

# Guided Implant Placement and Immediate Prosthesis Delivery Using Traditional Brånemark System Abutments: A Pilot Study of 23 Patients

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**D**emand from dental implant patients for quality and efficient treatment is increasing. Fortunately, dental implant treatment is evolving with patients' expectations. Traditional implant treatment, originally described by Brånemark in the 1960s, involved a 2-stage procedure of implant placement itself, followed by abutment connection after a 3- to 6-month healing period.<sup>1</sup> In the early 1990s, research began on an immediate loading 1-stage protocol in which abutment connection occurred the same day as implant placement.<sup>2-4</sup> By the end of the millennium, clinical reports had indicated the efficacy of the immediate loading protocol.<sup>5-8</sup>

More recently, with the use of computed tomography (CT) and CAD/CAM technology, it is now possible to construct a surgical implant guide that would allow the clinician to predetermine implant locations virtually and surgically place them without reflecting a tissue flap.<sup>9-12</sup> In addition, a screw-retained fixed prosthesis that was previously fabricated in the dental laboratory can be delivered, thereby immediately loading the implants. This protocol (Nobel Guide, powered by Procera, Nobel Biocare AB, Sweden) enabled the patient to

**Purpose:** The aim of this study is to demonstrate the accuracy and clinical precision of a guided surgery protocol by using traditional Brånemark System abutments in conjunction with a prefabricated all-acrylic provisional prosthesis that is immediately installed after implant placement.

**Materials:** All presurgical methods in this treatment follow the standard NobelGuide protocol with the exception of the laboratory phase. Once the master cast is retroengineered from the surgical template, traditional Brånemark System abutments were secured onto the implant replicas (master cast) and an all-acrylic provisional prosthesis was constructed at the abutment level. The typical abutments used with this protocol, adjustable Guided Abutments, were not used.

**Results:** Twenty-three patients were treated in this pilot study. Via the

surgical template, all implants were placed to the desired depth as planned in the virtual implant planning program. After the traditional Brånemark Abutments were installed, the provisional prosthesis was delivered and occlusion verified. The prosthesis fit was checked at abutment level clinically and radiographically.

**Conclusion:** This report shows the extreme accuracy of this guided surgery protocol. If each step of this protocol is followed precisely, it is possible to deliver a prefabricated prosthesis built to traditional Brånemark System Abutments, which is extremely favorable for long-term patient and prosthesis management. (*Implant Dent* 2008;17:128-135)

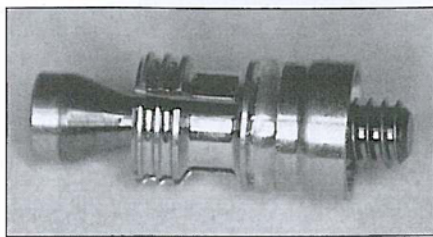
**Key Words:** dental implants, immediate loading, guided implant placement, transmucosal abutments, tissue integrated prosthesis, CAD/CAM

experience maximum benefits of dental implant treatment with minimum amount of time and office visits. A self-adjusting abutment (Guided Abutment, Nobel Biocare) is used with this protocol to accommodate any slight discrepancies during implant placement. This abutment is installed into the prosthesis and then the prosthesis is connected to the implant heads (Fig. 1).

With any fixed prosthetic reconstruction, general maintenance such as repairing fractures of veneering materi-

als, or replacing veneering materials due to advanced wear, will need to be used. A drawback to the Guided Abutment is that when the prosthesis requires removal, the abutments used with this system are removed from the implant head, thus resorting the prosthetic platform back to the implant level. Removal of this prosthesis can potentially be painful for the patient without a local anesthetic, since over time soft tissue integration can occur with the titanium copings that house the abutments.

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**Fig. 1.** The Guided Abutment, which is non-engaging to the implant, is designed to lock into the prosthesis and connect to the implant with a single tapered screw. The abutment is self-adjusting to accommodate some discrepancies for implant placement using the guided implant placement protocol.

The goal of this report is to evaluate the accuracy of the NobelGuide implant placement technique by fabricating a screw-retained prosthesis that connects to traditional Brånemark System abutments that are machined to a specific dimension. If these abutments are used, as opposed to the Guided Abutments, then all future prosthetic maintenance can be made at the abutment level, as opposed to the implant level. Assessment of prosthesis fit to the traditional abutments will be done clinically and radiographically, and implant survival will be analyzed.

## METHODS

All methods in this treatment follow the standard NobelGuide protocol until the laboratory phase begins.<sup>9-12</sup> The implant level master cast is retro-engineered from the surgical template and then is articulated using the stereolithographic duplicate denture and occlusal record from the CT scan. Then, appropriate abutments are selected relative to the gingival thickness and are secured to the master cast (Fig. 2). At this time an all-acrylic provisional prosthesis is fabricated in the laboratory to interface with the newly installed traditional abutments (Fig. 3, A and B).

The surgical placement of implants is performed under high magnification in order for the clinician to determine the precise depth of the implant mount in relationship to the surgical template sleeve. For a fully edentulous arch, 4 or 5 anchor pins are used to provide additional stabilization of the surgical template than the standard protocol (3 anchor pins). After all implants are placed, the surgical template



**2**



**3A**



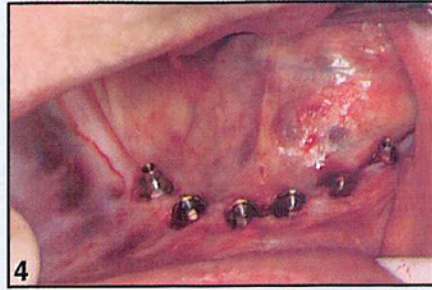
**3B**

**Fig. 2.** In the dental laboratory, traditional stock abutments are connected to the implant level master cast. It is imperative that the abutment is fully seated on the implant.

**Fig. 3.** (A) Frontal view and (B) occlusal view of the prefabricated all-acrylic provisional prosthesis to be delivered the day of implant placement.

is removed and the abutments used on the master cast to create the prosthesis are transferred to their identical positions intraorally (Fig. 4). Clinical confirmation of abutment seat is vital; radiographic confirmation at this time is recommended. The prosthesis is then delivered to the patient and connected with prosthetic screws. Assuming passive fit to the abutments, the occlusion is checked and adjusted if necessary (Fig. 5).

If any of the prosthetic cylinders in the all-acrylic bridge were not passively connected to the abutments, then the appropriate cylinders were trephined out of the bridge and reset into the proper position intraorally.



**4**



**5**

**Fig. 4.** After implant placement, the abutments from the master cast are transferred to the corresponding implant positions intraorally.

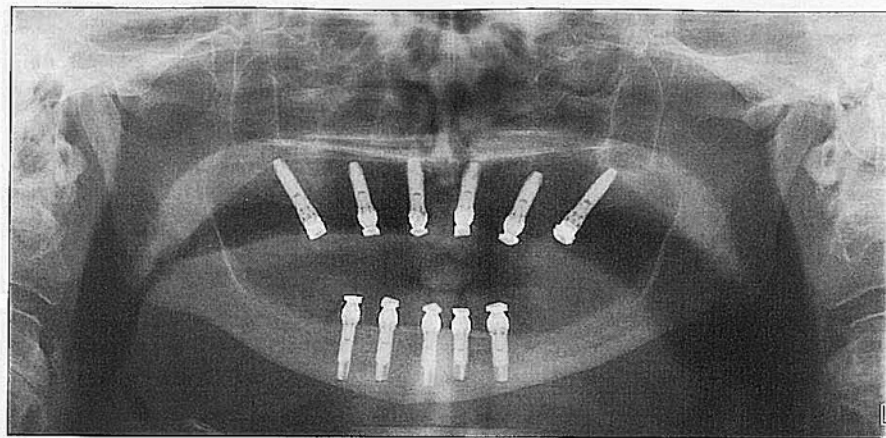
**Fig. 5.** Frontal view of the delivered all-acrylic provisional prosthesis.

## RESULTS

A radiograph is taken after the prosthesis delivery to confirm proper seating of the prosthesis to the abutments (Fig. 6). If the prosthesis has a passive connection and all components are seated properly both clinically and radiographically, this confirms that the placement of the implants with the surgical template were delivered to the precise location that was planned virtually on the implant planning software.

One hundred sixty-eight Brånemark System implants (Nobel Biocare USA, Yorba Linda, CA) were placed via a surgical template in 23 fully edentulous arches (range, 4-9). Six of these implants failed to achieve osseointegration and were removed, resulting in an implant survival rate of 97.6%. Prosthesis survival rate remained 100.0%, as the implants that failed were not vital for prosthesis support long-term and no further implant surgery was required. Follow-up times range between 3 months and 3 years (Table 1).

Two all-acrylic bridges did not fit passively to all abutments and required intraoral modifications to pickup the proper position of the abutments. These modifications were made by removing the misaligned cylinders in the all-



**Fig. 6.** Panoramic radiograph the day of implant placement, abutment connection, and provisional prosthesis delivery. The radiographic analysis confirms the proper seating of the abutments to the implants and the prosthesis to the abutments.

**Table 1.** Life Table Analysis

Period	Implants	Failures	Survival Rate (%)	Cumulative Survival Rate (%)
0-3 mo	168	3	98.2	98.2
3-6 mo	168	1	99.4	97.6
6-9 mo	104	0	100.0	97.6
9-12 mo	68	0	100.0	97.6
1 y	44	0	100.0	97.6
2 y	8	0	100.0	97.6
3 y	8	0	100.0	97.6

Cumulative survival rates of the implant population in these 23 patients between implant placement and 3+ year follow-up. All implant failure was noted in the first 6 months after implant placement.

acrylic bridges and readapting them intraorally using autopolymerizing acrylic resin. Consequently, there was a 98.8% (166 of 168) success in delivery of the implants to the precise position as virtually planned on the computer software.

## DISCUSSION

The introduction of NobelGuide to the clinical setting has dramatically advanced dental implant treatment for the edentulous patient. The protocol allows the clinician and laboratory to prefabricate a provisional or final prosthesis with the use of the Guided Abutment. Although this protocol satisfies patients' requests for fast, predictable, quality treatment in the short-term, it does not satisfy the authors' requirements for long-term predictable prosthodontic maintenance.

The removal of a screw-retained prosthesis that connects to the Guided Abutment requires the removal of the abutment from the implant head. This disturbs the biologic attachment between mucosa and abutment and can

often be painful for the patient. In addition, the removal of the abutment creates a microgap at the implant abutment interface and influences the crestal bone remodeling process.<sup>13-15</sup>

With the use of the guided surgery protocol in conjunction with traditional abutments placed immediately after implant placement, all future prosthesis maintenance can be performed comfortably and without anesthesia at the abutment level. Since the abutment never has to be removed, the potential for crestal bone loss can be minimized.

With the Guided Abutment, the screw hole in the prosthesis is slightly wider than the width of a typical abutment screw for the Brånemark System. When using traditional abutments, the screw hole width in the prosthesis is the diameter of a prosthetic screw, which is substantially smaller and results in stronger, more esthetic all-acrylic provisional bridge.

It is still the authors' philosophy to deliver a screw-retained provisional prosthesis, even though the technol-

ogy exists to have a milled titanium framework built to the master cast. The provisional prosthesis allows the patient to "test drive" the esthetics and phonetics of their fixed bridge. It will also act as insurance for the patient if something ever happens to the final prosthesis in the future.

Throughout the guided surgery presurgical and surgical procedures there are numerous areas where small discrepancies can lead to the misfit of a prosthesis that connects to traditional abutments. Precision must be used throughout the protocol. Otherwise, potential pitfalls may occur. The following list contains some items that need extra attention to ensure the accuracy and quality of the fixed prosthesis:

1. The position of the removable prosthesis in the patient during the CT scan in relationship to both the opposing dentition and the soft tissue anatomy.
2. The virtual relationship of the stainless-steel surgical template sleeve to the anatomy during implant planning.
3. Detailed and meticulous laboratory techniques.
4. Proper seat of the surgical template in patient and uniform biting closure onto surgical index.
5. Delivery of the implant mount to the precise depth in relationship to the surgical template sleeve.
6. Proper connection and torque of traditional abutment to implant head.

In the 2 abutment positions that required the all-acrylic bridge to be modified, it was determined at the time of implant placement that the bone quality in these sites was type I. This classification was made clinically according to the anatomical and bone density criteria established by Lekholm and Zarb.<sup>16</sup> It is the authors' opinion that the density of the bone caused some slight deflection of the implant during the placement procedure. It is recommended to prepare the osteotomy sites that are in very dense bone more thoroughly by using larger diameter twist drills and possibly a screw tap. Where, in softer bone sites, it may be advantageous to underprepare

the osteotomy site to achieve some lateral compaction in the bone and greater initial stability, it is not advised to implement the same preparations for the denser bone sites.

## CONCLUSION

This technique report indicates that NobelGuide implant procedures can be precise enough that self-adjusting abutments are not required for delivery of an immediate provisional prosthesis. With careful presurgical planning, followed by precise surgical execution, a laboratory-finished prosthesis can be delivered to the patient immediately after implant placement with few intraoral adjustments.

## Disclosure

Dr. Thomas J. Balshi and Stephen F. Balshi claim to have a financial interest in Nobel Biocare, whose implants, abutments, and cylinders are mentioned in this article.

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