Influence of Patient Age on the Success Rate of Dental Implants Supporting an Overdenture in an Edentulous Mandible: A 3-year Prospective Study

Henny J. A. Meijer, DDS, PhD[1]/Rutger H. K. Batenburg, DDS, PhD[2]/Gerry M. Raghoebar, DDS, MD, PhD[3]

The aim of this study was to determine the influence of age on peri-implant tissues in patients treated with implant-supported overdentures in the mandible. A prospective study was carried out with 2 groups of healthy edentulous patients. The mean age of the younger group (n = 32) was 46 years (range 35 to 50 years); the mean age of the older group (n = 26) was 68 years (range 60 to 80 years). Two dental implants were placed in the interforaminal region of the mandible, and after a 3-month healing period, overdentures were fabricated. Clinical and radiographic parameters were evaluated immediately after completion of the prosthetic treatment, after 1 year, and after 3 years. The evaluated clinical parameters were implant loss, Plaque Index, Gingival Index, Bleeding Index, and probing depth. Radiographic evaluation was performed using a standardized long-cone technique with a direction device. Statistical analysis was carried out with SPSS software. One implant in the older group was lost during the healing period. After 3 years, the mean scores for Plaque Index, Gingival Index, and Bleeding Index were between 0 and 1 for both groups (out of possible scores of 0 to 3), and the mean probing depth was 3 mm in both groups. The mean bone loss after 3 years was 1.2 mm in the younger group and 0.8 mm in the older group, but this difference was not significant. It was concluded from this study population that the clinical performance of implant-supported overdentures in the mandible is equally successful in younger and older patients. (INT J ORAL MAXILLOFAC IMPLANTS 2001;16:522–526)

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Edentulous patients often experience problems with mandibular complete dentures. Lack of stability and retention, together with decreased chewing ability, are the main complaints of these patients.[1] One of the treatment possibilities is the use of endosseous implants to which an overdenture can be attached. One of the first studies concerning overdentures supported by endosseous implants was published by van Steenberghe and coworkers in 1987.[2] Other investigators have reported implant survival rates at approximately 96%.[3] Different clinical trials have revealed that patients with an implant-supported overdenture in the mandible are significantly more satisfied than patients with a conventional complete denture, not only after 1 year[4] but also after 5 years.[5] Because of ever-lengthening life spans, more older edentulous adults are expected to need endosseous implants in coming decades.

It has been assumed that survival rates for implants are equally high in older and younger adults. However, bone and soft tissue healing after implant placement could be compromised by aging.[6,7] There could also be differences in prosthesis function. Additionally, differences in the bone to withstand chewing

[1]Prosthodontist and Associate Professor, Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthodontics, Groningen University Hospital, Groningen, The Netherlands; and Department of Oral Function and Prosthetic Dentistry, Dental School, Faculty of Medical Sciences, University of Groningen, The Netherlands.

[2]Oral and Maxillofacial Surgeon and Research Associate, Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthodontics, Groningen University Hospital, Groningen, The Netherlands.

[3]Oral and Maxillofacial Surgeon and Associate Professor, Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthodontics, Groningen University Hospital, Groningen, The Netherlands.

Reprint requests: Dr H. J. A. Meijer, Department of Oral and Maxillofacial Surgery and Maxillofacial Prosthodontics, University Hospital Groningen, P.O. Box 30.001, NL-9700 RB Groningen, The Netherlands. Fax: +31-50-3611136. E-mail: h.j.a.meijer@kchir.azg.nl

forces and differences in the skill needed to clean the small intraoral superstructure components could become evident. A number of studies have been carried out to compare implant outcomes in older and younger adults.[8–12] All have found no difference in implant success between the 2 groups. However, the follow-up periods in the majority of these studies do not exceed 2 years. Only Bryant and Zarb[12] reported results of a follow-up period of 4 years. However, this study involved a variety of prosthesis designs. The implants were used as retention for single crowns, short-span prostheses, complete-arch prostheses, and removable overdentures. Only the survival of implants was reported, leaving the clinical status of surrounding bone and soft tissues unnoted.

The aim of the present prospective study was to compare selected clinical parameters in older and younger edentulous patients with an implant-supported mandibular overdenture during a 3-year evaluation period.

MATERIALS AND METHODS

Patient Selection and Treatment

This study is part of a clinical trial in which treatment effects of different implant systems supporting mandibular overdentures in patients with severely resorbed mandibles are compared.[13] All patients had persistent problems with conventional complete dentures because of reduced stability and insufficient retention of their mandibular denture. The patients were informed about the treatment options and possible risks, and informed consent was obtained from all participants. The study was approved by the hospital medical ethical committee. Inclusion criteria for the clinical trial were an edentulous period of at least 2 years and severe resorption of the mandibular residual ridge (Class V or VI according to the Cawood and Howell classification[14]). Patients with a history of radiotherapy to the head and neck region or a history of preprosthetic surgery or previous implant placement were excluded. All patients were treated with implants in the right and left canine region of the mandible, using either Brånemark implants (Nobel Biocare, Göteborg, Sweden), IMZ implants (Friatec, Mannheim, Germany), or ITI implants (Straumann, Waldenburg, Switzerland).[15–17]

Three months after implant placement, a standard prosthetic procedure for all patients was carried out. A new maxillary complete denture and a mandibular overdenture supported by a round bar and clip attachment were fabricated. All patients were treated in the same department by one experienced oral and maxillofacial surgeon and one experienced prosthodontist. From this clinical trial, 2 groups of healthy patients were selected on the basis of age for the present study: *(1)* a younger group (n = 32) with an age of 50 years or less (mean age 44 years, range 35 to 50 years); and *(2)* an older group (n = 26) with an age of 60 years or more (mean age 67 years, range 60 to 80 years).

Table 1 Characteristics of the Patient Groups at Baseline

Characteristic	Younger group (n = 32)	Older group (n = 26)
Mean age (y) (range)	44.1 (35–50)	67.1 (60–80)
Male/female	6/26	10/16
Mean edentulous period mandible (y) (SD)	16.8 (7.2)	22.4 (12.6)
Mean mandibular bone height (mm) (SD)	16.9 (2.3)	16.0 (2.4)
Mean bone quality (possible score 1–4)	2.8	2.6

After the study of Bryant and Zarb,[12] patients between 50 and 60 years of age were omitted to ensure a clear distinction between the patient groups. Characteristics of the patients are listed in Table 1. Bone height was measured on a rotational panoramic radiograph with correction for distortion. Bone quality was determined according to Lekholm and Zarb[18] with the use of a lateral cephalometric radiograph.

Data collection of all patients was performed 3 times: T_0, baseline evaluation after placement of the overdenture; T_{12}, evaluation 12 months after placement of the overdenture; and T_{36}, evaluation 36 months after placement of the overdenture. One investigator made the measurements on all patients to prevent interobserver differences.

Clinical Analysis

The clinical analysis included a number of parameters. Implant loss was recorded after removal of a mobile implant any time after placement. For presence of plaque, the Index according to Mombelli and associates was used[19] (score 0 = no plaque detected, score 1 = plaque detected by running a probe across the smooth marginal surface of the implant, score 2 = plaque can be seen by the naked eye, and score 3 = abundant amount of plaque). The presence of calculus (score 1) or the absence of calculus (score 0) was scored. To quantify the degree of peri-implant

Table 2 Mean Values and Standard Deviations of Clinical Parameters at Evaluated Time Periods

	Overdenture placement			After 12 months			After 36 months		
Parameter	Younger group (n = 32)	Older group (n = 26)	Significance	Younger group (n = 32)	Older group (n = 25)	Significance	Younger group (n = 32)	Older group (n = 23)	Significance
Plaque Index	0.4 (0.7)	0.5 (0.8)	NS	0.4 (0.8)	0.6 (0.9)	NS	0.3 (0.7)	1.0 (0.9)	Significant
Calculus Index	0.5 (0.5)	0.5 (0.5)	NS	0.4 (0.5)	0.5 (0.5)	NS	0.4 (0.5)	0.7 (0.5)	NS
Gingival Index	0.4 (0.7)	0.5 (0.7)	NS	0.4 (0.6)	0.5 (0.7)	NS	0.6 (0.6)	0.7 (0.8)	NS
Bleeding Index	0.9 (0.6)	1.0 (0.5)	NS	0.8 (0.5)	0.9 (0.5)	NS	0.9 (0.6)	0.9 (0.4)	NS
Probing depth (mm)	3.2 (0.6)	3.4 (0.8)	NS	3.3 (0.7)	3.2 (1.1)	NS	3.2 (0.7)	3.2 (1.3)	NS

inflammation, the modified Löe and Silness Index was used[20] (score 0 = normal peri-implant mucosa; score 1 = mild inflammation, slight change in color, slight edema; score 2 = moderate inflammation, redness, edema, and glazing; score 3 = severe inflammation, marked redness and edema, ulceration). The Bleeding Index according to Mombelli and coworkers was used[19] (score 0 = no bleeding when using a periodontal probe, score 1 = isolated bleeding spots visible, score 2 = a confluent red line of blood along the mucosal margin, score 3 = heavy or profuse bleeding). Probing depth was measured at 4 sites of each implant (mesial, buccal, distal, lingual) with a periodontal probe (Merritt B, Hu-Friedy, Chicago, IL) after removal of the bar; the distance between the marginal border of the mucosa and the tip of the periodontal probe was recorded as the probing depth.

Radiographic Analysis

Standardized intraoral radiographs of each implant were obtained using a beam direction device as described by Meijer and associates.[21] Analysis was done with a digital sliding gauge (Helios digit E 2056, Schneider & Kern, Niedernhall, Germany), with which 2-point measurements were made along the implant axis from a fixed reference point to the bone level.[22] Measurement was performed at the mesial and distal of each implant.

Data Analysis

In analyzing the clinical and radiographic data, the worst score of each item per patient was used as representative for the status at that evaluation period. Analysis was done with SPSS (Statistical Package for the Social Sciences, version 9.0, SPSS Incorporated, Chicago, IL). For all tests, a significance level of .05 was chosen.

RESULTS

All patients were present at T_0. At T_{12}, 1 patient of the older group did not attend the evaluation because of illness. At T_{36}, 3 patients of the older group were not present because of illness. The assumption was made that absence from the evaluation was independent of clinical or radiographic status.

One implant was lost in a patient of the older group. This implant appeared to be mobile 3 months after placement, just before prosthetic treatment started. After removal of the implant and a bone healing period of 6 months, another implant was placed successfully. The mean scores on the indices for plaque, calculus, gingiva, and bleeding were very low at all evaluation periods (Table 2). The only significant difference between the groups was at T_{36} for the Plaque Index; this score was significantly worse in the older group. The mean probing depth did not exceed 3.5 mm, and the difference between the groups was not significant (Table 2).

The mean changes in marginal bone level are outlined in Table 3. Between T_0 and T_{36}, 1.2 mm of bone was lost in the younger group and 0.8 mm was lost in the older group. However, this difference was not significant. There were no significant differences among the different implant systems.

DISCUSSION

The survival rate of implants in this prospective study was 100% in the younger group and 98% in the older group. These percentages are comparable to other prospective studies that have reported

Table 3 Mean Changes in Marginal Bone Level During the Period of the Study

Parameter	Younger group (n = 32)	Older group (n = 25 at T_{12}, n = 23 at T_{36})	Significance
Mean change in marginal bone level between T_0 and T_{12} (mm) (SD)	–0.8 (0.9)	–0.8 (1.2)	NS
Mean change in marginal bone level between T_0 and T_{36} (mm) (SD)	–1.2 (1.1)	–0.8 (1.4)	NS

survival rates of implants supporting an overdenture: 97% in Mericske-Stern and associates,[23] 94.5% in Jemt and coworkers,[24] 98.6% in Naert and colleagues,[25] and 93% in Meijer and associates.[5] Comparison with studies that distinguish between younger and older patients is difficult because a variety of prosthetic designs were used in these studies.[8–12] None of these studies reported separately on survival rates of implants supporting overdentures. However, all studies demonstrated similar implant survival in both older and younger patients, which is in accordance with the results of this study.

The mean indices for plaque, calculus, gingiva, and bleeding were very low at all 3 evaluation periods for both groups. The scores are comparable with the study of Meijer and associates,[5] in which the same criteria were used. The strict oral hygiene regimen to which patients adhered helped to ensure healthy peri-implant tissues. It is possible that the later poorer performance of the older group (Plaque Index) may reflect difficulty in manipulation of materials/devices needed to clean the abutments and bar. However, a mean Plaque Index of 1.0 is still small and did not seem to influence the Gingival Index or the Bleeding Index as indices for inflammation. The mean probing depth was not different between the groups and appeared to be stable over time.

Marginal bone loss was 0.8 mm for both groups during the first year. This phenomenon of up to 1 mm bone loss has been described previously[15] and is related to maturation of bone after implant placement and adaptation of bone to withstand functional forces. An annual bone loss of 0.2 mm after this period has been recognized as acceptable.[26] This annual bone loss was seen in the younger group, but surprisingly not in the older group. There was no statistically significant difference between the 2 groups.

CONCLUSION

From this study population, it may be concluded that the clinical performance of implant-supported overdentures in the mandible was equally successful in younger and older patients. Age should not be used as a reason to exclude patients from being treated with endosseous oral implants.

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