Satisfaction and psychosocial aspects of patients with an extremely resorbed mandible treated with implant-retained overdentures

A prospective, comparative study

Key words: edentulous, extremely resorbed, implant, implant-retained overdenture, mandible, psychosocial, satisfaction

Abstract: The objective of the present report was to study the effect of implant treatment on subjective parameters in edentulous patients with an extremely resorbed mandible. Three different treatment modalities to support an overdenture were compared: transmandibular implant according to Bosker, augmentation of the mandible followed by four endosseous implants, and the insertion of four short endosseous implants. Sixty patients (50 women and 10 men, mean (± SD) age 59 (± 11) years) met the inclusion criteria and were assigned in one of the three treatment groups. Before treatment and 12 months after placement of the new overdentures, denture satisfaction, psychosocial aspects and experiences during the surgical phase were assessed with a battery of questionnaires. After 1 year, 58 patients were available for evaluation: one patient had died, and one patient had moved out of the region. There was a significant improvement of patient satisfaction and psychosocial functioning in all three treatment groups. At the 1-year evaluation, differences amongst the three groups were not significant. However, in terms of discomfort and pain during the surgical phase as well as the length of this phase (at least 6 months), the augmentation using an autologous bone graft from the iliac crest followed by inserting four endosseous implants 3 months later appeared the least favorite option of the three modalities studied.

With the availability of dental implants to stabilize (mandibular) overdentures in edentulous patients, treatment possibilities have changed dramatically. Dental implants can be applied in a predictable way (Batenburg et al. 1998a) to provide retention and stability for a mandibular overdenture in patients for whom only marginal and temporary improvement could be achieved in the past (De Koomen et al. 1979).

The primary aims of treating edentulous patients with implant-retained overdentures are to reduce pain and discomfort, to improve function, and to stimulate psychosocial well-being. In addition to objective improvement of retention, stability, and chewing efficiency, it is imperative to know the effect of such a treatment on the well-being of the patients. For patients, a treatment is only successful when oral comfort, chewing, self confidence, and appearance are restored to a satisfactory level.

Numerous treatment outcome studies have been published, most of which have focused on clinical and radiological aspects (Boerrigter et al. 1997; Batenburg et al. 1998b). Although there are several studies describing the effect of dental implants on subjective parameters, including patient satisfaction and psychosocial aspects (Kent 1992; Kent & Johns 1991), few studies have been designed according to the principles of a randomized clinical trial (Boerrigter

As long as the bone volume in the edentulous mandible is sufficient, the use of two endosseous implants installed in the interforaminal area has proved to be very successful in stabilizing and retaining an overdenture (Chao et al. 1995; Batenburg et al. 1998). The clinical results are very reliable (Boerrigter et al. 1997), and patients judge this kind of treatment to be very beneficial (Raghoebar et al. 2000). For cases with an extremely resorbed mandible, i.e. those ‘exceeding’ class VI in the classification of Cawood & Howell (1988), and diminished bone volume the following treatment options have been proposed.

- Transmandibular implant according to Bosker et al. (1991).
- Augmentation of the extremely resorbed mandible with an autogenous bone graft [iliac crest], followed after 3 months by the installation of four endosseous implants in the interforaminal region (Stellingsma et al. 1998).
- The installation of four short implants in the interforaminal region (Tripplet et al. 1991; Keller 1995; Stellingsma et al. 2000).

Evaluation of clinical aspects and subjective parameters following these strategies in a randomized, clinical trial has not yet been reported.

The objective of this study was to quantify and analyse the effect of the abovementioned treatment strategies on subjective parameters in patients with an extremely resorbed mandible. The clinical aspects will be reported separately.

Material and methods

Patient selection
Edentulous patients with an extremely resorbed mandible and persistent problems with their complete, conventional, mandibular dentures were included in this study. They were referred by general practitioners to the Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthetics of the Groningen University Hospital.

The criteria for inclusion were as follows.

- Edentulous upper and lower jaws for at least 2 years.
- Symphyseal height of the mandible ≤ 12 mm, measured on a standardized lateral radiograph.
- Severe functional problems with the mandibular dentures, i.e. poor retention and stability of the lower denture, and little or no improvement to be expected from making new conventional dentures.

Patients with a history of radiotherapy in the head and neck region, or a history of pre-prosthetic surgery or previous oral implantology were excluded from the study.

The patients were thoroughly informed about the three possible modes of treatment, and about the extra efforts (questionnaires, evaluation visits, etc.) associated with the trial before they gave their written consent to participate in this clinical trial. The study was approved by the medical ethical committee of the Groningen University Hospital.

Study design and treatment procedure
Eligible patients were allocated to one of the three modes of treatment.

Group I was treated with an overdenture supported by a transmandibular implant according to Bosker (M&R Haren b.v., Haren, the Netherlands) consisting of a base plate, four implant posts and five cortical screws, all made of a gold alloy (Bosker et al. 1991). The transmandibular implant was inserted under general anesthesia via an extra-oral approach. Patients were not allowed to wear a lower denture, and were advised to keep to a soft diet to minimize loading of the implant system. After 3 months an overdenture, according to a specified protocol, was constructed (Powers et al. 1994).

In group II, the mandible was augmented using an autologous bone graft from the iliac crest. This procedure was performed under general anesthesia (Stellingsma et al. 1998). After 3 months, four IMZ [Intra Mobil Zylinder] apical screw implants (Friatec, Mannheim, Germany) were inserted in the interforaminal region under local anesthesia. After an initial healing period of 3 months, abutment connection was carried out. The implants were connected with an egg-shaped triple-bar construction. The mandibular overdenture was connected with three [Dolder, Cendres Metaux, Biel-Bienne, Switzerland] clips to this bar construction. During the surgical phase, patients were not allowed to wear a lower denture.

In group III, four short [8 or 11 mm] Twin Plus IMZ implants (Friatec, Mannheim, Germany) were inserted in the interforaminal region to support an overdenture. This was done under local anesthesia in an outpatient setting. Patients were advised not to wear their lower denture for 3 weeks. After this period the frontal area of the denture was relieved, and the ‘old’ lower denture was adjusted with a soft liner (CoeSoft, Coe laboratories, Inc., Chicago, IL). Three months later abutment connection was carried out and the new (over)dentures were inserted. The construction of superstructure and overdenture was similar to that in the augmentation group.

The dentures in all three treatment groups were made with bilateral balanced occlusion using the lingualized occlusion concept with porcelain teeth (Khamis et al. 1998).

Treatments were allocated using a balancing procedure to provide an equal distribution of patients over the treatment groups with regard to important prognostic or confounding variables, i.e. age, gender, the edentulous period of the mandible, the number of previous mandibular dentures, the number of years of wearing the present mandibular denture, and the symphyseal bone height of the mandible. A computer program was used for the allocation of the patients (Zielhuis et al. 1990).

Operations on all patients were performed by one experienced oral and maxillofacial surgeon according to protocols that were established in close cooperation with the manufacturers of the implant systems. The prosthetic procedures were performed by two experienced prosthodontists following specific protocol procedures for each treatment modality.

Data collection
After inclusion (baseline T0) and 12 months after insertion of the (new) overdentures (T3), patients were requested to fill out questionnaires to assess the following parameters concerning satisfaction and psychosocial functioning in relation to their dentures.

- ‘Denture satisfaction’ was assessed using a validated questionnaire consisting of eight separate items focusing on the function of upper and lower dentures, and on specific features such as esthetics, retention, and functional comfort (Vervoorn et al. 1988). Each item was presented with a five-point
rating scale on which the patient indicated the extent he or she was [dis]satisfied.

- ‘Denture complaints’ were assessed using a validated questionnaire consisting of 54 items [Vervorn et al. 1988]. The extent of each specific complaint could be expressed on a four-point rating scale (0 = no complaints, 1 = little, 2 = moderate, and 3 = severe complaints). The questionnaire consisted of six scales representing specific complaints, each with a satisfactory reliability as determined with Cronbach’s $\alpha$ (varying between 0.76 and 0.89) and mean inter-item correlation (varying between 0.20 and 0.55). On each factor, final scores were calculated as the mean of the item score ranging from 0 to 3.

- ‘Overall denture satisfaction’ was expressed on a 10-point rating scale (0–10), ‘0’ being completely dissatisfied and ‘10’ being completely satisfied.

- The impact of denture problems on social activities, such as going out, and contacting and visiting people, was assessed using the ‘Groningen Activity Restriction Scale-Dentistry [GARS-D]’ [Bouma et al. 1997]. GARS-D is an 11-item scale (Cronbach’s $\alpha = 0.88$, mean inter-item correlation = 0.39) yielding a score ranging from 0 to 22; the higher the score, the larger the impact on social activities.

- ‘Psychological well-being’ was assessed using a scale for denture patients [Bouma et al. 1997] consisting of six items, focusing on psychosocial acceptance of the prosthesis. Examples of items are: ‘Do you experience the prosthesis as a part of your body?’ and ‘Are you ashamed about your prosthesis?’ The scale yields a score ranging from 0 to 12; the higher the score the more problems there are with the acceptance of the prosthesis (Cronbach’s $\alpha = 0.74$, mean inter-item correlation = 0.32).

- The ‘Experiences surgical phase’ parameter investigated the patient’s experiences during the surgical phase. Patients filled out a questionnaire about this phase 3 weeks after the operation. The questionnaire, focusing on pain, discomfort and facial appearance following the operation, consisted of six items. At the time of this questionnaire, none of the patients had been allowed to wear their lower dentures.

**Data analysis**

With regard to the ‘Denture satisfaction’, ‘Denture complaints’, ‘GARS-D’, and ‘Psychological well-being’ questionnaires, the outcome results within each of the three treatment groups were analyzed using the Wilcoxon matched pairs signed ranks test. Differences between the groups were analyzed by applying the Kruskal–Wallis one-way analysis of variance. The latter was also used for analyzing the ‘Experiences surgical phase’ questionnaire.

For the ‘GARS-D’ and ‘Psychological well-being’ questionnaires, the analyses were repeated after exclusion of persons with a score of 0 prior to treatment. For these two questionnaires the effect sizes were computed. An effect size of 0.20 or less is regarded as a small effect, an effect size of 0.50 as a medium effect, and an effect size of 0.80 (or higher) as a large effect [Cohen 1992].

The outcome results of the ‘Overall denture satisfaction’ rate for each of the treatment groups were analyzed using paired $t$-tests. Differences between the groups were analysed using one-way analysis of variance (ANOVA). In all statistical tests, a significance level of 0.05 was chosen. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS, version 9.0 for Windows, SPSS Inc., Chicago, IL).

**Results**

**Samples**

The study sample consisted of 60 persons (50 women and 10 men) with a mean ($\pm$ SD) age of 59.4 $\pm$ 11.0 years. They were edentulous for an average of 28.9 $\pm$ 10.9 years, and were wearing their third lower denture (range 1–6, median 3), which on average was 6.4 $\pm$ 5.8 years old. The mean jaw height measured in the symphyseal area on a standardized lateral cephalometric radiograph was 9.7 $\pm$ 1.4 mm. The pretreatment characteristics of the three groups are summarized in Table 1. After 1 year, two patients had dropped out: one patient [group III] had died, and one patient [group II] had moved out of the region and was lost to follow-up. Assuming that dropping out was unrelated to the treatment, these two patients were excluded from the study. Thus, 58 patients were available for evaluation.

**Implant loss**

In the transmandibular group [group I], one implant post had failed to integrate in the healing phase, and was replaced. Four implant posts in one patient lost integration, which was diagnosed at the 1-year follow-up visit. The implant was removed shortly thereafter, and the patient was treated according to an alternative protocol. In the augmentation-followed-by-implants group [group II], four patients lost one implant during the healing phase. It was decided to use the remaining three implants for construction of the superstructure. One patient lost all four implants during the healing phase, and was retreated with four implants. No loss of implants occurred in the short implants group [group III].

**Denture satisfaction**

The denture satisfaction of the treatment groups is presented in Table 2. Prior to treatment (baseline, T0), the patients were mainly dissatisfied with ‘lower denture’, ‘retention’ and ‘eating’, and there were no significant differences amongst the three subgroups [Kruskal–Wallis one-way analysis of variance, $P > 0.05$]. Following the treatment (T3), there was a significant change in general denture satisfaction in each treatment group [Wilcoxon matched pairs signed ranks tests, $P < 0.05$], including satisfaction concerning the upper denture [Wilcoxon matched pairs signed ranks tests, $P < 0.05$]. The scores at T3 did not differ significantly amongst the three groups [Kruskal–Wallis one-way analysis of variance, $P > 0.05$].

**Denture complaints**

The results of the ‘Denture complaints’ questionnaire are presented in Table 3. The 54 items were grouped into six scales, and for each scale the mean score and standard deviation were calculated. The complaints before treatment (T0) focused on the scales ‘lower denture’ and to a lesser degree ‘physiognomy’. The three (sub)groups did not differ significantly with regard to the complaints they had before treatment [Kruskal–Wallis one-way analysis of variance, $P > 0.05$]. After treatment (T3), all scales showed significant improvement for all three groups [Wilcoxon matched pairs signed ranks test, $P < 0.05$]. Again, the (sub)groups did not differ significantly after treatment [Kruskal–Wallis one-way analysis of variance, $P > 0.05$].

The scale ‘Complaints lower denture’ (scale B) improved significantly by nearly two points (varying from 1.73 to 1.92) on a
Table 1. Mean and standard deviation (±SD) of several characteristics of the patient population (mean and range for number of mandibular dentures), after inclusion in the clinical trial (T0), classified by treatment modality

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group I (TMI) (n = 20)</th>
<th>Group II (AUG) (n = 19)</th>
<th>Group III (SHORT) (n = 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59.4 (± 12.0)</td>
<td>57.4 (± 10.0)</td>
<td>61.4 (± 11.4)</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Male</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Edentulous period (years)</td>
<td>29.6 (± 11.9)</td>
<td>28.0 (± 7.1)</td>
<td>30.1 (± 9.9)</td>
</tr>
<tr>
<td>Number of mandibular dentures</td>
<td>3 (1–5)</td>
<td>3(1–4)</td>
<td>3 (1–6)</td>
</tr>
<tr>
<td>Age of mandibular denture (years)</td>
<td>6.0 (± 4.5)</td>
<td>8.3 (± 7.0)</td>
<td>5.0 (± 6.7)</td>
</tr>
<tr>
<td>Jaw height (mm)</td>
<td>9.7 (± 1.4)</td>
<td>9.5 (± 1.6)</td>
<td>9.8 (± 1.4)</td>
</tr>
</tbody>
</table>

TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.

Table 2. Mean scores of the items of the ‘Denture satisfaction’ questionnaire at baseline (T0) and 1 year after treatment (T3)

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Group I (TMI) (n = 20)</th>
<th>Group II (AUG) (n = 19)</th>
<th>Group III (SHORT) (n = 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T3</td>
<td>T0</td>
</tr>
<tr>
<td>General</td>
<td>4.30</td>
<td>1.28</td>
<td>3.80</td>
</tr>
<tr>
<td>Upper denture</td>
<td>2.55</td>
<td>1.50</td>
<td>2.50</td>
</tr>
<tr>
<td>Lower denture</td>
<td>4.75</td>
<td>1.33</td>
<td>4.75</td>
</tr>
<tr>
<td>Appearance</td>
<td>3.65</td>
<td>1.56</td>
<td>3.10</td>
</tr>
<tr>
<td>Retention</td>
<td>4.25</td>
<td>1.50</td>
<td>4.05</td>
</tr>
<tr>
<td>Functional comfort</td>
<td>3.80</td>
<td>1.72</td>
<td>3.65</td>
</tr>
<tr>
<td>Eating</td>
<td>4.10</td>
<td>1.50</td>
<td>3.95</td>
</tr>
<tr>
<td>Speaking</td>
<td>3.05</td>
<td>1.44</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Scale range 1–5: 1 = very satisfied, 2 = satisfied, 3 = neutral, 4 = dissatisfied, and 5 = very dissatisfied. TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.

Table 3. Mean scores (range 0–3) for the factors of the ‘Denture complaints’ questionnaire prior to treatment (T0) and 1 year after treatment (T3)

<table>
<thead>
<tr>
<th>Complaints</th>
<th>Group I (TMI) (n = 20)</th>
<th>Group II (AUG) (n = 19)</th>
<th>Group III (SHORT) (n = 19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T0</td>
<td>T3</td>
<td>T0</td>
</tr>
<tr>
<td>A. Upper denture</td>
<td>0.56</td>
<td>0.13</td>
<td>0.59</td>
</tr>
<tr>
<td>B. Lower denture</td>
<td>2.14</td>
<td>0.22</td>
<td>2.18</td>
</tr>
<tr>
<td>C. General</td>
<td>0.87</td>
<td>0.13</td>
<td>1.04</td>
</tr>
<tr>
<td>D. Physiognomy</td>
<td>1.78</td>
<td>0.14</td>
<td>1.52</td>
</tr>
<tr>
<td>E. Neutral space</td>
<td>0.66</td>
<td>0.25</td>
<td>0.61</td>
</tr>
<tr>
<td>F. Aesthetics</td>
<td>0.58</td>
<td>0.10</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Scale range 0–3: 0 = no complaints, 1 = few complaints, 2 = moderate complaints, and 3 = severe complaints. TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.

Overall denture satisfaction rate

The overall denture satisfaction rate, expressed on a 10-point rating [1–10], pre- and post-treatment is summarized in Table 4. The mean pre-treatment overall denture satisfaction rate did not differ significantly amongst the three allocated treatment groups [ANOVA, P < 0.05]. After treatment, there was a significant increase [paired t-tests, P < 0.05], which was similar for all groups. The post-treatment satisfaction rate did not differ significantly amongst the three treatment groups [ANOVA, P > 0.05].

GARS-D

Before treatment (T0) there was no significant difference amongst the three treatment groups with regard to their dental condition related to social activities [Kruskal-Wallis one-way analysis of variance, P > 0.05]. The scale scores are summarized in Table 5. Following treatment, the mean values on the GARS-D scale had improved significantly [Wilcoxon matched pairs signed ranks test, P < 0.05], although the differences amongst the treatment groups were not significant [Kruskal-Wallis one-way analysis of variance, P > 0.05]. Because a relatively large percentage of each group (between 25% and 50%) had a score of 0 before treatment, the analyses were repeated after exclusion of the persons with a score of 0 before treatment. No significant differences were found amongst the three treatment groups before or after treatment [Kruskal-Wallis one way analysis of variance, P > 0.05]. The major improvement in all three treatment groups is illustrated by the fact that 100% [group I], 73% [group II], and 91% [group III] of the patients had a score of 0 at T3, while nobody had deteriorated. This trend is confirmed by the effect sizes, which appeared to be considerable in all groups.

Psychological well-being of denture patients

In Table 6, the mean scores on the scale ‘Psychological well-being’ for denture patients are presented for the three treatment groups. Amongst these groups, the pre-treatment differences (T0) were not significant [Kruskal-Wallis one-way analysis of variance, P > 0.05]. After treatment, the mean score on this scale had decreased significantly [Wilcoxon matched pairs signed ranks tests, P < 0.05], and again, no significant differences could be detected when the three groups were compared [Kruskal-Wallis one way analysis of variance, P > 0.05]. Although the percentage of people with a score of 0 before treatment was not high [between 5 and 15%], the analyses were also carried out without this group. No significant differences were found amongst the three treatment groups before and after treatment [Kruskal-Wallis one way analysis of variance, P > 0.05]. After treatment, a strong improvement was seen on the ‘Psychological well-being’ scale from 0 to 3. This extent of improvement was not present for one of the specific items of scale B, namely the item ‘There is retention of food under the lower denture during chewing’. The significant improvement for this specific item was only one point [varying from 2.40 to 2.65 before treatment, and from 0.82 to 1.30 after treatment] on a scale from 0 to 3. This phenomenon was similar in all three treatment groups.
scale for denture patients (Wilcoxon matched signed ranks tests, $P<0.05$). Following treatment, 52% [group I], 39% [group II], and 44% [group III] had a score of 0, while nobody in any of the three groups had deteriorated. This was confirmed by the effect sizes.

**Experiences in the surgical phase**

A large majority of the patients were satisfied with the pre-surgical information (80%) and attention (95%) they received from the hospital staff. Most of the patients (90%) reported that they would undergo, when necessary, the same procedure again. No significant differences existed amongst the three treatment groups [Kruskal–Wallis one-way analysis of variance, $P>0.05$].

In the augmentation group [group II], 50% of the patients experienced the operation more negatively than expected, which was significantly different from groups I (15%) and III (25%). The same phenomenon was observed concerning post-operative pain: 85% of the patients in group II reported serious pain for more than 1 week, which was significantly higher [Kruskal–Wallis one-way analysis of variance, $P<0.05$] than in groups I and III (20%).

In groups I and II, about 70% of the patients reported an improvement in their facial appearance, vs. 20% in group III (in this group, 70% reported no change, and 10% reported a deterioration of their facial appearance). This difference was significant [Kruskal–Wallis one-way analysis of variance, $P<0.05$].

**Discussion and conclusions**

The patients entering this clinical trial had functional complaints about their dentures which focused on lack of retention of the lower denture. The treatment effect on subjective parameters as described in this study was apparent. In addition to general satisfaction and denture complaints, psychosocial functioning significantly improved in this patient group. There were relatively few complaints about the maxillary denture. Installing dental implants in the mandible improves the retention and stability of the lower denture, thereby minimizing complaints about the lower denture, as expected from other studies [Wismeier et al. 1992; Boerrigter et al. 1995]. However, not only complaints about the mandibular denture, but also complaints about the maxillary denture decreased significantly in this study. The explanation for this may be 2-fold: on one hand the dentures were made by two highly qualified prosthodontists with extensive experience in prosthetic implantology, and on the other hand the results may be attributed to the knowledge of the patients that they were participating in a clinical trial, the so-

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**Table 4. Overall denture satisfaction rate: mean and standard deviation (±SD) are presented before (T0) and after treatment (T3 = 12 months) in the three groups**

<table>
<thead>
<tr>
<th>Overall denture satisfaction rate (range 0–10)</th>
<th>Group I (TMI, $n = 20$)</th>
<th>Group II (AUG, $n = 19$)</th>
<th>Group III (SHORT, $n = 19$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline (T0)</td>
<td>4.1 (± 1.4)</td>
<td>4.3 (± 1.7)</td>
<td>4.4 (± 1.5)</td>
</tr>
<tr>
<td>Post-treatment (T3)</td>
<td>8.0 (± 1.1)</td>
<td>7.9 (± 1.6)</td>
<td>8.9 (± 1.2)</td>
</tr>
</tbody>
</table>

Scale range 0–10: 0 = completely dissatisfied and 10 = completely satisfied.

TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.

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**Table 5. Mean scores and standard deviation (±SD) of the Groningen Activity Restriction Scale-Dentistry (GARS-D) scale before (T0) and after treatment (T3 = 12 months) in the three groups**

<table>
<thead>
<tr>
<th>GARS-D</th>
<th>Group I (TMI, $n = 20$)</th>
<th>Group II (AUG, $n = 19$)</th>
<th>Group III (SHORT, $n = 19$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>2.2 (± 3.2)</td>
<td>3.4 (± 4.4)</td>
<td>3.4 (± 5.2)</td>
</tr>
<tr>
<td>T3</td>
<td>0.0</td>
<td>0.3 (± 1.1)</td>
<td>0.1 (± 0.22)</td>
</tr>
<tr>
<td>Effect size*</td>
<td>0.68</td>
<td>0.96</td>
<td>0.92</td>
</tr>
<tr>
<td>Patients with a score of 0 at T0 excluded (n)</td>
<td>10</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>T0</td>
<td>4.4 (± 3.3)</td>
<td>4.6 (± 4.5)</td>
<td>6.3 (± 5.7)</td>
</tr>
<tr>
<td>T3</td>
<td>0.0</td>
<td>0.4 (± 1.1)</td>
<td>0.1 (± 0.3)</td>
</tr>
<tr>
<td>Effect size*</td>
<td>1.33</td>
<td>1.27</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Scale range 0–22: 0 = no impact on social activities and 22 = maximum impact on social activities.

*Effect size is defined as the quotient of the difference T0–T3 and the pooled standard deviation.

TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.

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**Table 6. ‘Psychological well-being’ scale for denture patients: mean and standard deviation (±SD) before (T0) and after treatment (T3 = 12 months) in the three groups**

<table>
<thead>
<tr>
<th>Psychological well-being</th>
<th>Group I (TMI, $n = 20$)</th>
<th>Group II (AUG, $n = 19$)</th>
<th>Group III (SHORT, $n = 19$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>3.9 (± 3.6)</td>
<td>3.8 (± 2.7)</td>
<td>3.9 (± 2.8)</td>
</tr>
<tr>
<td>T3</td>
<td>1.5 (± 2.3)</td>
<td>1.6 (± 2.2)</td>
<td>1.6 (± 1.9)</td>
</tr>
<tr>
<td>Effect size*</td>
<td>0.75</td>
<td>0.88</td>
<td>0.97</td>
</tr>
<tr>
<td>Patients with a score of 0 at T0 excluded (n)</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>T0</td>
<td>4.5 (± 3.5)</td>
<td>4.0 (± 2.6)</td>
<td>4.3 (± 2.7)</td>
</tr>
<tr>
<td>T3</td>
<td>1.7 (± 2.5)</td>
<td>1.7 (± 2.3)</td>
<td>1.7 (± 2.0)</td>
</tr>
<tr>
<td>Effect size*</td>
<td>0.92</td>
<td>0.96</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Scale range 0–12: 0 = no problems with acceptance of the prosthesis and 12 = maximum problems with acceptance of the prosthesis.

*Effect size is defined as the quotient of the difference T0–T3 and the pooled standard deviation.

TMI = transmandibular implant; AUG = mandible augmented using an autologous bone graft from the iliac crest; SHORT = four short (8 or 11 mm) Twin Plus IMZ implants (Friatec) inserted in the interforaminal region.
called Hawthorne effect, which may have affected their attitude. Because a substantial percentage of the patients (up to 35%) reported considerable retention of food under their lower overdenture in the ‘Denture complaints’ questionnaire after treatment [T3], it is important to inform patients about this phenomenon before treatment. Thus patients are aware of the fact that some complaints (e.g. food retention) may remain after inserting dental implants and the construction of an overdenture. The change in the ‘Overall denture satisfaction’ rate [range 0–10] following treatment with dental implants is comparable to that found in other studies, in which this rate was used to express the effectiveness of a treatment modality [Raghoebar et al. 2000].

With regard to psychosocial effects (assessed in the ‘GARS-D’ and ‘Psychological well-being’ questionnaires) there was also a significant improvement, consistent with several other studies [Blomquist & Lindquist 1982; Kiyak et al. 1990; Kent 1992].

The questionnaire ‘Experiences surgical phase’ strongly suggested that the patients in the three groups experienced the surgical phase differently, concerning the operation itself as well as post-operative pain and facial appearance just after the operation. During the surgical phase, the augmentation group reported the worst results concerning discomfort and pain, although simultaneously reported an improvement of facial appearance (in common with the transmandibular implant group). However, these differences could not be detected in terms of satisfaction and psychosocial functioning 12 months after treatment in the questionnaires used in this study. Considering the end result, subjective parameters do not appear to be decisive in selecting one of the three treatment modalities for a patient with an extremely resorbed mandible. However, in terms of discomfort, and pain during the surgical phase as well as the length of this phase (at least 6 months), the augmentation of the extremely resorbed mandible using an autologous bone graft from the iliac crest, followed by insertion of four endosseous implants 3 months later, is the least favorable option of the three modalities.

From this study, it can be concluded that patients with an extremely resorbed mandible and functional complaints regarding their (lower) dentures undergoing dental implant therapy report significant improvement in oral and social functioning. The results of the three modes of treatment described in this study were not significantly different with regard to the subjective parameters 1 year after treatment. Future follow-up studies of this group will reveal the long-term stability of these results.

Résumé
Le but de ce présent rapport a été d’étudier l’effet du traitement implantaire sur des paramètres subjectifs chez des patients édentés ayant une mandibule extrêmement réabsorbée. Trois modalités de traitement pour le support d’une prothèse ont été comparées : implant transmandibulaire (Bosker et al. 1991), épaisseur de la mandibule suivi par quatre implants, et insertion de quatre implants courts, cette dernière opération étant la seule pratique sous anesthésie locale. Soixante patients (30 femmes et 30 hommes) de 59 ± 11 ans) ont participé à cette étude et ont été répartis au hasard dans un des trois groupes de traitement. Avant traitement et douze mois après le placement des nouvelles prothèses, la satisfaction, les aspects psychosociaux et l’expérience vécue durant la chirurgie ont été évalués à l’aide d’un questionnaire. Après une année, 58 patients restaient disponibles pour l’évaluation. Un patient était décédé et un autre avait quitté la région. Il y avait une amélioration significative de la satisfaction des patients, du fonctionnement psychosocial dans les trois groupes traités. À l’évaluation d’une année, les différences entre les groupes n’étaient pas significatives. Cependant, en terme d’inconfort et de douleur durant la phase chirurgicale ainsi que la longueur de cette phase (au moins six mois), l’épaississement utilisant un greffon osseux autologue de la crête iliaque suivi par l’insertion de quatre implants trois mois plus tard apparaissait comme l’option la moins acceptable pour les patients.

Zusammenfassung

Resumen
El objeto del presente informe fue estudiar el efecto del tratamiento de implantes sobre parámetros subjetivos en pacientes edéntulos con una reabsorción mandibular extrema. Se compararon tres diferentes modalidades de soporte de una sobredentadura: implante transmandibular según Bosker, aumento de la mandíbula seguido de cuatro implantes endósicos; y la inserción de cuatro implantes endosícos cortos. Setenta pacientes (35 mujeres, 35 hombres, media ± SD edad: 59 ± 11 años) cumplieron los criterios de inclusión y se distribuyeron aleatoriamente en uno de los tres grupos de tratamiento. Antes del tratamiento y doce meses tras la colocación de las nuevas sobredentaduras se valoraron la satisfacción, los aspectos psicológicos y las experiencias durante la fase quirúrgica con una batería de cuestionarios. Tras un año, 58 pacientes estuvieron disponibles para evaluación: un paciente murió, y otro se trasladó fuera de la región. Hubo una mejora significativa en la satisfacción del paciente, funcionamiento psicosocial en los tres grupos de tratamiento. En la evaluación del año, las diferencias entre los tres grupos no fueron significativas. De todos modos, en términos de desconfort y dolor durante la fase quirúrgica al igual que la longitud de esta fase (al menos seis meses), el aumento usando injertos de hueso autólogo de la cresta ilíaca seguido por la inserción de cuatro implantes endósi-

要旨
本研究では、インプラント治療が重度の下顎骨欠損を有する無歯患者において主観的パラメーターに及ぼす影響を検証した。Boskerによる下顎インプラント及び骨質壊死後の4本の骨内インプラント挿入、短い骨内インプラント4本の挿入という、オーバーデントチャー支持のための3つの異なる治療模式を比較した。参加基準を満足する患者60名（女性50名、男性10名、平均年令59才、SD±11才）を非選択的に3群に振り分けた。新設と新しいオーバーデントチャーを装着した12ヶ月後に、満足度、心理的社会的側面及び経験を様々な項目のアンケートにより評価した。1年後に術後58名を評価することができた1名は死亡し、1名は遠隔地に転居した。患者の満足度及び心理的社会的機能は、3群にわたりにおいて有意に改善した。1年後の評価では、3群間に有意差はなかった。しかし、半月期の快感度と満足度及び同期間の長さ（少なくとも6ヶ月）については、術前後の自宅での生活を用いた増生を行った3ヶ月後に4本の骨内インプラントを入れた群が、3つの治療模式の中で最も望ましくない選択肢であると思われた。
References


