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**study**

# How many implants are needed for maxillary overdentures?

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## Background

Unsatisfied patients with a conventional maxillary full denture benefit greatly from implant support. In the short and medium term, comparisons of maxillary overdenture rehabilitation with four or six implants show similar results.

Ten-year research data showed high implant survival rates of between 94.4% and 99.3%, while a retrospective analysis showed a survival rate of 86.1% for six implants with a milled bar and overdenture after 10 years in function.

In some studies, implants were placed in posterior areas in conjunction with sinus-floor elevation, whereas in other studies implants were placed in anterior areas.

Long-term outcomes from randomised clinical trials have not yet been reported. Furthermore, there are no guidelines for a recommended implant position in the edentulous maxilla. In the maxillary anterior region, sufficient bone is usually available, but in the posterior region more complex bone augmentation (e.g., sinus-floor elevation) is required.

Implant placement in the anterior region can save extensive surgical treatments, patient morbidity, and costs.

## Aim

The aim of this study was to evaluate the clinical and radiographic outcomes of maxillary bar-retained overdentures on four or six implants, as well as implant survival and patient satisfaction.

## Materials & methods

- A randomised, two-arm clinical trial included patients requiring implants in the edentulous maxillary jaw.
- Inclusion criteria were persistent complaints regarding maxillary full dentures, ample bone volume for implant placement in the anterior maxilla, and sufficient interocclusal space to deliver a bar-retained overdenture.
- Fifty subjects were randomly assigned into two groups to receive either four or six implants (OsseoSpeed 4.0S dental implants, Astra Tech AB, Mölndal, Sweden). If necessary, small augmentation procedures were performed with autologous bone harvested from the tuberosity area mixed with deproteinised bovine bone mineral (Bio-Oss, Geistlich Pharma AG, Wolhusen, Switzerland) and the use of a resorbable collagen membrane (Bio-Gide, Geistlich Pharma). After a submerged healing period of three months, the implants were uncovered and supplied with healing abutments.
- All patients received a screw-retained milled titanium bar with distal extensions and an overdenture with gold retentive clips.
- The primary outcome was the change in marginal bone levels between baseline and 10 years. The intraoral periapical radiographs were analysed using a computer software (DICOM Networks, University Medical Centre, Groningen, Netherlands). The implant dimension was used to calculate the bone-level changes in millimetres.
- Secondary outcomes were implant survival, overdenture survival, technical/mechanical complications, changes in clinical parameters, the occurrence of peri-implant mucositis and peri-implantitis, and patient-reported outcomes.
- All outcomes were evaluated at one-, five-, and 10-year follow-up appointments.
- Patients were instructed in oral-hygiene procedures associated with bar-retained overdentures and received annual supportive care.

**Table:** Mean values and standard deviations (SDs) of the marginal bone loss in mm, and frequency distribution of the bone loss five and 10 years after overdenture placement in the four- and six-implant groups

Bone loss	5 years		10 years	
	Four-implant group (N = 96)	Six-implant group (N = 131)	Four-implant group (N = 76)	Six-implant group (N = 99)
Mean (SD)	0.50 mm (0.37)	0.52 mm (0.43)	0.41 mm (0.37)	0.70 mm (1.07)
0–0.5 mm	64%	60%	75%	66%
>0.5–1.0 mm	21%	19%	14%	11%
>1.0–1.5 mm	12%	12%	7%	9%
>1.5–2.0 mm	1%	7%	3%	8%
>2.0 mm	2%	2%	1%	6%

**Note:** Differences between the study groups were tested with the independent student's t-test ( $p < .05$ ). The mean marginal bone loss did not differ significantly between the groups ( $p = .305$  at five years;  $p = .274$  at 10 years).

## Results

- Thirty-six patients attended the 10-year follow-up (four-implant group: 19 patients, 76 implants; six-implant group: 17 patients, 99 implants). Over the follow-up period, 14 patients were lost because of death, severe illness, or relocation.
- Marginal bone levels changes between baseline and the 10-year follow-up were 0.41 mm in the four-implant group and 0.7 mm in the six-implant group, with no statistically significant difference between the two groups.
- The implant survival rate was 100% and 96.1% for the four-implant and the six-implant groups respectively. One implant was lost during healing and another three because of peri-implantitis.
- The overdenture survival rate was 57.6% in the four-implant group and 29.4% in the six-implant group.
- There were no statistically significant differences between the groups with respect to clinical parameters. All clinical measurements showed low scores.
- The incidence of peri-implant mucositis in the four-implant group was 52.6% and the incidence of peri-implantitis 10.5%, whereas the six-implant group showed respective incidences of 52.9% and 23.5%.
- Between the five- and 10-year observation period a new denture had to be provided in 20 patients. In one patient, a surgical intervention to remove mucosal hyperplasia had to be carried out.
- The overall satisfaction of the patients was high in both groups.

## Limitations

- The drop-out rate of subjects (from 50 at randomisation to 36 after 10 years) may have affected the outcomes with respect to the primary and secondary parameters.
- A team of experienced surgeons and prosthodontists together with carefully selected patients may have positively influenced the results.

## Conclusions & impact

- Patients with a bar-retained overdenture in the maxilla showed similar satisfactory results over 10 years with four or six anteriorly placed implants.
- Implant survival was high in both groups.
- The incidence of peri-implant mucositis and peri-implantitis increased over time.
- A high percentage of bar-retained overdentures had to be newly fabricated between the five- and 10-year follow-up, particularly in the six-implant group.
- The restoration of an edentulous maxilla with four implants in the anterior region for a bar-supported overdenture can be considered as a valid treatment option compared to a similar reconstruction with six implants.



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