A prospective, controlled clinical trial evaluating the clinical and radiological outcome after 3 years of immediately placed implants in sockets exhibiting periapical pathology

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Key words: bone regeneration, controlled clinical trial, dental implantation, endosseus, human, immediate implant placement, periapical pathology, prospective study, treatment outcome

Abstract

Objectives: The aim of the present study was to compare the clinical and radiological outcome of immediately placed implants in sockets with or without periapical pathology 3 years after implant placement.

Materials and methods: Twenty-nine patients with immediate implant placement were clinically and radiologically followed 3 years after implant placement (test group: 16 patients without periapical pathology, control group: 13 patients with periapical pathologies). Clinical (full-mouth bleeding score, full-mouth plaque score, clinical attachment level measurements and width of keratinized mucosa buccally of the implant) and radiological parameters (vertical distance from the implant shoulder to the first bone-to-implant contact [IS-BIC]) were assessed. Both 95% confidence intervals, as well as results of statistical tests (one-sample, two-sample and paired t-test) were provided.

Results: The implant survival rate was 100% for all 29 implants after 3 years. The clinical and radiological parameters showed no statistically significant difference between the test and the control group at 3 years (two-sample t-test). The IS-BIC was between 1.54 ± 0.88 mm (mesial, test) and 1.69 ± 0.92 mm (distal, test). Between the 1- and 3-year visit the IS-BIC increased in both groups significantly on one side of the implant: 0.30 ± 0.37 mm (mesial, test) and 0.33 ± 0.43 mm (distal, control) (one-sample t-test).

The 13 examined radiographs of implants immediately placed in sockets with periapical pathologies revealed retrograde peri-implantitis after 3 years.

Conclusion: It is concluded within the limitations of this study, that after careful debridement of the extraction socket, immediate placement of implants into sites with periapical pathologies can be a successful treatment modality for at least 3 years with no disadvantages in clinical and radiological parameters to immediately placed implants into healthy sockets.

Implant placement immediately after tooth extraction is a widely accepted procedure revealing high survival rates ranging from 93.9% to 100% [Kan et al. 2003; Ferrara et al. 2006; Esposito et al. 2007; den Hartog et al. 2008; De Rouck et al. 2008]. This technique aimed originally at preserving the pre-extraction contours of the alveolar process (Schulte & Heimke 1976; Annenoth et al. 1985; Lazzara 1989), because a marked resorption of the buccal bone plate after tooth loss was observed. However, dimensional ridge alterations could not be prevented when implants were immediately placed into fresh extraction sockets (Botticelli et al. 2004; Araujo
The aim of the present study was to assess whether immediately placed implants in sockets with or without periapical pathology show any differences regarding survival rates, clinical parameters and interproximal bone levels after 3 years following implant placement. Another purpose was to look for residual or newly formed radiolucencies (retrograde peri-implantitis) around the tip of the implants as described previously in the literature.

Material and methods

Study design and patients
In the present controlled clinical trial, patients with immediate implant placement were clinically and radiologically followed after 3 years following implant placement. All patients had been treated at the Department of fixed and removable prosthodontics and dental material science at the University of Zurich, Switzerland and were part of a former study evaluating the early events and the 1-year follow-up (Siegenthaler et al. 2007). The local ethical committee approved all procedures and the patients provided informed consent. All of the 29 patients included in the present 3-year follow-up data collection belonged to either one of the following treatment groups: test group including 16 patients without periapical pathologies or control group with 13 patients showing periapical pathologies. These pathologies included pain, periapical radiolucencies >1 mm, suppuration or a combination of these findings. In 11 patients, the reason for extraction was endodontic failure. One patient lost his tooth because of root fracture and one patient presented with endodontic failure in combination with root caries. Six patients of the test group showed a buccal fistula with suppuration. Another four patients showed localized suppuration from the gingival sulcus of the tooth to be extracted due to an endodontic lesion that drained over the periodontal ligament. None of the patients lost the respective tooth because of periodontal reasons. All but two patients suffered from symptoms like chronic pain or pain on pressure. In order to categorize the lesions radiographically, periapical radiographs taken before tooth removal were scanned. The perpendicular distance between the biggest in the radiograph visible extent of the pathology and the root surface was measured according to the magnification of the X-ray.

The control group consisted of patients in need of tooth replacement with an implant but showed no periapical pathology. Implant sites were limited to incisors, canines and premolars and bone regeneration was performed according to standard clinical procedures (Lang et al. 1994; Hammerle et al. 1998). All of the patients were in good general health and had no history of periodontal disease. In the test group two patients were smokers and in the control group one patient was a smoker. The mean age of the patients in the test group was 48 years [range 26–85 years] whereas that of the control group was 58 years [range 26–80 years] at the time of the 3-year follow-up visit. There were no dropouts between the 1- and the 3-year examination and all of the 29 patients could be examined.

Treatment protocol
The surgical procedure has been described in detail in the previous study [Siegenthaler et al. 2007]. In brief, after raising a full mucoperiosteal flap, the tooth was extracted in a gentle way to minimize damage to the bony housing. After thoroughly removing all granulation tissues, an implant (Standard Plus or Tapered Effect, Straumann Dental Implant System, Straumann AG, Basel, Switzerland) with dimensions best suited to obtain primary stability was placed immediately in an optimal prosthetic position. GBR was performed using deproteinized bovine bone mineral (Bio-Oss spongiosa particles, Geistlich-Pharma, Wolhusen, Switzerland) and a resorbable collagen membrane (Bio-Gide, Geistlich-Pharma). All of the patients received penicillin antibiotics (Clamoxyl 750 mg, 1-1-1) for 5 days and rinsed with a 0.2% chlorhexidine digluconate solution. After transmucosal or semisubmerged healing, implants were loaded at 3 months after placement.

Three-year follow-up data collection

Clinical parameters
At the 3-year follow-up visit, clinical photographs were taken and the following clinical data were collected:

- Full-mouth bleeding score (FMBS) (Lang et al. 1986).
• Full-mouth plaque score (FMPS) [O’Leary et al. 1972].
• Buccal and lingual/palatal interproximal clinical attachment level measurements (CAL) at the tooth-sides of the adjacent teeth facing the site of the implant. In order to compare the CAL with the data collected at the 1-year follow-up, the two lingual/palatal and the two buccal CAL measurements were averaged to one value.
• Buccal width of keratinized mucosa (KM) at the site of the implantation.

Radiological parameters
Standardized radiographs of the implant and the adjacent teeth were taken using the same individual bite block as in the previous study [Siegenthaler et al. 2007]. The radiographs were scanned and examined in the way as in the former publication at a 10 times magnification using an image-processing program (Image J64, Version 10.2). Vertical measurements were taken from the mesial and distal shoulder of the implant to the first bone-to-implant contact level in an axis parallel to the implant (IS-BIC). All distance measurements were recorded in pixels and subsequently converted to millimeters. To adjust each radiograph for distortion, the distance between the tips of three threads of the implant was additionally assessed and the vertical measurements were multiplied by the ratio between the manufacturer-specified thread pitch of 0.8 mm [TE Implant], 1.25 mm [Standard Plus Implant, Regular Neck] and 1 mm [Standard Plus Implant, Narrow Neck] and the observed distance.

Two observers aiming for agreement regarding the first BIC performed the radiographic assessment. In cases of disagreement, an author of the previous study was involved until consent was reached. Furthermore, the periapical area of the implant was observed thoroughly by two of the authors for possible residual or newly formed periapical radiolucencies.

Statistical analysis
A power calculation was carried out to determine the sample size using the implants as the statistical unit. Primary outcome was the increase of the vertical distance from the implant shoulder to the first BIC between 1 and 3 years. A possible bone resorption of 0.2 mm annually was considered clinically relevant after the first year of loading. Consequently, relevant changes between the 1- and 3-year visit should be bigger than 0.4 mm.

One-sample t-test: To detect with 80% power, a relevant difference of the primary outcome of $\delta = 0.4$ [change between 1- and 3-year visit in mm] with a standard deviation of $\sigma = 0.4$, a sample size of 10 is needed. Not only the changes in measurements between the 1- and 3-year visit within the test and control group separately are of interest but also the differences of these changes in this 2-year time span between the test and control group are important. Therefore, a difference of 0.5 mm is considered clinically relevant.

Two-sample t-test: To detect with 80% power a relevant difference of the primary outcome of $\delta = 0.5$ with a standard deviation of $\sigma = 0.4$, a sample size of 11 is needed for each (test and control) group.

The values of IS-BIC mesial/distal, FMBS, FMPS, CAL mesial/distal and the width of KM were computed at 3 years and descriptive statistics [mean, standard deviation and range] were provided. Because of small sample sizes in each group, medians were computed to give the reader an impression of symmetry or asymmetry of the data. Kolmogorov–Smirnov test was applied to check if the assumption of approximately normal sampling distribution does not hold. The results showed no significance ($P > 0.157$). Consequently, a two-sample $t$-test was applied to investigate the differences in these parameters between test and control group.

Changes in IS-BIC mesial/distal, FMBS, FMPS, CAL mesial/distal and the width of KM were computed at 3 years and descriptive statistics [mean, standard deviation and range] were provided. Because of small sample sizes in each group, medians were computed to give the reader an impression of symmetry or asymmetry of the data. Kolmogorov–Smirnov test was applied to check if the assumption of approximately normal sampling distribution does not hold. The results showed no significance ($P > 0.035$). All other variables showed no significance ($P > 0.185$). Therefore, we used nonparametric methods (Wilcoxon’s signed rank test for the paired test and Mann–Whitney test for comparison between test and control group) for analysis of this variable. Otherwise, parametric techniques were applied. Means, standard deviations and medians were computed. One-sample $t$-test was applied to the differences for control and test group separately. [It is equivalent to the paired $t$-test.] Moreover, the corresponding 95% confidence intervals [95% CI] were provided. A two-sample $t$-test was applied in order to disclose differences in IS-BIC mesial/distal, FMBS, FMPS, CAL mesial/distal and the width of KM between test and control group. Mean differences between groups together with the corresponding 95% CIs were provided. For statistical analysis, SPSS version 17.0 was used. Results of the tests with $P$-values < 5% were reported to be statistically significant. Because 28 tests were applied in this study, an increased false-positive rate of the significant results could be expected. Therefore, in addition Bonferroni’s correction was performed, rendering only results with a $P$-value smaller than 0.00179 (0.05 divided by 28) to be considered statistically significant.

Results
Of the original 34 patients (17 with and 17 without periapical pathologies), five patients had to be withdrawn from the study because primary implant stability could not be achieved. Four of these belonged to the test and one to the control group. There was no statistically significant difference regarding the early exits between the groups (Siegenthaler et al. 2007). Of the remaining 29 patients, all could be recruited for a 3-year follow-up visit (13 in the test group and 16 in the control group). The size of the periapical pathology in the present study was 1.1–3 mm in the test group, measured as the maximal width of the radiolucency projected by the pathology on the root surface in the radiograph. The implant survival rate was 100% for all 29 implants after 3 years.

Two patients of the control group refused to take X-ray pictures at the 3-year follow-up visit, rendering 13 patients in the test and 14 patients in the control group for radiographic evaluation.

Clinical measurements at 3 years (test: $n = 13$; control: $n = 16$)
At the 3-year follow-up visit, the FMBS was $11 \pm 7\%$ [test] and $12 \pm 9\%$ [control] (Table 1). The FMPS was $21 \pm 18\%$ [test]
and 14 ± 6% (control). The results for the CAL were: CAL mesial of the implant site in the test group was 2.7 ± 1 mm (range from 1 to 5 mm) and 3.4 ± 1.3 mm (range from 2 to 7.5 mm) in the control group. CAL distal of the implant site was 2.7 ± 0.9 mm in the test group (range from 1.5 to 4.5 mm) and 3.6 ± 1.3 mm (range from 2 to 7 mm) in the control group. The width of the KM buccally of the site of implantation showed no statistically significant difference between the 3- and 1-year evaluation (Table 2). In the control group, however, the FMBS and the FMPS significantly decreased between the 1- and 3-year visit (dFMBS control group: −3.7 ± 6.2%; dFMPS control group: −7.1 ± 9.1%). The clinical attachment level at the tooth-side mesial of the implant significantly increased in the control group between the two evaluations (dCAL mesial 0.6 ± 1 mm). However, in the control group the width of the KM buccally of the implant site and CAL at the tooth-side distally of the implant remained stable over the 2-year period. When comparing the differences between the 3- and 1-year evaluation of the test and the control group with each other, the control group showed a statistically significant increased clinical attachment level at the tooth side mesial of the implant site (dCAL mesial: 1.02 mm). All other clinical measurements showed no significant difference between the test and control groups.

In the test group, the full-mouth plaque score, the full-mouth bleeding score, the clinical attachment level at the tooth-sides of the adjacent teeth mesial and distal facing the site of the implantation and the width of the KM buccally of the site of implantation showed no statistically significant difference between the two groups at 3 years.

Table 1. Clinical measurements excluding early exit cases at 3 years

<table>
<thead>
<tr>
<th>Clinical measurements</th>
<th>Mean (SD); median</th>
<th>P-value*</th>
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</thead>
<tbody>
<tr>
<td>FMBS (%)</td>
<td>11 (7); 8</td>
<td>0.832</td>
</tr>
<tr>
<td>FMPS (%)</td>
<td>21 (18); 17</td>
<td>0.18</td>
</tr>
<tr>
<td>CAL mesial (mm)</td>
<td>2.7 (1); 3</td>
<td>0.15</td>
</tr>
<tr>
<td>CAL distal (mm)</td>
<td>2.7 (0.9); 2.5</td>
<td>0.078</td>
</tr>
<tr>
<td>KM site (mm)</td>
<td>3.5 (1.7); 3</td>
<td>0.428</td>
</tr>
</tbody>
</table>

*Two-sample t-test, statistically significant difference < 0.05.
FMBS, full-mouth bleeding score; FMPS, full-mouth plaque score; CAL mesial/distal, interproximal clinical attachment level at the tooth-sides of the adjacent teeth facing the site of the implantation, the buccal and oral values were averaged to one value; KM site, width of keratinized mucosa buccal of the site of implantation; SD, standard deviation.

Radiological measurements at 3 years (test: n = 13; control: n = 14)

The vertical distance from the implant shoulder to the first BIC mesially of the implant site was 1.54 ± 0.88 mm in the test group (range from 0.6 to 3.4 mm) and 1.57 ± 0.57 mm in the control group (range from 0.7 to 2.4 mm) (Table 3). On the distal aspect of the implant, the values were 1.69 ± 0.92 mm in the test group (range from 0.8 to 3.7 mm) and 1.59 ± 0.8 mm in the control group (range from 0.6 to 2.8 mm). There was no statistically significant difference between the groups at 3 years.

The vertical distance of the implant shoulder to the first BIC increased statistically significantly at the mesial side of the implant in the test group (0.3 ± 0.37 mm) where as in the control group it increased at the distal side of the implant between the 3- and the 1-year visit (0.33 ± 0.43 mm) (Table 4). When comparing the differences between the 3- and the 1-year evaluation of the test and the control group with each other, the test group showed a statistically significant higher increase of IS-BIC than the control group at the mesial side of the implant (−0.25 mm). Conversely, the control group showed a statistically significant higher increase of IS-BIC on the distal side of the implant (0.44 mm).

Table 2. Differences of clinical measurements between 3 and 1 years

<table>
<thead>
<tr>
<th>Mean difference within groups between 3 and 1 years (SD)</th>
<th>Test, n = 13</th>
<th>Control, n = 16</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>dFMBS (%)</td>
<td>−1.3 (6.9); −2</td>
<td>(−5.4, 2.9)</td>
<td>0.507</td>
</tr>
<tr>
<td>dFMPS (%)</td>
<td>−1.1 (22.3); −1</td>
<td>(−14.5, 12.4)</td>
<td>0.865</td>
</tr>
<tr>
<td>dCAL mesial (mm)</td>
<td>−0.42 (1.2); −0.5</td>
<td>(−1.1, 0.27)</td>
<td>0.21</td>
</tr>
<tr>
<td>dCAL distal (mm)</td>
<td>−0.4 (0.9); −0.5</td>
<td>(−1.0, 0.19)</td>
<td>0.158</td>
</tr>
<tr>
<td>dKM site (mm)</td>
<td>0.31 (0.63); 0</td>
<td>(−0.07, 0.69)</td>
<td>0.104</td>
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</tbody>
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<table>
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<tr>
<th>P-value‡</th>
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<tr>
<td>Mean 95% CI</td>
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<tr>
<td>0.037†</td>
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<tr>
<td>0.096†</td>
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<tr>
<td>0.385</td>
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</table>

*Statistically significant difference < 0.05.
†Paired t-test; dKM site (mm): Wilcoxon’s signed rank test.
‡Two-sample t-test; dKM site (mm): Mann–Whitney test; 95% CI: 95%, confidence interval.
All differences were calculated 3-year values minus 1-year values. To calculate the differences between control and test group, control- minus test-group values were computed.

dFMBS, difference in full-mouth bleeding score between 3 and 1 years; dFMPS, difference in full-mouth plaque score between 3 and 1 years; dCAL mesial/distal, difference in interproximal clinical attachment level at the tooth-sides of the adjacent teeth facing the site of the implantation between 3 and 1 years, the buccal and oral values were averaged to one value; dKM site, difference in width of keratinized mucosa buccal of the site of implantation between 3 and 1 years; SD, standard deviation.
Discussion

The present follow-up study aimed at investigating the 3-year clinical and radiological results following the immediate placement of implants into extraction sockets of teeth with and without periapical pathologies. The results showed that immediate implant placement into sockets with periapical pathologies did not lead to differences in clinical or radiological parameters after 3 years. Implant survival was 100% at 3 years in both groups and no periapical radiolucencies were found.

In the literature, data for long-term survival of immediately placed implants with conventional loading are scarce. Two clinical studies report on immediately placed implants with conventional loading demonstrating a survival rate between 92% and 100% after 1 year (Lindeboom et al. 2006; Romeo et al. 2008). No studies were found with longer observation periods. In a recent systematic review, a meta-analysis revealed no differences in survival between immediate, early and conventional implant placement and showed an overall survival rate of 95.5% after 1 year (den Hartog et al. 2008). The present study provides a 3-year survival rate of 100% for immediately placed implants and the long-term follow-

<table>
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<th>Table 3. Radiological measurements excluding early exit cases at 3 years</th>
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<tr>
<td><strong>Mean (SD); median</strong></td>
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<tr>
<td><strong>Test, n = 13</strong></td>
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<tr>
<td>IS-BIC mesial (mm)</td>
</tr>
<tr>
<td>IS-BIC distal (mm)</td>
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</tbody>
</table>

*Two-sample t-test, statistically significant difference <0.05.
IS-BIC mesial/distal, vertical distance from the implant shoulder to the first bone-to-implant contact on the mesial or distal side; SD, standard deviation.

<table>
<thead>
<tr>
<th>Table 4. Differences of radiological measurements between 3 and 1 years</th>
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<tr>
<td><strong>Mean difference within groups between 3 and 1 years (mm); median</strong></td>
</tr>
<tr>
<td><strong>Test, n = 13</strong></td>
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<tr>
<td>Mean (SD); median</td>
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<tr>
<td>Change IS-BIC mesial</td>
</tr>
<tr>
<td>Change IS-BIC distal</td>
</tr>
</tbody>
</table>

*Statistically significant difference <0.05.
†Paired t-test;
‡Two sample t-test; 95% CI: 95% confidence interval.
All differences were calculated 3-year-values minus 1-year-values. To calculate the differences between test and control group, control minus test-group values were computed.
Change IS-BIC mesial/distal, change of vertical distance from the implant shoulder to the first bone-to-implant contact mesial/distal from the 3- to the 1-year visit. A positive value represents a bone loss, a negative value a bone gain; SD, standard deviation.

Fig. 1. Periapical radiographs showing a test implant at position 14. [a] At baseline, [b] at loading after 3 months, [c] at 1 year after placement and [d] at 3 years after placement.

Fig. 2. Periapical radiographs showing a control implant at position 44. [a] At baseline, [b] at loading after 3 months, [c] at 1 year after placement and [d] at 3 years after placement.
up of radiological and clinical parameters. However, the success of implant therapy is not only determined by high survival rates but also by stable hard- and soft-tissue conditions [Meijer et al. 2005].

Therefore, long-term changes in vertical bone levels after immediate implant placement and clinical parameters are of great interest. When comparing the radiological 3-year results of implants placed into sockets showing such periapical lesions with such placed into healthy sites, the results revealed no statistically significant difference and were favorable in both groups. The radiological evaluation showed a mean distance from the implant shoulder to the first BIC between 1.54 mm (test group, mesial) and 1.60 mm (test group, distal). Keeping in mind that the polished area of the presently used implants (Straumann Dental Implant System) has a height of 1.8 mm, these values reveal that the bone, on average, stayed on a slightly higher level than the junction between the polished and the structured surface of the implant. A possible explanation for this finding could be that all implants were placed having the polished neck partially infrabony to match esthetic expectations. Analyzing the bone loss measurements over the entire study period including the early bone loss from implant placement to the first year (Siegenthaler et al. 2007), the values are comparable with other studies reporting on immediate implant placement. A clinical comparative study reported a mean mesial bone loss of 1.16 ± 0.32 mm and a mean distal bone loss of 1.17 ± 0.41 mm after 2 years [Crespi et al. 2008]. Also, when comparing the results to implants placed in completely healed ridges, the values are similar [Astrand et al. 2004]. This prospective comparative study reported a mean vertical bone loss of 1.98 ± 0.21 mm for Bränemark implants and 1.74 ± 0.45 mm for Astra implants after 5 years. In the present study, IS-BIC increased over the 2-year period in both groups significantly on one side of the implant: 0.30 ± 0.37 mm in the test group (mesially) and 0.33 ± 0.43 mm in the control group (distally). As no statistically significant difference could be detected between the groups at 3 years, it can therefore be assumed that the IS-BIC leveled off over the 3 years. Furthermore, when applying the Bonferroni’s correction for the level of significance \(P < 0.0017\) to make up for a possible increased rate of false-positive results, none of the values showed a statistically significant difference.

There are certain limitations using standardized periapical radiographs in detecting bone defects on the buccal or on the lingual side of the implant as the implant covers such defects with its radioopacity. Furthermore, it can be difficult to detect structural details due to limitations in resolution after scanning. Especially immediately placed implants often require augmentation procedures on the buccal aspect of the implant because of differences in the shape of the socket of the extracted tooth and the implant bed. Cone beam computed tomography could help in future studies to detect bone resorption and report on the long-term remodeling processes of the augmented bone. However, concerns about the validity of such measurements have been expressed, because of slight scattering effects of titanium implants.

The results of the evaluation of the clinical parameters showed a low FMBS and FMPS over the 3 years. This favorable outcome can be based on a good maintenance program, which was conducted over the observation period. The FMBS and FMPS significantly decreased in the control group between the 1- and 3-year visit. This could have possibly led to a better outcome in the control group, which was not seen at the 3-year evaluation.

The clinical attachment level in the present study remained stable between the 1- and 3-year visit, except for the tooth-side mesial of the implant in the control group. This is in contrast to a CAL increase at the adjacent tooth-side between the time of implant placement and the 1-year follow-up [Siegenthaler et al. 2007]. This can be the result of the flap elevation during the surgical procedures. Because no statistically significant difference of CAL could be detected at 3 years, it can be assumed that the CAL also leveled out over the 3 years, thus showing no disadvantage of immediately placed implants into sites with periapical pathology for the attachment levels of the neighboring teeth after 3 years. The width of the KM buccal of the implant also remained stable in both groups over the 2-year period and on average, at an acceptable width of least 2 mm of KM buccal of the implant shoulder. This width was recently recommended in a clinical study to be mandatory to minimize the risk of lingual plaque accumulation and bleeding as well as buccal soft-tissue recession over a period of 5 years (Schrott et al. 2009). All other clinical measurements also revealed no difference between the test and the control group. The axis of an implant placed in the anterior area to match esthetic expectations differs from the axis of the tooth that is extracted. It can therefore be assumed that even though the diameter of the implant might be bigger than that of the periapical pathology, the buccal part of the former pathology would remain intact despite the drilling sequence. Hence, even when the size of the periapical pathology falls below the diameter of the implant, thorough debridement of the periapical region is of high importance. Thus, the main criteria for immediate placement of an implant into a socket with a periapical pathology should be the achievement of primary implant stability after extensive debridement, and not the size of the pathology itself.

Therefore, it can be assumed that implants perform equally after 3 years following implant placement, on the bone as on the soft tissue level, whether they show a periapical pathology at the time of implant placement or not. Future studies should additionally aim at evaluating further esthetic parameters such as crown-length and soft-tissue parameters like the modified papilla index (Jent 1997).

Considerations about possible future peri-implant radiolucencies and primary stability have to be made when immediately placing implants into extraction sites of teeth with periapical pathologies. The present study did not reveal any periapical radiolucencies after immediate implant placement into sockets with periapical pathologies after 3 years. This is in contrast to other studies that report periapical radiolucencies on the tip of the implant after implant placement in sites with a former endodontic pathology [Oh et al. 2003; Quirynen et al. 2005]. Some authors suspect a higher risk of early contamination of the tip of the implant due to persisting microorganisms [Quirynen et al. 2005]. Others have shown an osseointegration free of complications in a dog model after
placing implants in artificially induced periapical lesions [Marcaccini et al. 2003; Novaes et al. 1998, 2003; Novaes & Novaes 1995; Papalexiou et al. 2004]. In the previous study of our group, in agreement with other reports, no radiolucencies were found after 1 year following implant placement [Casap et al. 2007; Siegenthaler et al. 2007]. No studies with longer follow-up periods and multiple patients could be found. The present evaluation showed no signs of radiolucencies around the tip of the implants after 3 years in 13 patients with former periapical pathologies and immediate implant placement.

Conclusion

Clinical and radiological parameters were favorable for implants placed into sockets with or without periapical pathology after a 3-year observation period. Within the limits of the present study, it can therefore be suggested, that when carefully debriding the extraction socket, immediate placement of implants into sites with periapical pathologies can be a successful treatment modality for at least 3 years with no disadvantages in clinical and radiological parameters to immediately placed implants into healthy sockets.

References


