

## A One-Year Clinical, Radiographic and RFA Study of Neoss Implants Used in Two-Stage Procedures

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*This study reports a survival rate of 98.1% for 102 Neoss implants in 44 patients with a mean bone loss of 0.7 mm after one year. The reduced component inventory and innovative designs enhancing primary stability and facilitating laboratory technology/prosthetics offer practical advantages whilst the clinical results with the implant system tested compare favourably with existing systems*

### INTRODUCTION

The use of implant-supported bridges is a routine treatment modality for the edentulous patient with documented good long-term results (Albrektsson & Sennerby 1991, Esposito et al. 1998). From initially a rather complicated and restricted procedure, the techniques of implant-supported dentistry have improved and simplified, at least from a surgical point of view. The introduction of self-tapping and surface modified implants, surgical guides, shortened healing periods and immediate loading are some examples. However, improvements could still be made in dental laboratory and prosthetic techniques in order to reduce further treatment times and the overall cost of the treatment.

The aim of the present study was to evaluate a new implant system (Neoss) for one year using clinical and radiographic examinations and implant stability measurements by resonance frequency analysis (RFA).

### MATERIALS AND METHODS

#### *Patient inclusion*

Consecutive patients requiring implant treatment for total or partial loss of teeth were included in the study until at least 100 implants had been inserted. Only two-stage procedures with 3 months of healing from placement to abutment connection were performed.

Preoperative examinations included intraoral and panoramic radiographs. Computerized tomography was used if required. The implant sites should have sufficient bone for at least 7 mm long implants. Patients should be over 18 years old and present no contraindications

for oral surgery under local anaesthesia.

#### *Clinical techniques*

Patients were administered 2 gr of amoxicillin (Augmentin, Roche, Milan, Italy) and sedation if required (Valium®, Roche, Milan, Italy, 5 mg) prior to surgery. Anaesthesia was induced by infiltration with articain/epinephrine (Septocain™, Specialites Septodont, Saint-Maur-Des-Fosses, France). Crestal incisions were used for flap elevation. Implant sites were prepared with a 2.2 mm twist drill followed by a 3 mm (3.5 mm wide implant), 3.4 mm (4.0 mm wide implant) and 3.9 mm drills (4.5 mm wide implant) (Neoss Ltd, Harrogate, UK). Full countersink preparation was made for all implants. Implants were inserted with the torque driver set to 40 Ncm and final seating was performed with a hand wrench. Cover screws were applied and the flaps were replaced and sutured. Bone quality and quantity according to Lekholm and Zarb (1985) were registered.

Abutment connection was performed 3 months later, usually with a punch technique and no sutures. Bite registration and impressions were taken with closed tray and then healing abutments were connected. Neolink™ abutments (Neoss Ltd, Harrogate, UK) of gold or titanium (to match the metal of the framework) were used. Abutments were either cast or welded into the metal frameworks. Porcelain and acrylic veneers were used. Constructions were screw-retained if implant angulation permitted; otherwise, individual abutments (Neo Matrix, Neoss Ltd, Harrogate, UK) were used for cementation.

*Follow-up*

Implant stability was assessed by RFA (Mentor®, Integration Diagnostics AB, Gothenburg, Sweden) at implant surgery, abutment connection and after one year of loading (after unscrewing the constructions). Cemented constructions were not removed.

Digital or conventional intraoral radiographs were taken at abutment connection and after one-year of service. Conventional radiographs were photographed with a digital camera on a light desk. Measurements were made using a personal computer (Image J 1.34S, National Institutes of Health, USA) at mesial and distal aspects. Each radiograph was calibrated using the known width of the coronal cylinders of the implants. The upper platform was used as a reference point for measurements (Figure 1).

**RESULTS**

Forty-four (44) patients (16 male and 28 female, mean age 54 years) were treated according to the protocol. Forty-eight (48) prosthetic constructions were delivered including five full cross-arch bridges, 28 partial bridges and 17 single crowns. A total of 102 implants were placed, 34 in the maxilla and 68 in the mandible, in bone quality and quantity as presented in Table 1. Implant lengths and diameters are presented in Tables 2 and 3.

At writing all patients have completed one year in function. All constructions except one patient with a cemented bridge on five implants were removed for stability checking.

All patients maintained a fixed bridge or crown during the one year study. Two failures were experienced, giving a survival rate of 98.1% after one year. One 13 mm long by 4.0 mm wide implant placed in a defect in a mandible was removed at impression due to mobility. In this case, a new implant was placed and a temporary bridge was made on the remaining three implants whilst awaiting healing. One 7 mm long by 4.5 mm wide implant in Q4 bone in the 1<sup>st</sup> molar region in a maxilla was lost after one year. The implant was removed and the three-unit bridge was supported on the remaining two implants. No other prosthetic complications such as fractures or screw-loosening were experienced.

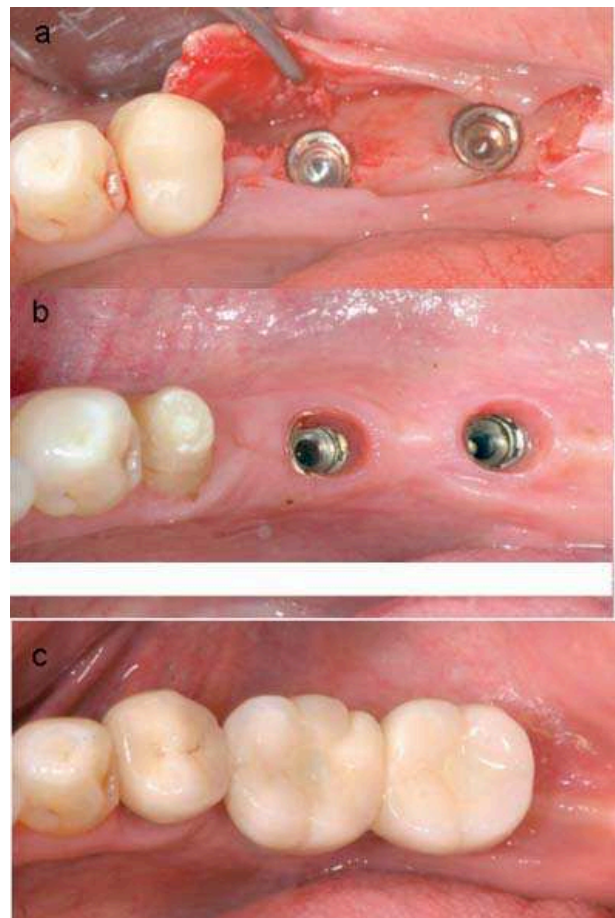


Figure 1. Clinical photographs showing a/ two implants in the posterior mandible after insertion, b/ healing of soft tissues at the time of bridge delivery, c/ final bridge.

Quantity	Number	Quality	Number
A	3	1	3
B	47	2	68
C	52	3	26
D	-	4	5

Table 1. Bone Quality and Quantity encountered

Table 2. Implant Sizes placed

Diameter	Number
3.5 mm.	17
4.0 mm.	57
4.5 mm.	28

Table 3. Implant lengths placed

Diameter	Number
7	9
9	30
11	23
13	19
15	21

A total of 92 implants with readable radiographs at baseline and follow-up have been evaluated to date. On average, the marginal bone level was located 0.6 mm (SD 0.7) below the platform at baseline and 1.3 mm (SD 1.0) below after one year; giving an average bone loss of 0.7 mm (SD 1.0) at one year. X implants showed more than 3 mm bone loss.

Stability measures by RFA gave a mean of 75.0 (SD 6.5) ISQ at placement, 74.4 (SD 6.8) at abutment connection and 76.2 (SD 6.6) after one-year. There seems to be a relation between bone quality and ISQ at implant placement (Fig. 4). Implant stability increased with time for implants in Q4 bone whilst stability decreased for implants in very dense bone, resulting in a similar stability for all implants after one year.

## DISCUSSION

Early experience with the Neoss implant system used in a two-stage procedure with 3 months of healing in the present study shows satisfactory results. Two of 102 implants were lost during one year which compares well with the results reported from other implant systems (Albrektsson & Wennerberg 2004). From a surgical point of view, the implant was stable during insertion and good primary stability was generally achieved. When poor primary stability was encountered, a wider implant was used to enhance stability. Since the different implant diameters have the same prosthetic platform, an implant could be replaced with a wider diameter without requiring changes to the other prosthetic components, as is commonly necessary with other implant systems. Abutment connection was easier with this implant than previously experienced with external connection implants, which often require a flap procedure and removal of bone tissue in order to fit an abutment. A punch technique without suturing could frequently be used in the present study and in most cases impressions were taken in conjunction with abutment connection. The use of integrated abutments with the framework facilitated prosthetics and reduced the overall costs.

The RFA measurements revealed a high average primary stability of these implants which is most probably due to the geometric features of the implant. Firstly, it has a two-start thread, a twin helix, with two threads running parallel but on diametrically opposite sides of the cylindrical substrate. Thus, the actual thread pitch

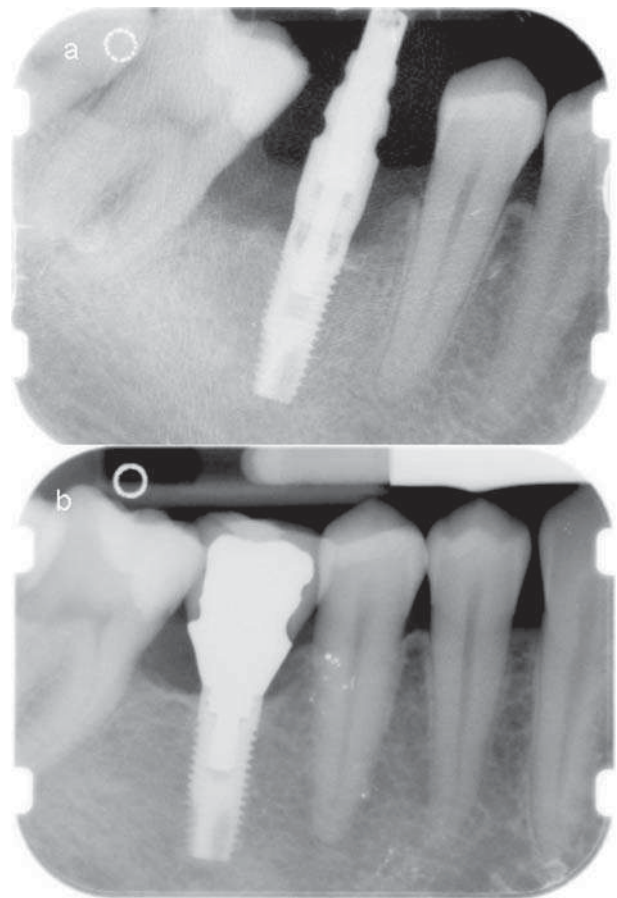


Figure 2. Radiographs from a single tooth case at a/ baseline and b/ after one year

is double the “apparent” thread spacing, so the implant advances twice as far with one turn as for a single-helix thread. This feature reduces the insertion time and counteracts wobbling during insertion. Secondly, the implant has a positive tolerance, meaning that the implant is slightly conical in the coronal direction and as the implant screws home its diameter increases slightly and there is a slight tendency to tighten the thread base against the bone. Previous research has shown higher stability for slightly tapered implants in soft bone than for parallel-sided implants, without jeopardizing the integration process (O’Sullivan et al 2000, O’Sullivan et al 2004a, 2004b). Decreased primary stability was seen with decreased bone density, which is in line with the findings of Östman et al (2006). Implant stability increased slightly with time and was similar for all bone qualities after one year of function, which indicates a favourable bone tissue response to the implants. The greatest increase of stability was seen for implants in Q4 bone which is in line with the findings of Friberg et al. (1999).. This can be explained by stiffening of the bone-implant interface

with time due to bone formation and remodelling. In contrast, decreased stability was observed in dense bone, which may be explained by mechanical relaxation and/or bone remodelling as a response to the presumably high stresses induced by implant placement.

The radiographic analysis revealed that about 0.7 mm of bone was lost during the first year of loading, which is in the range of previously reported results with other systems (Oh et al. 2002). X implants showed more than 3 mm bone loss during one year. The fact that the bone level was located 0.6 mm below the platform at abutment connection indicates some remodelling during healing as generally the implants were placed flush with the surrounding bone. This accords with the findings of Engquist et al. (2001) who compared the marginal bone tissue response at Astra Tech and Brånemark system implants.

It is concluded that prosthetic rehabilitation of the edentulous patient with the Neoss implant system results in good short-term clinical and radiographic outcomes. The innovative design solutions do seem to enhance primary stability and facilitate laboratory technology/prosthetics, and with the reduced component inventory this system offers advantages over our experiences with other implant systems.

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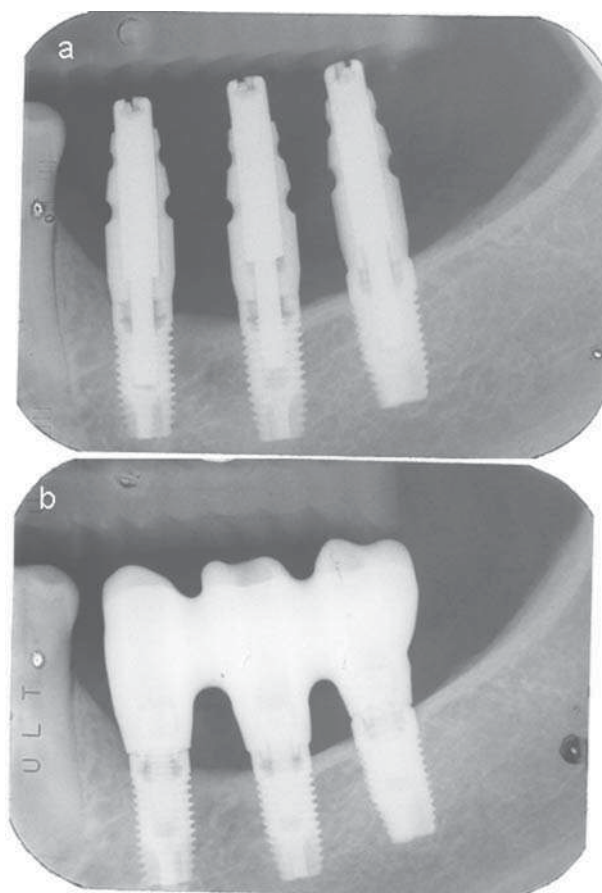


Figure 3. Radiographs from a partial edentulous mandible at a/ baseline and b/ after one year

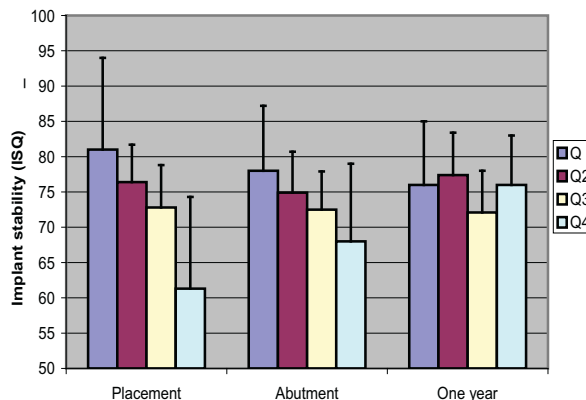


Figure 4. Results from RFA measurements in relation to bone quality and time.

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