Computer-guided implant surgery using Neoss guide kit: Clinical report of a severely atrophic osteoporotic patient

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A guided surgery technique for prosthetic rehabilitation of a severely atrophic osteoporotic patient using Neoss implants is described in this clinical report.

INTRODUCTION
During the past years, technological progress of interactive software for three-dimensional (3D) reconstruction of computed-tomography (CT) scans has facilitated treatment of dental implant patients.¹,² Computer-software planning is used to predictably perform implant placement in partially edentulous as well as fully edentulous cases involving a single arch or both arches.

The computer-guided implant placement approach has numerous advantages. The pre-surgical planning and surgery is more focused on the prosthetic aspect and emphasizes the team approach of the prosthodontist, surgeon, and dental laboratory. The surgeon can place the implants more accurately, predictably, and safely, in the optimal positions as planned in the virtual software. In addition, vital structures, such as adjacent tooth roots and the inferior alveolar nerve, can be carefully assessed and avoided. Another important advantage offered by this type of technique is represented by placing implants in minimal amounts of available bone, including patients that would traditionally require bone grafting.¹

Guided surgery is often performed using a minimally invasive approach without raising a flap, thereby minimizing postoperative pain, swelling and recovery time.⁴,⁷

However, guided surgery is not free from errors, and the operator has to be proficient in the use of this procedure. Moreover, the operator has to follow strict protocols in order to overcome any difficulties and reach treatment success.

A recent systematic review on computer guided implant surgery revealed a high cumulative survival rate (CSR), 97.2% with a low marginal bone loss (1.45 mm) during 4 years of follow-up.⁸

The aim of this clinical report is to describe a guided surgery technique for Neoss implants using the Neoss guide kit. The rehabilitation of a 70-year-old woman with a severely atrophic maxilla is presented.

TECHNIQUE DESCRIPTION AND CLINICAL REPORT
Patient history
A 70-year-old female presented with a dental abscess in the upper jaw and an unsatisfactory lower denture. Her medical conditions included multiple sclerosis, hypertension and osteoporosis. The osteoporosis was treated by oral bisphosphonate (alendronic acid once a week for the last 6 years). A panoramic x-ray was taken and showed the presence of mobile grade II and III teeth in the upper jaw and a severe bone resorption of the mandible (Figure 1). The
maxillary teeth were all extracted and a provisional full denture was provided to the patient and frequently relined.

**CT scan**

After six months of healing, computed tomography (CT) scanning of both arches was performed using the double scanning technique. The first CT was taken with the patient wearing two new relined radiolucent prostheses with gutta-percha fiducial markers and a radiological silicon index for the occlusion (Figure 2). The second CT was taken of the denture replica alone. This scan was taken to get a higher quality digitization of the denture because of the similarity in radiodensity of the denture and the soft tissue. The two CT scans were transferred into the surgical planning software (NobelClinician Software, Nobel Biocare) and matched using the fiducial markers.

**Digital planning**

The 3D planning was performed using the planning software. The implant positions were optimized in accordance with the anatomical structures as well as the prosthetic references. In the maxilla it was possible to virtually plan six Neoss ProActive Tapered 13 mm implants parallel to each other in order to facilitate the application of the pre-fab-

![Figure 1: Panoramic radiograph showing the pretreatment clinical situation: Mobile hopeless teeth in the maxillary arch supporting a removable prosthesis. Dramatic bone resorption in the mandible caused by the use of a removable denture for more than 20 years.](image1)

![Figure 2: Six months after extraction of remaining teeth, the patient underwent CT examination with a double scanning technique wearing a radiological template. Six parallel Neoss Tapered implants were virtually planned according to the prosthetic plan.](image2)
ricated prosthesis (Figure 2). Three anchor pins were planned buccally and two crossing palatal anchor pins were planned to prevent surgical template bending movements during surgery (Figure 2). In the atrophic mandible, virtual planning was performed, followed by a standard non-guided open flap procedure to place four 7 mm implants.

Laboratory work
Based on the digital planning, a surgical template and laboratory products were ordered. The dental technician fabricated a cast model using the surgical template to achieve accurate implant positions according to the digital planning. Implant mounts were attached to the surgical template, and implant replicas were connected to the implant mounts. This way, the implant replicas were correctly placed into the cast model. A rigid framework was then easily created by soldering a bar on six temporary abutments connected to the cast model. The framework was adapted inside the old provisional denture. The flanges and the palatal portion of the denture were removed, transforming the denture into a rigid metal-reinforced fixed provisional prosthesis ready to be installed immediately after implant insertion (Figure 3).

Patient preparation
On the day of surgery, preoperative antibiotics (Amoxicillin 2 g) were given orally 1 hour prior to the surgery and were continued for another 5 days postoperatively. Intravenous sedation (Midazolam 5mg/5ml) and local anesthetic (2% lidocaine on 1:80,000 of adrenalin) was administered.

Surgical procedure
The surgical template was secured intraorally using the anchor pins. A tissue punch was used to remove the gingiva from the alveolar bone through each guide sleeve.

A strict drilling protocol was followed. The implants osteotomies were prepared using a series of guide keys with different diameters that completely coincide with the series of twist drills (Figure 4). The osteotomies were prepared in order to gain a minimum insertion torque of 35 Ncm.

Once the osteotomies were prepared, six Neoss ProActive Tapered 4.5 x 13 mm implants were placed through the surgical template and secured by means of dedicated Neoss guided implant mounts. At the end of the surgery the mounts, the anchor pins and the surgical template were removed (Figure 4). Implant stability (ISQ, Osstell Mentor) was measured and the prefabricated prosthesis was screwed onto the implants and endo-oral radiographs were taken to check the fit of the prosthesis (Figure 5).
Figure 4: Surgical procedure: intraoral stabilization of the surgical template by means of three buccal and two crossing palatal pins, removal of soft tissue by circular guided mucotome. After drilling sequences, tapered Neoss implants were inserted through the guide. The surgical template was removed at the end of the surgery showing the results of flapless insertion.

Figure 5: The prefabricated provisional prosthesis was screwed onto the implants after surgery. Occlusal check with the lower denture inserted into the mouth and radiological control of the fit of the prosthesis.
Definitive prosthesis delivery
Three months after implant placement, a CAD/CAM screw-retained titanium-resin implant bridge was inserted in the maxilla.

Clinical follow-up
Clinical and radiological follow-up was performed at 6, 12 and 24 months. The prosthesis was removed at each follow-up to evaluate individual implant mobility, presence of pain, osteonecrosis and/or suppuration. After 24 months all implants were clinically and radiographically successful osseointegrated, no osteonecrosis and no suppuration was observed (Figure 6). The implant stability quotient (ISQ) values ranged from 50 to 62, with an average of 56.6 ± 4.5 after surgery and an ISQ values ranged from 50 to 59, with an average of 54.8 ± 3.3 at 24 months.

DISCUSSION
The present clinical case report describes a guided surgery technique and shows that the technique can be used in osteoporotic patients, as long as a strict clinical protocol is followed and the clinician is properly trained.

The use of dental implants in patients suffering from skeletal osteoporosis was long considered contra-indicated since type IV bone or “soft bone” was considered to be more prone to early implant failure. However, more recent studies have found no contra-indications for the use of dental implants in patients with osteoporosis even though a correlation was found between skeletal and jaw bone density.

Van Steenberghhe et al. reported an implant cumulative survival rate after 5 years of 91.5% for implants placed with guided surgery and immediately loaded with fixed prostheses. They found that implants placed in non-smokers performed better than implants placed in smokers, both in terms of survival rate (98.9% vs. 81.2%) and mean marginal bone loss (1.2 mm vs. 2.6 mm). This indicates that extra precaution should be taken when performing guided surgery in patients with known risk factors. Further longitudinal comparative studies should be conducted to understand long-term success rate.

REFERENCES


