No. of Proximal embasures</td>
<td>191</td>
</tr>
<tr>
<td>Mesial</td>
<td>134</td>
</tr>
<tr>
<td>Distal</td>
<td>57</td>
</tr>
</tbody>
</table>

Approval of the study protocol was obtained from the Institutional Review Board of Chonbuk National University Hospital, Jeonju. All subjects provided informed consent. The study was conducted in accordance with the Helsinki declaration of 1975, as revised in 2000.

Clinical assessments

The degree of proximal contact tightness was judged as tight (definite resistance to the passage of the dental floss), loose (minimal resistance), and open (no resistance) when each proximal contact between a tooth and implant-supported FDP was tested with waxed dental floss (Oksan Preden, Uiwang, Korea) (O’Leary et al. 1975). Periodontal/peri-implant mucosa conditions assessed at the mesial/distal site of the implant and adjacent tooth in the proximal embrasure included oral hygiene status determined as the presence/absence of visible plaque at the soft tissue margin, probing depth measured to the nearest 0.5 mm with a calibrated PGF/W periodontal probe having 1 mm markings (Hu-Friedy, Chicago, IL), and bleeding on probing assessed following probing with a pressure of 0.25 N. In addition, the patients were asked to comment whether they had felt food impaction in the proximal embrasure between tooth and implant-supported FDP.

Radiographic assessments

At the recall examination, digital radiographs (Heliodentvario; Sirona Dental System, Long Island, NY) were taken with the digital X-ray sensor parallel and the X-ray beam perpendicular to the proximal embrasure between the implant-supported FDP and tooth (Fig. 2). Linear measurements were performed in digitized images of the radiographs using the

![Fig. 1. Numbers of proximal contact (blue) and contact loss (red) with respect to the implant position following the FDI tooth numbering system.](image-url)
software program NIH Image (Wayne Rasband, U.S. National Institutes of Health, available from the NIH Image website at http://rsb.info.nih.gov/nih-image: Wyatt et al. 2001). The known implant length and diameter were used for calibration with magnification. Linear distances regarding proximal embrasure dimensions and peri-implant tissue conditions were assessed to the nearest 0.1 mm with the use of a reference line drawn at the implant/abutment level. These distances included horizontal implant-tooth distance (distance between implant and adjacent tooth at the reference level), contact point level (vertical distance from the reference level to the apical border of the contact area between implant-supported crown and adjacent tooth), and bone level at implant (vertical distance between the reference level and the bone-to-implant contact, measured at the tooth-facing site of the implant). One calibrated examiner (S.-J.B.) who had not been involved in the treatment of the patients performed all assessments.

Data analyses

The tight and loose degree of proximal contacts were combined as the proximal contact group \(n = 126\), and the open contact was defined as the proximal contact loss group \(n = 65\). The primary end outcome for data analysis was the proximal contact or proximal contact loss. Mean values, standard deviations, and proximal contact loss rate of the variables were calculated for data description with the proximal embrasure as a statistical unit. Proximal contact loss rates during the follow-up periods were estimated with the Kaplan–Meier method. For the analysis of potential factors influencing proximal contact loss, the generalized estimating equation (GEE) procedure was utilized because of cluster-correlated data; that is, each subject provided different numbers of sites with proximal contact \([1–6\text{ cases}]\) [Begg 2009]. Age, follow-up period, gender, implant position, jaw position, splinting of the implants, splinting of the adjacent teeth, vitality of adjacent tooth, position of the proximal contact, and proximal embrasure dimensions were included as explanatory variables for the proximal contact loss in the univariate GEE analysis. The influence of the proximal contact positions (mesial or distal) on the proximal contact loss was further investigated in 55 implant-supported FDPs of 42 patients bordered by both mesial and distal teeth. A multivariate GEE analysis to find factors influencing the proximal contact loss was performed in the model including the explanatory variables that had a value of \(P < 0.20\) in the univariate GEE analysis [Mickey & Greenland 1989]. The influences of the proximal contact loss on food impaction and periodontal/peri-implant tissue conditions in the proximal embrasure were also estimated by the use of univariate GEE analysis. Odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated and reported as the results of GEE analyses. Data analyses were performed by the use of the Stata® 11.1 statistical software program (Stata Corp., College Station, TX, USA). A \(P\)-value <0.05 was considered statistically significant in all analyses.

Results

Of 191 proximal contacts between implant-supported FDPs, 65 (34%) were judged as an open degree of proximal contact, 39 (20%) as loose, and 87 (46%) as tight. The proximal contact loss rates estimated with the Kaplan–Meier method continuously increased over the 13-year follow-up periods, and 50% of the proximal contacts were lost by about 9 years (113 months) after FDP delivery (Fig. 3). Proximal contact loss rates of the study variables are presented in Table 2. The highest contact loss rate (52.4%) was observed when the teeth adjacent to the implant-supported FDP were splinted with a FDP, while the lowest rate (24.6%) was observed when the proximal contact was positioned in the distal aspect to the implant-supported FDPs.

Univariate GEE analysis revealed that a longer follow-up period, splinted implants, and mesial aspect of proximal contact were significant factors influencing the proximal contact loss \((P < 0.05)\) [Table 3]. The proximal contact loss group was older than the proximal contact group \((58.8 ± 10.3\text{ vs. } 55.6 ± 10\text{ years old})\), but the difference was not statistically significant. The follow-up period of the proximal contact loss group was longer than that of the proximal contact group \((66.5 ± 42.3\text{ vs. } 51.8 ± 40\text{ months})\), and the chances of proximal contact loss increased 9.4% annually over the follow-up periods \((P = 0.034)\). The proximal contacts adjacent to the implants splinted with a FDP showed 2.5 times higher chances of proximal contact loss than those adjacent to the single implant-supported crowns \((P = 0.006)\). The proximal contact loss was 2.1 times more frequently found in mesial aspects than in distal aspects \((P = 0.048)\). However, the proximal contact loss was not influenced by the mesial/distal aspect of the proximal contact in the analysis of 55 FDPs of 42 patients that were bordered by both mesial and distal teeth \((P = 0.250)\), not reported in
Table 2. Numbers of proximal contact/contact loss, contact loss rate, and mean follow-up period of the variables included in the study

<table>
<thead>
<tr>
<th>Gender</th>
<th>Contact (n)</th>
<th>Contact loss (n)</th>
<th>Contact loss rate (%)</th>
<th>Mean follow-up period (months ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n = 106)</td>
<td>73</td>
<td>33</td>
<td>31.1</td>
<td>53.1 ± 37.6</td>
</tr>
<tr>
<td>Female (n = 85)</td>
<td>53</td>
<td>32</td>
<td>37.6</td>
<td>61.5 ± 45.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implant position</th>
<th>Univariate GEE</th>
<th>Multivariate GEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-molar (n = 62)</td>
<td>1.094 (1.007–2.272)</td>
<td>1.094 (1.003–1.192)</td>
<td>0.042</td>
</tr>
<tr>
<td>Molar (n = 129)</td>
<td>1.703 (0.885–3.276)</td>
<td>1.883 (0.963–3.682)</td>
<td>0.065</td>
</tr>
<tr>
<td>Jaw position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxilla (n = 91)</td>
<td>1.320 (0.759–2.295)</td>
<td>1.088 (0.503–3.895)</td>
<td>0.520</td>
</tr>
<tr>
<td>Mandible (n = 100)</td>
<td>1.265 (0.704–2.272)</td>
<td>1.532 (0.878–3.461)</td>
<td>0.113</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Splinting of implants</th>
<th>Univariate GEE</th>
<th>Multivariate GEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not splinted (n = 135)</td>
<td>1.073 (0.885–3.276)</td>
<td>1.088 (0.503–3.895)</td>
<td>0.520</td>
</tr>
<tr>
<td>Splinted (n = 56)</td>
<td>1.320 (0.759–2.295)</td>
<td>1.088 (0.503–3.895)</td>
<td>0.520</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vitality of adjacent teeth</th>
<th>Univariate GEE</th>
<th>Multivariate GEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital (n = 165)</td>
<td>1.088 (0.410–2.883)</td>
<td>1.088 (0.410–2.883)</td>
<td>0.866</td>
</tr>
<tr>
<td>Non-vital (n = 26)</td>
<td>1.320 (0.759–2.295)</td>
<td>1.088 (0.503–3.895)</td>
<td>0.520</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proximal contact position</th>
<th>Univariate GEE</th>
<th>Multivariate GEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesial aspect (n = 134)</td>
<td>1.088 (0.410–2.883)</td>
<td>1.088 (0.410–2.883)</td>
<td>0.866</td>
</tr>
<tr>
<td>Distal aspect (n = 57)</td>
<td>1.088 (0.410–2.883)</td>
<td>1.088 (0.410–2.883)</td>
<td>0.866</td>
</tr>
</tbody>
</table>

Table 3. Odds ratio, 95% confidence interval (CI), and P-value of the variables included in the univariate and multivariate generalized estimating equations (GEEs)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate GEE</th>
<th>Multivariate GEE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>1.030 (0.999–1.061)</td>
<td>1.028 (0.997–1.060)</td>
<td>0.078</td>
</tr>
<tr>
<td>Follow-up period (years)</td>
<td>1.094 (1.007–1.188)</td>
<td>1.094 (1.003–1.192)</td>
<td>0.042</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female/male</td>
<td>1.265 (0.704–2.272)</td>
<td>1.265 (0.704–2.272)</td>
<td>0.431</td>
</tr>
<tr>
<td>Implant position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molar/non-molar</td>
<td>1.703 (0.885–3.276)</td>
<td>1.703 (0.885–3.276)</td>
<td>0.111</td>
</tr>
<tr>
<td>Jaw position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maxilla</td>
<td>1.320 (0.759–2.295)</td>
<td>1.320 (0.759–2.295)</td>
<td>0.326</td>
</tr>
<tr>
<td>Mandible/maxilla</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Splinting of implants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not splinted</td>
<td>2.544 (1.303–4.965)</td>
<td>2.544 (1.303–4.965)</td>
<td>0.006</td>
</tr>
<tr>
<td>Splinted</td>
<td>1.703 (0.885–3.276)</td>
<td>1.703 (0.885–3.276)</td>
<td>0.111</td>
</tr>
<tr>
<td>Splinting of adjacent teeth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not splinted</td>
<td>2.453 (0.883–6.810)</td>
<td>2.453 (0.883–6.810)</td>
<td>0.085</td>
</tr>
<tr>
<td>Splinted</td>
<td>2.453 (0.883–6.810)</td>
<td>2.453 (0.883–6.810)</td>
<td>0.085</td>
</tr>
<tr>
<td>Vitality of adjacent tooth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-vital/vital</td>
<td>1.088 (0.410–2.883)</td>
<td>1.088 (0.410–2.883)</td>
<td>0.866</td>
</tr>
<tr>
<td>Proximal contact position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesial/distal</td>
<td>2.101 (1.006–4.391)</td>
<td>2.101 (1.006–4.391)</td>
<td>0.048</td>
</tr>
<tr>
<td>Proximal embrasure dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact point level (mm)</td>
<td>0.932 (0.801–1.084)</td>
<td>0.932 (0.801–1.084)</td>
<td>0.359</td>
</tr>
<tr>
<td>Horizontal implant–tooth distance (mm)</td>
<td>0.959 (0.789–1.166)</td>
<td>0.959 (0.789–1.166)</td>
<td>0.674</td>
</tr>
</tbody>
</table>

*P = 0.002.

Table 4. Differences of periodontal/peri-implant tissue conditions between proximal contact and contact loss groups

<table>
<thead>
<tr>
<th>Contact</th>
<th>Contact loss</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the adjacent tooth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of plaque (%)</td>
<td>20.4%</td>
<td>11.9%</td>
</tr>
<tr>
<td>Bleeding on probing (%)</td>
<td>19.6%</td>
<td>22.6%</td>
</tr>
<tr>
<td>Pocket depth (mm ± SD)</td>
<td>2.52 ± 0.69</td>
<td>2.53 ± 0.96</td>
</tr>
<tr>
<td>At the implant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of plaque (%)</td>
<td>11.9%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Bleeding on probing (%)</td>
<td>46.0%</td>
<td>43.1%</td>
</tr>
<tr>
<td>Pocket depth (mm ± SD)</td>
<td>3.37 ± 0.99</td>
<td>3.37 ± 1.23</td>
</tr>
<tr>
<td>Bone level (mm ± SD)</td>
<td>0.66 ± 0.88</td>
<td>0.88 ± 1.11</td>
</tr>
</tbody>
</table>

*P-value in generalized estimating equations.

Discussion

More than a half [open proximal contact; 34%, loose proximal contact; 20%] of all proximal contacts that had been checked to maintain a tight proximal contact at the time of FDP delivery lost the original proximal contact strength during the follow-up visits, and the proximal contact loss rate continuously increased over the follow-up periods. The present study utilized a waxed dental floss to assess the degree of proximal contact, and the proximal contact loss was defined as open contact with no resistance to the passage of the dental floss (O’Leary et al. 1975; Hancock et al. 1980; Jernberg et al. 1983). In comparison with other studies that reported a proximal contact loss rate of 58% (Wei et al. 2008) and 43% (Koori et al. 2010), the present rate of 34% was lower. Furthermore, the half time of the proximal contact loss [9.4 years] estimated with the Kaplan–Meier method was longer (Koori et al. 2010; 5.5 years). However, direct comparisons between the studies were hampered because adequate proximal contact was defined as when a 50-µm-thick strip could be inserted with moderate or appropriate resistance in the referred studies (Wei et al. 2008; Koori et al. 2010).

The proximal contacts at the mesial aspect were lost 2.1 times higher than those at the distal aspect in the univariate GEE analysis [P = 0.048]. The result agrees with a previous study (Koori et al. 2010). Mesial drifting of the teeth adjacent to the osseointegrated implant supporting FDP has been attributed...
to the proximal contact loss at the mesial aspect (Heij et al. 2006; Wat et al. 2011). However, in the present study, 25% of proximal contacts in the distal aspect were also lost, and the differences in the proximal contact loss rate between the mesial and distal aspects (38% and 25%, respectively) were not as pronounced as the previously reported respective values of 52% and 16% (Koori et al. 2010). In fact, the position of proximal contact did not significantly influence the proximal contact loss in the multivariate GEE analysis that controlled for other confounding factors. Furthermore, the analysis of 55 FDPs bordered by both mesial and distal adjacent teeth in 42 patients revealed that the mesial/distal aspect of the proximal contact did not significantly affect the proximal contact loss \( P = 0.250 \). Hence, there must be other explanations for the proximal contact loss at the distal aspect of the implant-supported FDPs other than the mesial drifting of the adjacent teeth, because the latter can only explain the proximal contact loss at the mesial aspect of the osseointegrated implant supporting FDP. The osseointegrated single implant, which behaves like ankylosic teeth, faces the risk to be positioned in infraocclusion by time because of continuous eruption of the adjacent teeth and/or facial bone growth even in adulthood, which affects teeth alignment (Chang & Wennstrom 2012). Similarly, the proximal contact loss may be developed at the mesial aspect as well as the distal aspect of the proximal contact by positional change of the adjacent teeth in relation to the osseointegrated implant-supported FDP.

The proximal contact loss rate adjacent to the implants splinted with a FDP was 2.5 times higher than that adjacent to the single implant-supported restorations in the univariate analysis \( P = 0.006 \). However, it must be noted that a majority of the FDPs supported by multiple implants in the current study were placed in the free-end edentulous ridges and so had proximal contact only at the mesial aspect, which showed a more frequent contact loss than that at the distal aspect. In fact, the splitting of the implants was not a significant factor for the proximal contact loss in the multivariate analysis including mesial/distal proximal contact position as well as other potential factors as explanatory variables.

The earliest proximal contact loss between the implant-supported FDPs and teeth was found at 8 months after the FDP delivery, whereas tight proximal contact was still maintained at 13 years. However, the follow-up period significantly affected the proximal contact loss and the chances of proximal contact loss increased by 9.4% annually in the univariate GEE analysis \( P = 0.005 \). Besides, in the multivariate analysis after controlling other confounding variables, the follow-up period was the only significant factor influencing the proximal contact loss. This result corroborates previous findings (Wei et al. 2008; Koori et al. 2010). However, proximal contacts at the distal aspects of the FDPs and the cluster-correlated structure in the data that would rarely behave independently were not considered during the statistical analysis in the referred studies (Gerds 2009).

Food impaction was reported in 47% of all proximal embrasures, and it was more frequent in the proximal contact loss group than the proximal contact group (63% vs. 39%). GEE univariate analysis revealed that the food impaction occurred 2.2 times more frequently in the proximal contact loss group than the proximal contact group \( P = 0.020 \). Previous studies also reported that proximal contact types between teeth had a significant relationship with the food impaction (Hancock et al. 1980; Jernberg et al. 1983). Although no information about the frequency of food impaction between the implant-supported FDPs and teeth is available, the frequency in the present study seems to be quite high in comparison with that in the open proximal contacts between teeth (63% vs. 18%) (Jernberg et al. 1983). Food impaction is felt when a fibrous food was wedged interproximally in the open or loose proximal contacts, and/or food was entrapped in the embrasure spaces between teeth (Hancock et al. 1980; Jernberg et al. 1983). The embrasure spaces between implant-supported FDPs and adjacent teeth are usually larger than those between teeth due to the emergence profile of the implant-supported crown. Furthermore, 76% of subjects in the current study were under supportive periodontal therapy after periodontal treatment and were instructed to use proximal brushes after delivery of the implant-supported FDPs. Consequently, most of the proximal embrasures were not completely filled with papilla (91%). Hence, the chances of food impaction may be higher in the proximal embrasures between implant-supported FDPs and adjacent teeth than those between teeth with a healthy periodontal tissue condition. To deal with discomfort due to the food impaction in relation to proximal contact loss, a retrievable design in which clinicians can resurface the contact area after removal of the FDPs could be an option (Wat et al. 2011). In addition to the proximal contact loss, other factors including location and area of the proximal contact, marginal ridge integrity, plunger cusp mechanisms, and degree of papilla fill should be considered as potential factors for the food impaction (Kepic & O’Leary 1978; Hancock et al. 1980; Jernberg et al. 1983).

Proximal contact loss negatively affects periodontal tissue conditions (Hancock et al. 1980, Jernberg et al. 1983). Based on these findings, it was speculated that the proximal contact loss might also jeopardize the peri-implant tissue health (Koori et al. 2010). However, in the present study, the proximal contact loss did not significantly influence any variables in relation to periodontal/peri-implant tissue conditions in the proximal embrasure (Table 2). This could be partially explained by the fact that most subjects in the present study were under supportive periodontal therapy during periodontal treatment. However, it was not possible to find the influence of the proximal contact loss on the periodontal/peri-implant tissue conditions over the time with the cross-sectional study design of the current study.

There are some limitations in the present study. As a common feature complicating the application of survival analysis to dental research (Gerds 2009), the exact event times of the study units (i.e., time of the proximal contact loss) were unknown. Therefore, it was assumed that the proximal contact loss took place at the time of the follow-up visits. Dental floss has been used as an easy and simple conventional method to assess the degree of proximal contact strength (Prakki et al. 2004; Kim & Suh 2007). However, the assessment of the resistance to the passage of the dental floss into the proximal contact was dichotomized as proximal contact vs. proximal contact loss in the current study. Hence, in future studies, a prospective study design with a short follow-up interval to find the event time of the proximal contact loss as close as possible, or the use of a device quantifying the proximal contact strength, would be warranted to confirm the diachronic nature of the proximal contact loss between the implant-supported FDPs and teeth (Dorfer et al. 2000; Loomans et al. 2007).

In conclusion, the proximal contact loss between implant-supported FDPs and teeth was frequently found and increased continuously.
over the follow-up period. The proximal contact loss significantly affected the food impaction, but not the periodontal/peri-implant tissue conditions. Hence, the proximal contact loss should be carefully monitored at the follow-up examinations in relation to its common complication, food impaction.

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References


