Patient satisfaction and esthetic outcome after immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment

Key words: endosseous dental implantation, implant-supported dental prosthesis, patient satisfaction, retrospective study, single-tooth dental implants

Abstract

Objectives: To assess patient satisfaction and esthetic outcome after immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment and a provisional crown followed by later placement of a definitive crown.

Materials and methods: In private practice, a single-tooth implant was placed immediately after tooth extraction in the esthetic zone of 54 patients. A definitive individual abutment and a provisional crown were mounted in the same visit. The definitive crown was placed after a mean period of 7 months. After a mean follow-up period of 33 months, the subjective and professional evaluation of the total implant treatment, peri-implant soft tissues, and implant crown were assessed on a 10-cm visual analog scale (VAS). The professional esthetic treatment outcome was also evaluated using pink esthetic score (PES), white esthetic score (WES), and total score of PES/WES.

Results: The evaluation of total implant treatment, peri-implant soft tissues, and implant crown demonstrated a significantly higher subjective than professional score for all 3 parameters (P < 0.001), for example, for the overall treatment, the mean scores were 9.4 and 7.0, respectively. A significant positive correlation was revealed between the professional VAS scores and the PESs and WESs.

Conclusions: Immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment and provisional crown followed by later placement of a definitive crown demonstrated high subjective and professional satisfaction. Generally, the professionals seem to be more critical than the patients. A strong correlation was observed between the professional VAS scores and the PES and WES scoring systems.

The outcome of implant therapy involving immediate implant placement has been evaluated in recently published systematic reviews (Chen & Buser 2009; Esposito et al. 2010). Immediate implant installation can be combined with immediate provisionalization using a provisional or a definitive abutment. This treatment modality has also recently been reviewed [De Rouck et al. 2008; Canullo et al. 2010; De Bruyn et al. 2013]. However, patient satisfaction and professional assessment of the esthetic treatment outcome have been addressed sparsely [Cosyn et al. 2011; Raes et al. 2012]. Consequently, the purpose of this study was to evaluate patient satisfaction and esthetic outcome after immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment and a provisional crown. In addition, correlations between the various subjective and professional outcome measures were assessed.

Material and methods

The material and methods including crown survival, implant survival, marginal bone level change, and health status of the peri-implant tissues have been described in detail previously to which the reader is referred for a detailed description (Hartlev et al. 2013).
Patients and description of procedures
A total of 68 consecutively treated patients with indication for immediate placement and provisionalization of one single-tooth implant within the incisor, canine, and premolar regions were included initially in the study. All patients were treated in private practice by the same dentist (PK) between 2001 and 2009.

The tooth was initially extracted, and an implant (Replace Select Tapered TiUnite, Nobel Biocare, Göteborg, Sweden) was inserted in the same surgical procedure. The implant position was registered by placing an impression coping (Impression Coping Open Tray, Nobel Biocare, Göteborg, Sweden) glued with Triad Gel (Dentsply, York, PA, USA) to a custom-made acrylic splint. A healing abutment was finally placed after removal of the impression coping and the acrylic splint. An individual definitive titanium or zirconium abutment (Nobel Biocare, Göteborg, Sweden) and a provisional heat-cured resin crown were made by a dental technician within 2 h. The healing abutment was removed, and the definitive abutment was placed. Finally, the provisional crown was cemented with Dycal (Dentsply, York, PA, USA) in a nonfunctionally loaded position. Definitive crowns, all-ceramic crowns or metal-ceramic crowns, were placed after a mean period of 7 (range: 2–37) months after implant installation. The crowns were cemented with zinc phosphate cement (DeTrey Zinc, Dentsply, Konstanz, Germany). All crowns were made on patients at least 23 years of age when growth seems to be ceased. When the patients were younger than 23 years the provisional crowns were still in place.

The patients were recalled as part of the study after a mean follow-up period of 33 (median: 31, range: 11–89) months by JH. A photo taken before tooth extraction was used as the reference tooth within the incisor and canine region or the adjacent premolar within the premolar region as a reference tooth. A photo taken before tooth extraction was available in 19 patients (19 implants). The professional evaluation of the gingiva was performed using the same VAS as for the assessment of the peri-implant soft tissues. Moreover, peri-implant soft tissue changes from tooth extraction to the final follow-up were evaluated using landmarks on the neighboring teeth as reference. The evaluation included assessment of the buccal peri-implant mucosa, mesial papilla, and distal papilla. A change was registered when a discrepancy of more than 1 mm could be assessed.

All measurements from 10 randomly selected patients were repeated after 6 months to assess the reproducibility of the assessment of the aesthetic outcome.

Data analysis
Data management and analysis including calculation of descriptive statistics were performed using Excel (Microsoft, Redmond, WA, USA) and Stata (StataCorp, College Station, Texas, USA). Because the data were not normally distributed, nonparametric analyses were used when comparing two groups. The results were reported by proportions (%), median, mean, and 10/90 percentiles. Correlations between measurements were evaluated with Spearman’s rank correlation and the professional and subjective registrations were compared by Wilcoxon’s signed rank test. Independent groups were compared by Wilcoxon’s rank sum test or Kruskal–Wallis test.

Results
Representative cases are presented in Figures 1 and 2.

Subjective and professional evaluation (VAS) of total implant treatment, peri-implant soft tissues, and implant crown
The subjective and professional evaluation of total implant treatment, peri-implant soft tissues, and implant crown using VAS is
presented in Table 1, including the results of the comparisons of the subjective and professional evaluation.

The subjective evaluation was for all three parameters characterized by significantly higher (\(P < 0.001\)) scores than the professional evaluation, for example, for the overall treatment the mean scores were 9.4 and 7.0, respectively. A positive weak correlation was observed between the subjective and professional scores, although the correlation was only statistically significant for the peri-implant soft tissues and the implant crown.

A significant positive correlation was revealed between the subjective evaluation of the total implant treatment and the length of the follow-up, the correlation was not significant (\(r = 0.21, P = 0.22\)).

No significant differences in the subjective evaluation of the provisional crown and the 2 types of definite crowns were observed. The professional evaluation of the all-ceramic crowns and the metal-ceramic crowns did not reveal a significant difference, but a significant difference was observed between the 2 definite crowns and the provisional crowns (\(P < 0.001\)).

Furthermore, neither the subjective nor the professional evaluation of the peri-implant soft tissues were influenced (\(P > 0.099\)) by provisional crown loosening (33 of 54 implant crowns).

The professional evaluation of the total implant treatment and the length of the follow-up, the correlation was not significant (\(r = 0.21, P = 0.22\)).

No significant differences in the subjective evaluation of the provisional crown and the 2 types of definite crowns were observed. The professional evaluation of the all-ceramic crowns and the metal-ceramic crowns did not reveal a significant difference, but a significant difference was observed between the 2 definite crowns and the provisional crowns (\(P < 0.001\)).

Furthermore, neither the subjective nor the professional evaluation of the peri-implant soft tissues were influenced (\(P > 0.099\)) by provisional crown loosening (33 of 54 implant crowns).

<table>
<thead>
<tr>
<th>Table 1. Subjective and professional evaluation (VAS) of total implant treatment, peri-implant soft tissues, and implant crown, including comparison of subjective and professional evaluation</th>
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<tbody>
<tr>
<td>Subjective evaluation</td>
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<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Total implant treatment</td>
</tr>
<tr>
<td>Peri-implant soft tissues</td>
</tr>
<tr>
<td>Implant crown</td>
</tr>
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</table>

**Professional evaluation using pink esthetic score and white esthetic score**

The professional evaluation based on PES and WES is presented in Tables 2 and 3.

The mean score of PES/WES was 17.6. A minor discrepancy [1–2 mm] and a major discrepancy [> 2 mm] of the level of facial soft-tissue margin were observed on 15 (24%) and 7 (13%) implants, respectively. On the other hand, only at 1 implant was the abutment visible.

A significant positive correlation was revealed between 1) the total implant treatment (VAS) and PES/WES (\(r = 0.71, \ P = 0.001\)), 2) professional evaluation of the peri-implant soft tissues (VAS) and PES (\(r = 0.72, \ P = 0.001\)), and 3) implant crown (VAS) and WES (\(r = 0.68, \ P = 0.001\)).

**Professional evaluation of gingiva before tooth extraction and peri-implant soft tissues at final follow-up**

The professional evaluation of the gingiva before tooth extraction and the peri-implant soft tissues at the final follow-up using VAS is presented in Table 4. No significant difference was observed (\(P > 0.05\)).

The professional evaluation of the peri-implant soft tissue changes from tooth extraction to the final follow-up is presented in Table 5. Buccal recession was observed at most implants. Actually, only 8 (42%) of the 19 implants did not show peri-implant soft tissue changes from tooth extraction to the final follow-up. The recession was in most cases small, and extensive recession was exclusively observed at 1 implant (Figure 3). Similarly, only minor changes of the papillae were observed.

**Reproducibility**

The reproducibility of assessment of the esthetic outcome (VAS) revealed no systematic changes from first to second evaluation. The mean and standard deviation on the differences between the 2 registrations were 1| 0.48 [95% CI: −0.43; 1.39] and 1.27 [95% CI: 0.87; 2.31] for total implant treatment, 2| 0.71 [95% CI: −0.14; 1.56] and 1.18 [95% CI: 0.81; 2.16] for soft tissues, and 3| 0.11 [95% CI: −1.01; 1.23] and 1.56 [95% CI: 1.08; 2.85] for implant crown. Regarding the PES and WES, the differences between the 2 registrations were in 9 of 10 patients within ±1 score.

**Discussion**

There is increasing focus on patient-reported outcome measures within the field of implant dentistry (McGrath et al. 2012). The
The present study focused on patient satisfaction and the esthetic outcome after immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment. The patients were in general highly satisfied with the treatment outcome and the professional evaluation confirmed a satisfactory treatment outcome.

The present study revealed that the patients were satisfied with the esthetic treatment outcome of the total implant treatment, peri-implant soft tissues, and implant crown. Comparable results have been reported after conventional implant treatment (Vermylen et al. 2003; Pjetursson et al. 2005; Baracat et al. 2011; Vilhjalmsson et al. 2011). Patient satisfaction scores were significantly higher than the professional evaluation scores, and only a weak positive correlation was revealed between the subjective and professional evaluation. Previously published studies with focus on the implant crown, papilla, and level of the buccal peri-implant soft tissues have in accordance with the present study reported higher subjective than professional scores (Chang et al. 1999; Kokich et al. 2006; Suphanantachat et al. 2012). In other words, professionals seem in general to be more critical than the patients.

Variations in follow-up period within the present study enabled analyses of the influence of the length of the follow-up period on the treatment outcome. It was revealed that the subjective evaluation of the total implant treatment was significantly influenced by the length of the follow-up period. In contrast, the professional evaluation of the total implant treatment was not significantly influenced by the length of the follow-up period. Papilla growth over time has been demonstrated in several studies involving conventional implant placement (Jemt 1997; Henriksson & Jemt 2004; Lai et al. 2008). This finding could not be confirmed within the present study.

### Table 2. Professional evaluation based on pink esthetic score and white esthetic score

<table>
<thead>
<tr>
<th>Pink Esthetic Score (PES)</th>
<th>Score</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Mesial papilla</td>
<td>Absent</td>
<td>Incomplete</td>
</tr>
<tr>
<td>Distal papilla</td>
<td>Absent</td>
<td>Incomplete</td>
</tr>
<tr>
<td>Level of facial soft-tissue margin*</td>
<td>Major discrepancy (&gt;2 mm)</td>
<td>Minor discrepancy (1–2 mm)</td>
</tr>
<tr>
<td>Alveolar process deficiency</td>
<td>Obvious</td>
<td>Slight</td>
</tr>
<tr>
<td>Soft-tissue color*</td>
<td>Obvious difference</td>
<td>Moderate difference</td>
</tr>
<tr>
<td>Soft-tissue texture*</td>
<td>Obvious difference</td>
<td>Moderate difference</td>
</tr>
</tbody>
</table>

### Table 3. Professional evaluation based on pink esthetic score and white esthetic score

<table>
<thead>
<tr>
<th>Mean</th>
<th>Median (10–90 percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink esthetic score (PES)</td>
<td>9.9</td>
</tr>
<tr>
<td>White esthetic score (WES)</td>
<td>7.7</td>
</tr>
<tr>
<td>PES/WES</td>
<td>17.6</td>
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</tbody>
</table>

### Table 4. Professional evaluation (VAS) of gingiva before tooth extraction and peri-implant soft tissues at final follow-up

<table>
<thead>
<tr>
<th>Mean</th>
<th>Median (10–90 percentile)</th>
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</thead>
<tbody>
<tr>
<td>Gingiva before extraction</td>
<td>7.0</td>
</tr>
<tr>
<td>Peri-implant soft tissues at final follow-up</td>
<td>6.8</td>
</tr>
</tbody>
</table>

### Table 5. Professional evaluation of peri-implant soft tissue changes from tooth extraction to final follow-up

<table>
<thead>
<tr>
<th>Buccal peri-implant soft tissues</th>
<th>No change</th>
<th>Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesial papilla</td>
<td>13 (68%)</td>
<td>6 (32%)</td>
</tr>
<tr>
<td>Distal papilla</td>
<td>16 (84%)</td>
<td>3 (16%)</td>
</tr>
</tbody>
</table>

Fig. 3. A representative case (55-year-old male, left maxillary central incisor) with extensive recession of the buccal peri-implant mucosa probably due to a too facial placement of a 6.0 mm wide platform implant. Before extraction [a] and at the 8-year follow-up with the definitive metal-ceramic crown [b].
Immediate implant placement has previously been characterized as a treatment modality involving a risk for recession of the buccal peri-implant soft tissues [De Rouck et al. 2008; Evans & Chen 2008; Chen & Buser 2009; Chen et al. 2009].

In our study, approximately 2/3 of the total number of patients exhibited either an incomplete proximal papilla or a discrepancy of the level of facial soft-tissue margin. Furthermore, at 1 implant, the abutment was visible. On the other hand, this seems to be of minor concern for most of the patients because they reported a high degree of satisfaction with both the total treatment outcome and with the appearance of the soft tissue. In the group consisting of 19 patients where a photo taken before tooth extraction was available, 8 (42%) of the implants did not show peri-implant soft tissue changes from tooth extraction to the final follow-up. The recession of the papilla or facial soft-tissue margin was in most cases between 1–2 mm and extensive recession (>2 mm) was only observed at 1 implant.

The risk of recession of the peri-implant soft tissues after immediate implant placement and provisionalization of single-tooth implants has exclusively been addressed in 2 studies [Cosyn et al. 2011; Kan et al. 2011]. Increased risk of recession of the peri-implant soft tissues was reported in one study [Kan et al. 2011], while no changes were shown in another study [Cosyn et al. 2011]. Therefore, long-term studies assessing the risk of recession of the peri-implant soft tissues are needed before final conclusions can be made.

The evaluation of the implant crown may be influenced by the type of crown. The patient’s evaluation was comparable for ceramic crowns, metal-ceramic crowns, and provisional crowns. In contrast, the 2 definite crowns were characterized by significantly higher scores than the provisional crown by the professionals. No difference between all-ceramic and metal-ceramic crowns has also been reported previously [Hosseini et al. 2012]. Therefore, the type of definitive crown material seems not to influence patient satisfaction and the evaluation by professionals. The influence of abutment type was not addressed in the present study, because only few zirconia abutments were used.

It is a challenge to develop a comprehensive and feasible index to evaluate the aesthetic outcome after implant treatment [Annibali et al. 2012]. The previously reported PES and WES scoring systems used within the present study involve the same value to all parameters, although some parameters seem to be of greater importance than others. However, implementation of a weighted value of each parameter may introduce other problems. A significant correlation was observed between the professional VAS scores and PES and WES, respectively. Comparable results involving correlation analyses of other indexes and VAS scores have recently been reported [Hosseini & Gotfredsen 2012]. However, further studies are needed to address the applicability of PESs and WESs in comparison with VAS scores. Another aspect to address is the threshold for a clinically acceptable treatment outcome. This aspect has been addressed previously [Belser et al. 2009; Cosyn et al. 2012], but such an arbitrary threshold may be problematic due to the previously mentioned same value of all parameters assessed. However, according to these guidelines, the obtained treatment outcome within the present study seems acceptable.

Conclusions

Immediate placement and provisionalization of single-tooth implants involving a definitive individual abutment and a provisional crown followed by later placement of a definitive crown were characterized by a high esthetic outcome evaluated both by patients and by professionals. However, the professionals seem in general to be more critical than the patients. Extensive recession of the buccal peri-implant soft tissues was observed only at 1 implant. Finally, the study revealed a strong correlation between the professional VAS scores and the professional PES and WES scoring systems.

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References


