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# Patient-centered outcome of immediately loaded implants in the rehabilitation of fully edentulous jaws

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**Key words:** chewing comfort, dental implants, eating comfort, edentulous, esthetics, immediate loading, patient-centered outcome, patient opinion, patient satisfaction, perceived comfort, phonetics, postoperative complications

## Abstract

**Introduction:** Edentulism often involves functional, esthetic, phonetic and psychological problems.

**Objectives:** To evaluate patient-centered outcomes of full-arch screw-retained rehabilitation on immediately loaded implants.

**Material and methods:** Fifty patients treated with Astra Tech™ implants answered self-administered questionnaires on a visual analogue scale (VAS) 100 mm scale or with multiple-choice or open questions: at baseline, 1 week, 3 or 6 months and 1 year. Changes of VAS in time were analyzed using mixed models for repeated measures, adjusting for gender, age and jaw; comparison of cross-sectional parameters between jaws was performed with the Mann–Whitney *U*- or  $\chi^2$ -test, all at the 0.05 significance level.

**Results:** The median calculated general satisfaction score increased from 40.25 (mean = 40.9; SD = 23.82; range = 0–95) at baseline to 98.25 (mean = 95.3; SD = 6.68; range = 74–100) after 1 year. Overall comfort, eating comfort, speaking comfort and perceived esthetics improved significantly within 1 week after surgery and immediate provisionalization. This did not change significantly until the final bridge was installed after 3 months (mandible) or 6 months (maxilla), when a further significant improvement was demonstrated. The most common postoperative complication was swelling, especially in the maxilla. The importance of one-stage surgery and immediate loading was rated very high by patients before treatment, especially in the mandible. The main reason for choosing fixed prosthetics was eating comfort. Phonetics and esthetics were more important in the maxilla than in the mandible.

**Conclusion:** Immediate full-arch rehabilitation yields an instant significant improvement in general patient satisfaction and self-perceived factors related to comfort, function and esthetics. Eating comfort is the main concern for the patient and shows the highest improvement. Postoperative complications are limited and patients considered immediate loading important.

Although the prevalence of edentulism and the incidence of tooth loss are declining in industrialized countries (Österberg et al. 2000; Mojon 2003), these are still common conditions in our patient population. European prevalence numbers of edentulism

for 64- to 75-year-old patients range from 15% to 72% (Mojon 2003). The average age to become edentulous is increasing but so is life expectancy. Therefore, the total number of edentulous patients is declining less rapidly. Today patients have higher

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expectations concerning chewing comfort and prosthetic outcome (Müller et al. 2007). Patients' attitude and satisfaction with prosthetic restorations are influenced by the current trends in adult dental health. Furthermore, the ability to adjust to removable dentures decreases with age. As a consequence, complaints related to removable dentures may increase in higher age groups and a shift in the request for prosthetic rehabilitation may arise (Allen & McMillan 2003; Müller et al. 2007).

Edentulism is often associated with functional and esthetic burdens for the patient and is related to psychological problems possibly influencing daily activities. Tooth loss can deeply affect patients' psycho-social well-being, even for patients who seem to adjust reasonably well to a conventional denture (Fiske et al. 1998). A recent review concluded that the oral condition seemed to have a negative impact on quality of life in fully edentulous patients (Strassburger et al. 2006). Psychological and emotional factors can play a major role in patients who do not adjust to the treatment performed (Carlsson 1997). Patient-centered outcomes may therefore be the main factors determining treatment success for the patient (Pjetursson et al. 2005). Research on patients' perception or the evolution of patient-centered outcomes concerning oral comfort is rather scarce and has been addressed only in 2% of the available literature (Pjetursson et al. 2005), which mainly involves fully edentulous patients. The main treatment outcomes are perception of general comfort, esthetics, chewing function and speech (Al-Omiri et al. 2005).

Patient satisfaction with immediate loading protocols has been described in a prospective study with mandibular overdentures. This study demonstrated a significant improvement of the oral health status, compared with the previous conventional denture (Attard et al. 2006). In the maxilla, patient satisfaction with early compared with delayed loading has been investigated in fully edentulous patients. No difference in satisfaction could be demonstrated between loading after 14 days compared with loading after 3–4 months (Fischer & Stenberg 2006).

The aims of the present study were to determine: (1) whether immediate loading of dental implants with a provisional bridge

improves the overall comfort of the patient and more specifically, perceived esthetics, function, comfort with eating and speaking and oral hygiene measures; (2) how patients experience postoperative complications like pain and swelling or hematoma; (3) whether patients would repeat the treatment, if necessary, or whether they would recommend it to other people; (4) how important immediate loading with a provisional bridge is for the patient; (5) the main reasons why patients choose fixed prosthetics; and (6) whether there are differences for all these parameters between the maxilla and the mandible.

## Material and methods

### Clinical treatment protocol

The study population consists of 50 consecutively treated patients from a private periodontal practice in Brussels, Belgium, treated with implants in order to totally rehabilitate the maxilla or the mandible. All implants were loaded within 24 h after surgery. In the maxilla, seven to eight implants (Astra Tech™, Mölndal, Sweden) were placed and the provisional metal-reinforced acrylic bridge was replaced by the final restoration after 6 months of function. In the mandible, five implants were placed and the glass fiber-reinforced temporary bridge was replaced after 3 months (Van de Velde et al. 2007). The final restorations were porcelain-fused-to-metal or metal-reinforced acrylic screw-retained constructions. The treatment protocol and clinical outcomes up to 3 years have been described recently (Collaert & De Bruyn 2008; De Bruyn & Collaert 2008; De Bruyn et al. 2008). According to the clinical protocol, antibiotics were prescribed only to risk patients based on the health-related protocols (Esposito et al. 2003). During the 2 weeks following surgery, a chlorhexidine mouth rinse was used, complemented by normal oral hygiene measures with an extra soft tooth brush (Special Care, Tepe, Malmö, Sweden). Paracetamol or non-steroidal anti-inflammatory drugs were used for analgesia according to patients' needs. No dietary advice was given and patients were allowed to eat everything including hard food. Patients were included in a recall scheme and oral hygiene was restructured if necessary. The final reconstruction was

manufactured by the referring dentist. The radiographic follow-up and maintenance care was performed by the periodontist and/or the referring dentist.

This monocentric study was conducted according to the principles of the Declaration of Helsinki from 1975. An informed consent was signed by all patients. The use of the study material has been approved by the Ethical Committee of the University Hospital Ghent, Belgium.

### Questionnaire study

Patients' opinion was assessed using questionnaires with open, multiple-choice and visual analogue scale (VAS) questions. With the latter, patients marked their opinion on a 100 mm scale between 0 (maximal disagreeing or minimal experienced) and 100 (maximal agreement or maximal experienced).

The questionnaires were filled out at four different time points: before the treatment, postoperatively after 1 week with the provisional restoration, before the manufacture of the final restoration at 3 months in the mandible or 6 months in the maxilla and with the final bridge 1 year after surgery.

The patient-centered outcomes of the questionnaires at all time points were overall comfort, eating comfort, speaking comfort and esthetics. These specific factors provide an insight into which aspects are improved with implant-supported restorations compared with the conventional denture before the treatment (Strassburger et al. 2004). A general satisfaction score for each patient was calculated from these answers as the mean VAS score for overall comfort, eating comfort, speaking comfort and esthetics. At all postoperative time points, patients were also asked whether they would repeat the treatment if necessary or whether they would recommend it to other people. In addition, questions were asked about the ease of oral hygiene measures with the temporary and final restorations. The questionnaire before treatment focused on the importance for the patient to have a one-stage surgery and immediate loading of the implants compared with delayed loading after 1 or 3 months. Moreover, patients were asked about their main reasons for choosing fixed prosthetics. The questionnaire after one week also asked about eating behavior immediately after

surgery and postoperative complications, including perception of pain, swelling or hematoma, and how severe these complications were perceived.

**Statistical analysis**

Patients’ perception of general satisfaction, overall comfort, eating comfort, speaking comfort, esthetics, easy oral hygiene, possibility to eat all kinds of food and the willingness to repeat or recommend the procedure to others, were analyzed using mixed models for repeated measures, adjusting for gender, age and jaw. Parameter estimation was performed using restricted maximum likelihood. A compound symmetry (CS) covariance structure was assumed, but Liang & Zeger’s (1986) ‘sandwich’ estimator was used to anticipate incorrect covariance structure assumption. A 5% significance level was assumed throughout the paper. Comparison of cross-sectional parameters between the maxilla and the mandible and of the drop-out group with the follow-up group was performed by means of the Mann–Whitney *U*-test. The percentages of patients indicating the reasons for choosing fixed prosthodontics were compared between jaws by means of the  $\chi^2$ -test. In the descriptive statistics, both median and mean VAS values were presented. The former are more indicative because distributions are skewed; the latter are necessary to allow a comparison with previous studies in the discussion. Statistical analysis was performed with SPSS (Version 15.0; SPSS, Chicago, IL, USA), and SAS (Version 9.1, SAS Institute Inc., Cary, NC, USA). PROC MIXED was used for longitudinal data analysis.

**Results**

**Study population**

The 50 patients included in the present study were between 35 and 76 years old, with a mean age of 56.8 (SD = 9.96). The population consisted of 28 women and 22 men, 28% were smokers. Twenty-five patients were treated in the maxilla and 25 in the mandible. On average, patients were wearing mucosa-supported dentures for 10 years (SD = 10; range = 1–40). Not all questionnaires were answered as meticulously by all patients. Some values were missing due to inattention of the patient or

the clinicians who forgot to deliver the questionnaire. This happened especially at the 1-year follow-up visit because maintenance care of the patients was sometimes performed by the referring dentist. Questionnaires were missing for seven patients at the 3- or 6-month recall visit, and for another seven patients at the 1-year follow-up.

**General satisfaction**

The general satisfaction results calculated from the VAS questions over time are shown in Fig. 1. Mixed model analysis showed no significant differences for gender, age or jaw. The median baseline values increased from 40.25 (mean = 40.9; SD = 23.82; range = 0–95) to 98.25 (mean = 95.3; SD = 6.68; range 74–100) after 1 year. The differences were statistically significant ( $P < 0.001$ ) between all time points, except for the time frame between 1 week and 3/6 months postoperatively when the provisional restoration was present.

**Eating comfort, phonetics, esthetics and oral hygiene measures**

The VAS values for patients’ perception of overall comfort, eating comfort, speaking comfort and esthetics are presented in Table 1. No gender-, age- or jaw-related statistically significant differences were

observed. Comparison of these variables for the different time frames showed statistically significant differences ( $P < 0.0001$ ) between baseline and all postoperative time points. Only eating comfort showed a statistically significant difference between 1 week and 3/6 months. Changing the provisional restoration (3/6-month results) to the final restoration (1-year results) demonstrated a statistically significant difference for eating comfort, speaking comfort and esthetic experience.

95.9% of the patients had the first normal meal at the evening of the surgery or on the next day, indicating that they had no problems in eating normally. A couple of patients who did not have a normal meal immediately noted this was due to fear rather than the inability to eat normally. The median score for the ease of eating hard food after 1 week was 84 (mean = 83.7; SD = 15.40; range = 19–100). Patients were also asked to what extent they could eat all kinds of food after 3/6 months and after 1 year. The median VAS scores were, respectively, 100 (mean = 93; SD = 11.49; range = 47–100) and 99.5 (mean = 95.8; SD = 9.31; range = 47–100), and showed a borderline significant improvement ( $P = 0.0488$ ).

The opinion on the ease of oral hygiene measures was rated 91.5 (mean = 86.1;

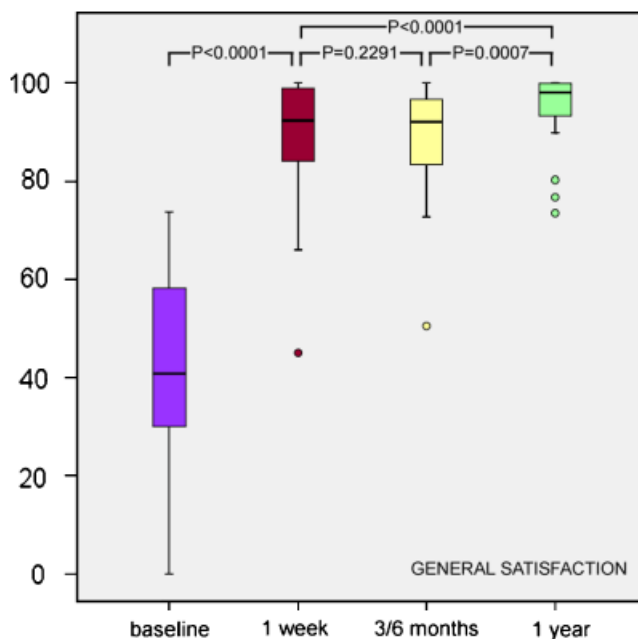


Fig. 1. Boxplot with general satisfaction score calculated (on a scale of 100) at the different time points (baseline, 1 week, 3 months [mandible] or 6 months [maxilla] and 1 year) for 48, 48, 42 and 36 patients respectively. *P*-values of the mixed models for repeated measures analysis for the comparison between different time points are demonstrated.

**Table 1.** Median and mean VAS values (on a scale with 100 = maximal comfort or esthetics) including standard deviation and range for overall comfort, eating comfort, speaking comfort and esthetics. Evaluation was done prior to treatment, with the provisional bridge after 1 week and 3 (mandible) or 6 months (maxilla) and with the final restoration after 1 year. *P*-values of the mixed models for repeated measures analysis for comparison between the different time points are presented

	Baseline	1 week	3/6 months	1 year
Overall comfort	Median = 25	Median = 98	Median = 100	Median = 99
	Mean = 33.1	Mean = 90.4	Mean = 92.1	Mean = 94.2
	SD = 27.29	SD = 15.56	SD = 13.86	SD = 10.84
	Range = 0–100	Range = 24–100	Range = 33–100	Range = 50–100
	N = 48	N = 49	N = 42	N = 36
$\underbrace{\hspace{10em}}_{P<0.0001}$ $\underbrace{\hspace{10em}}_{P=0.4534}$ $\underbrace{\hspace{10em}}_{P=0.1821}$ $\underbrace{\hspace{10em}}_{P=0.0088}$				
Eating comfort	Median = 20.5	Median = 96	Median = 98	Median = 100
	Mean = 29.0	Mean = 88.0	Mean = 92.4	Mean = 97.5
	SD = 29.71	SD = 15.51	SD = 11.24	SD = 4.14
	Range = 0–100	Range = 47–100	Range = 47–100	Range = 83–100
	N = 48	N = 48	N = 42	N = 36
$\underbrace{\hspace{10em}}_{P<0.0001}$ $\underbrace{\hspace{10em}}_{P=0.0394}$ $\underbrace{\hspace{10em}}_{P=0.0034}$ $\underbrace{\hspace{10em}}_{P<0.0001}$				
Speaking comfort	Median = 53	Median = 93	Median = 95	Median = 99
	Mean = 50.5	Mean = 88.2	Mean = 89.2	Mean = 93.8
	SD = 27.69	SD = 14.95	SD = 14.93	SD = 9.83
	Range = 0–100	Range = 33–100	Range = 33–100	Range = 61–100
	N = 48	N = 49	N = 42	N = 36
$\underbrace{\hspace{10em}}_{P<0.0001}$ $\underbrace{\hspace{10em}}_{P=0.6629}$ $\underbrace{\hspace{10em}}_{P=0.0080}$ $\underbrace{\hspace{10em}}_{P=0.0029}$				
Esthetics	Median = 54.5	Median = 95	Median = 92.5	Median = 99
	Mean = 50.9	Mean = 87.7	Mean = 88.9	Mean = 95.7
	SD = 29.07	SD = 15.84	SD = 13.91	SD = 8.87
	Range = 0–100	Range = 48–100	Range = 50–100	Range = 52–100
	N = 48	N = 50	N = 42	N = 36
$\underbrace{\hspace{10em}}_{P<0.0001}$ $\underbrace{\hspace{10em}}_{P=0.8465}$ $\underbrace{\hspace{10em}}_{P=0.0012}$ $\underbrace{\hspace{10em}}_{P=0.0017}$				

SD = 16.61; range = 21–100) with the provisional and 91 (mean = 86.8; SD = 14.98; range = 33–100) with the final restoration, the difference being not statistically significant (*P* = 0.6602).

**Postoperative complications**

For all patients, the median perception of pain, swelling, hematoma and the seriousness of these symptoms were, respectively, 18 (mean = 22.5; SD = 21.91; range = 0–100), 40 (mean = 39.6; SD = 26.61; range = 0–98), 9 (mean = 23.3; SD = 30.8; range = 0–97) and 13 (mean = 20.2; SD = 23.7; range = 0–100). Figure 2 presents the VAS scores according to jaw. The perception of swelling was more pronounced in the maxilla (*P* = 0.016). The median VAS score for swelling during the first week postoperatively in the maxilla was 46 (mean = 46.9; SD = 21.01; range = 9–82)

compared with 23 (mean = 32.2; SD = 29.86; range = 0–98) in the mandible.

Patients were provided with analgetics to which they had access if needed. In total, 93.9% of the patients took pain killers, such as paracetamol or ibuprofen. From this group, 54.8% stopped this after a maximum of 3 days. For 36.7% of the patients, it was medically indicated to prescribe antibiotics according to the health-related protocols.

**Repeating the treatment or recommend it to others**

The VAS values for the question whether the patient would repeat the procedure or recommend it to others in a similar situation are presented in Table 2. There were no significant differences related to gender, age or jaw. The results after 3/6 months and 1 year improved significantly compared with 1 week.

**Importance of one-stage surgery and immediate loading**

Before the start of the treatment, patients were asked about how important it was for them to receive a one-stage surgery and an immediate loading procedure. The answers for both jaws are shown in Table 3. Figure 3 represents the VAS values according to jaw. Patients seem to find it more important to receive a one-stage procedure when implants are placed in the mandible. The median VAS score in the mandible is 100 (mean = 96.7; SD = 5.52; range = 82–100) compared with 96.5 (mean = 87.8; SD = 20.98; range = 23–100) in the maxilla. The importance of immediate loading compared with loading after 3 months is 100 (mean = 94.5; SD = 15.83; range = 23–100) in the mandible compared with 96.5 (mean = 93.42; SD = 8.11; range = 71–100) for the maxilla.

**Reasons for choosing fixed prosthetics**

Patients were asked about their possible reasons for choosing a fixed prosthetic restoration by means of multiple-choice questions, and they could indicate several possibilities. The percentages of patients indicating eating comfort, speaking comfort and/or esthetics as a reason were, respectively, 84%, 60% and 68% in the maxilla and 83.4%, 45.8% and 41.7% in the mandible. Differences between the maxilla and the mandible are clear for speaking comfort and esthetics (*P* < 0.001), which are much more pronounced in the maxilla compared with the mandible.

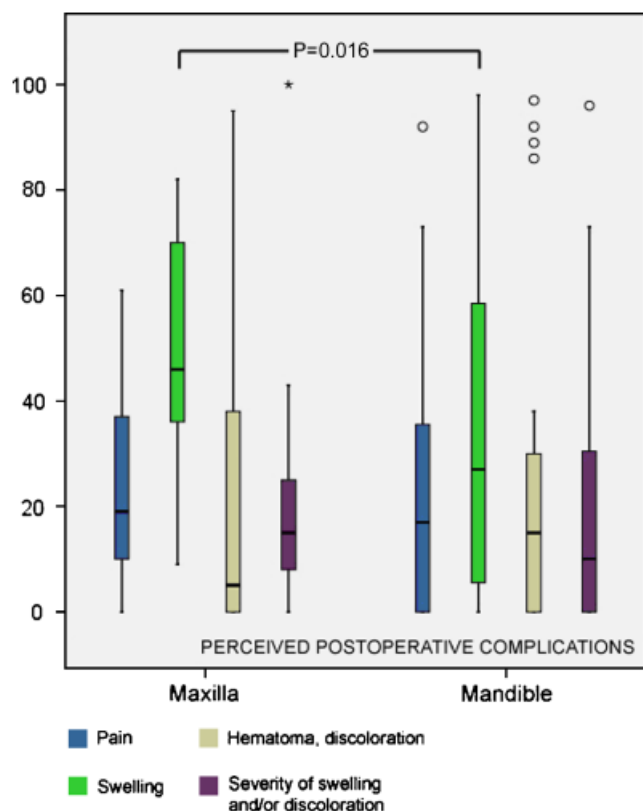
**Discussion**

The survival rate was 100% after 1 year. The individual implant success rate according to Albrektsson & Isidor (1994) after 1 year was 97% in the maxilla compared with 78.4% in the mandible (Collaert & De Bruyn 2008; De Bruyn & Collaert 2008; De Bruyn et al. 2008). These results are in agreement with the review of Nkenke & Fenner (2006).

Patient-centered outcomes after immediate loading of screw-retained restorations in both jaws were evaluated by self-administered questionnaires. Most answers were marked on a VAS, a standard in research on pain (Huskinson 1974), and patients' perception and satisfaction. Pjetursson et al. (2005) found a good

**Table 2.** Median and mean VAS values (on a scale with 100 = maximal comfort or esthetics) including standard deviation and range of the answer on the questions: "Would you undergo the procedure again having the experience you have today?" and "Would you advise the procedure to others in a similar situation?" after 1 week, 3/6 months and 1 year. P-values of the mixed models for repeated measures analysis are presented

	1 week	3/6 months	1 year
Repeat procedure?	Median = 99	Median = 100	Median = 100
	Mean = 91.9	Mean = 97.1	Mean = 98.2
	SD = 13.73	SD = 4.79	SD = 3.80
	Range = 44–100	Range = 79–100	Range = 80–100
	N = 50	N = 42	N = 36
P=0.0079		P=0.1008	
P=0.0008			
Advise procedure to others?	Median = 100	Median = 100	Median = 100
	Mean = 93.8	Mean = 97.8	Mean = 97.7
	SD = 11.40	SD = 4.27	SD = 7.10
	Range = 47–100	Range = 83–100	Range = 58–100
	N = 50	N = 42	N = 36
P=0.0110		P=0.7855	
P=0.0064			



**Fig. 2.** Boxplot with VAS values (on a scale with 100 = maximal severity) of perceived postoperative complications, namely perception of pain, swelling, hematoma and the perceived severity of these symptoms. Results are given separately for maxilla and mandible for all patients. Significantly different P-values of the Mann-Whitney U-test for comparison between maxilla and mandible are presented.

correlation between qualitative questionnaires with categorical answering possibilities and VAS answers and recommend VAS alone, or VAS in combination with categorical questions. Since a high score for

general comfort does not necessarily exclude other problems, additional questions concerning comfort, speech, eating and esthetics were included. It has been shown that very generalized questions lead to

more positive answers (Strassburger et al. 2004).

Two out of the 50 analyzed patients were excluded from the statistical analysis of comfort and esthetics, because they did not wear a complete denture at baseline, which made a pre–post comparison impossible. The total drop-out of 14 patients (28%) did not influence the satisfaction with the treatment because a *post hoc* comparison of the 1-week and 3/6-month outcome of the drop-out group with the compliant responders showed no significant differences, except for esthetics, which showed better results at 3/6 months for patients who dropped out after 1 year.

Overall comfort, eating comfort, speaking comfort and esthetics improved significantly compared with baseline within 1 week and remained stable with the provisional bridge, except for eating comfort, which showed a significant improvement between 1 week and 3/6 months. A further significant improvement was achieved for eating comfort, speaking comfort and esthetics when the provisionals were changed to ceramic and/or an extra extension of one premolar was added bilaterally in the final bridge. Patients indicated that they could eat all kinds of food. A continuous significant subjective improvement of eating comfort was demonstrated over time from surgery to provisional and from provisional to final reconstruction. Shortened dental arches consisting of front teeth and premolars in general meet the needs of a functional dentition (Kanno & Carlsson, 2006). Eating comfort, however, seemed to increase when additional posterior extensions were present.

According to Feine & Lund (2006), 89% of the variation in general satisfaction can be explained by comfort, chewing ability, speech, esthetics and denture stability. The general satisfaction score in the present study was calculated as the average of four of the above-mentioned factors, excluding denture stability, not being an issue when fixed restorations are evaluated. This general satisfaction score was very high immediately after treatment and throughout the further follow-up. Changes compared with baseline are statistically as well as clinically significant. This agrees with the available literature (Albrektsson et al. 1987; Cibirka et al. 1997; De Bruyn et al. 1997; Sandberg et al. 2000; Al-Omiri et al.

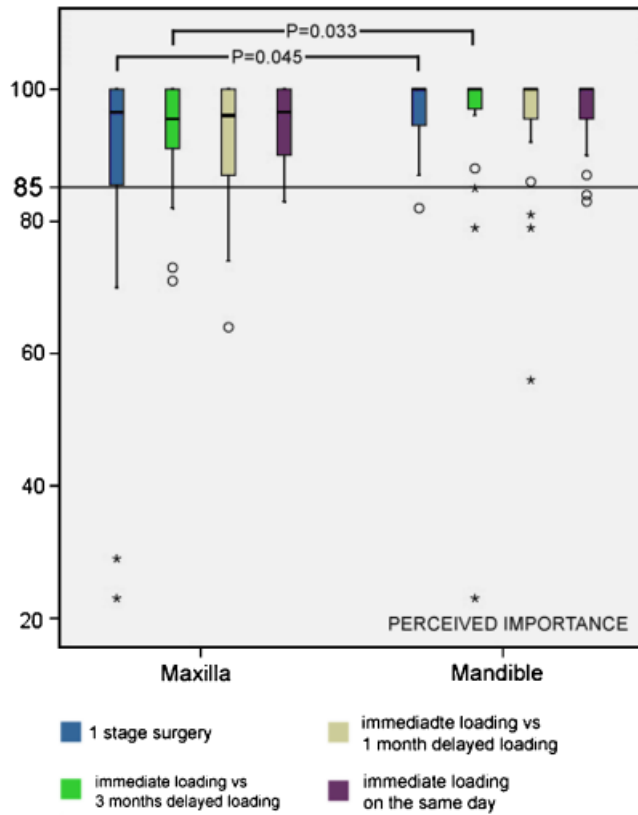


Fig. 3. Boxplot with VAS values (on a scale with 100 = maximal importance) for the importance of one-stage surgery and immediate loading compared to delayed loading after 1 or 3 months. Over 75% of the patients think it is very important (VAS score >85) to receive a one-stage surgery combined with immediate loading, even compared to loading within 1 month. Results are given separately for 24 patients in the maxilla and 25 patients in the mandible. Statistically significant differences (Mann-Whitney U-test  $P < 0.05$ ) between maxilla and mandible are demonstrated.

**Table 3. Median and mean VAS values (on a scale with 100 = maximal comfort or esthetics) including standard deviation and range of the questions concerning the importance of a one-stage surgery and immediate loading compared to delayed loading after 1 or 3 months**

How important is it to you that only one surgery is necessary, compared with two different surgical procedures?	Median = 99 Mean = 92.2 SD = 15.80 Range = 23–100 N = 48
How important is it to you that you do not have to wait for 3 months before the dentist can start with the manufacturing of the prosthetic restoration (fixed teeth)?	Median = 99 Mean = 94.0 SD = 12.54 Range = 23–100 N = 49
How important is it to you that you do not have to wait for 1 month before the dentist can start with the manufacturing of the prosthetic restoration (fixed teeth)?	Median = 97 Mean = 92.9 SD = 10.8 Range = 56–100 N = 49
How important is it to you to have a fixed provisional restoration (fixed teeth) on the same day as the implant surgery?	Median = 100 Mean = 95.3 SD = 6.99 Range = 67–100 N = 49

2005; Feine & Lund 2006; Fischer & Stenberg 2006; Peñarrocha et al. 2007).

The present study did not show any statistically significant differences related to gender for comfort, phonetics or esthetics with the implant-supported construction. Pan et al. (2008) did not find any gender-related differences in satisfaction for implant-supported overdentures.

The postoperative complications reported in this study were low (Fig. 2), which may be influenced by the fact that patients were allowed to use analgetics. In general, pain after implant surgery is described as being light (González-Santana et al. 2005) or mild to moderate (Hashem et al. 2006; Al-Khabbaz et al. 2007). The latter study described similar mean VAS scores of 2.4 on the first day and decreasing over time. The pain scores were most pronounced on the first 3 days after surgery. Al-Khabbaz et al. (2007) found VAS values of 20 the first day postoperatively, and moderate to severe pain was only described by a minority of patients. Nkenke et al. (2007) compared conventional with flapless surgery in two groups of five patients and found higher scores in the conventional group with mean VAS scores of 57 after 6 h. These decreased to a mean score of 24 after 1 week. The VAS score for perception of swelling in our study was the most pronounced score and was significantly higher in the maxilla than in the mandible (Fig. 2). Hashem et al. (2006) also indicated swelling as the most important postoperative symptom. They described swelling in 76% of the patients on day 1, decreasing to 39% after 6 days, and hematoma formation in 53% and 33%, respectively. Patients did not seem to experience these symptoms as a major burden.

The high VAS scores given to the willingness to repeat or recommend the procedure to others also point to the high satisfaction. Because of the high median score, the increasing mean score is more indicative of the narrowing spread over time. Within 1 week, 75% of the VAS scores increased above 85, significantly improving to 75% above VAS 95 after 3/6 months and 1 year (Table 2). In other words, patients seem to show even greater satisfaction after a long-term experience with the implant-supported reconstruction. The attitude of patients towards

implant treatment is influenced by the experience of pain and discomfort during surgery (Klepac et al. 1980). The statistically significant improvement of these answers over time might therefore be explained by the fact that the memory of the surgery is still fresh right after the procedure and healing is not yet complete after 1 week. It is reasonable to suggest that this memory of the surgery is fading in the future and the gain of comfort starts to predominate. Nkenke et al. (2007), however, did not find a significant difference for these questions asked of five patients 1 week and 1 year after surgery, unlike our study. De Bruyn et al. (1997) asked this as yes/no questions to fully and partially edentulous patients receiving implant treatment. Over 90% of the patients would repeat the treatment and all of them would advise it to other people. Long-term results for solitary and partially fixed implant-supported restorations presented by Pjetursson et al. (2005), after a mean period of 10 years, described comparable VAS scores of 93 (SD = 17 or 16, respectively) for these questions.

The mean VAS score for the ease of oral hygiene in our study was 86.8 (SD = 14.98; range = 33–100) after 1 year, which is also comparable with Pjetursson et al. (2005), who presented a score of 89 (SD = 19). There was no difference between the provisional and the final restoration.

The VAS scores for the importance of immediate loading in our study are high (Fig. 3) and patients seem to expect results as soon as possible. This is even more important in the mandible, which showed a smaller spread of the results than the maxilla. Of course, the study group included a selection of the population who

sought treatment with implants, and the results cannot be generalized. Immediate loading may not be a necessity for everyone, not to mention the financial feasibility. Before the era of oral implants, Carlsson et al. (1967) reported that 90% of the patients with conventional dentures adapted sufficiently to their prosthesis. However, 20% of the patients described their denture as a catastrophe and 24% complained about insufficient retention in the mandible. The aim of the present study was not to evaluate patient satisfaction with conventional dentures, but only one patient had a general satisfaction score over 80 at baseline and no differences could be identified between males and females. The latter is in contrast to a recent publication, which did find sex differences in conventional denture satisfaction, with females showing lower scores than males (Pan et al. 2008).

Over half of the patients mentioned the expectancy of a better comfort while speaking and better esthetics as one of the reasons for implant treatment. Comparison between the maxilla and the mandible demonstrates that esthetics and speaking comfort are more important in the maxilla than in the mandible. However, eating comfort remains the main factor and is as important in the maxilla as in the mandible. This is in agreement with De Bruyn et al. (1997), who stated that the request for implant treatment in the mandible was mainly directed by the lack of eating comfort. In the maxilla, esthetic problems were also considered to be an important factor. The lowest score at baseline in the present study was eating comfort, but this increased to the highest value 1 year after the treatment with the implant-supported

prosthesis. Fulfilling this specific demand after the treatment may affect general satisfaction.

## Conclusion

Immediate loading in edentulous jaws yields a significant instant improvement of patient satisfaction, in terms of comfort, function and esthetics, and this increases further with the final reconstruction. The improvement is the highest for eating comfort, which correlates with patients' preoperative needs and demands. Postoperative complications are limited and rated as less serious by patients.

Patients who are dissatisfied with a removable denture today have new treatment possibilities thanks to oral implants. The request for these treatments will probably increase further in the future. As individuals become edentulous at an older age, their capacity to adapt to a removable denture decreases. For these patients, the treatment with immediate loading on dental implants is a predictable solution. Thus, whenever it is economically and biologically feasible, immediate loading must be considered as one of the treatment options.

Further research is necessary to evaluate patient satisfaction on a longer term and the psycho-social impact of this treatment on the daily life and functioning of patients.

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