



A Peer-Reviewed Case Report

Novaloc[®] Overdentures

A Noticeable Improvement in
Low-Profile Attachment Systems

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ABSTRACT

This clinical report focuses on upper and lower implant-supported overdentures working with the Novaloc® attachment system (Straumann). The treatment plan was confirmed with facial landmarks including the support of the upper lip useful in verification of tooth position. The factors in a successful outcome include construction of durable prostheses that are functional for chewing, speech articulation, and facial expression.

A concept gaining traction relates to a patient's perception of a generalized feeling of oral health in terms of quality of life. Not only are functional considerations a key point that deserves attention, but also the psychological components related to confidence in a social setting that play a huge role in a patient's perception of oral health. Studies have been designed to evaluate the emotional effects of tooth loss and more specifically focus on the relationship in which missing "occlusal units" decreased a patient's perceived quality of life.^{1,2}

One hundred twenty-three survivors who lost their dentures in the earthquake that shook Japan in 2011 were evaluated based on a relative risk to oral health and perceived quality of life.³ The three highest age-adjusted and sex-adjusted risks in terms of perceived quality of life were: 1) problems with smiling, laughing, and showing teeth without embarrassment (Relative Risk = 7.49); 2) problems enjoying the company of other people, such as family, friends, or neighbors (RR = 5.78); and 3) difficulty speaking clearly (RR = 5.38). Compare these findings to the difficulty in eating food (RR = 2.99) as a more functional consideration. Those who had lost their

dentures showed a significant difference or negative impact in their oral health-related quality of life.

Research has focused on the correlation between dental implants and oral health-related quality of life.⁴ The question becomes how many fixtures are recommended for patients who are interested in restorative treatment that includes dental implants.⁵⁻⁸ Once the treatment is completed, how does the restorative outcome respond to care and maintenance required in what has been described as the "chronic condition context" in an effort to help patients manage their new condition?⁹⁻¹¹

Certain design features of the Novaloc® attachment system (Straumann) create successful outcomes for patients. A low-profile attachment system works well for a great majority of dental implant-retained and dental implant-supported overdenture solutions. The advantages include flexibility of restorative space requirements, as well as the flexibility to maintain more of the patient's residual alveolar ridge structure. Low-profile abutment/attachment systems can be connected

directly to the dental implant fixture and also be incorporated in more sophisticated designs that include connecting bars.

The challenge for attachment systems designed to connect directly to the implant fixture is correcting for the relative divergence of the dental implants within the arch. Accommodation for this divergence is accomplished through increasing the height of the directly connected abutment or modifying the design of the attachment insert.¹² The low profile of the Novaloc attachment system maintains consistent with the design features of its patented Novaloc PEEK inserts (Straumann) of various retentive strengths. The Novaloc abutments are available in a variety of heights, as well as an option for a 15-degree angled abutment, in addition to the traditional straight abutment accommodating for the relative divergence of the dental implants up to 60 degrees.¹³

Clinical Report

This author had the opportunity to work with a patient who presented with a fractured lower overdenture (Figure 1 and Figure 2). She had many of the concerns of a patient embarrassed by a very visible and personal area of her face. She was not comfortable with family and friends, had difficulty speaking and showing facial expression, and was limited in what she could eat.

One can only imagine her disappointment after she chose to move forward



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FIG. 1



FIG. 2

(1) Initial presentation of fractured lower overdenture prosthesis. **(2)** Definitive restorative outcome working with the Novaloc attachment system for the lower overdenture, where the planning focused on maintaining the restorative volume appropriate to maintain structural durability of the removable prosthesis.



(3 THROUGH 5) The lower overdenture prosthesis fractured at the area of the metal housing, demonstrating compromised space available for restorative materials.

with treatment including a dental implant-supported overdenture, only to have it fracture soon after insertion. The 61-year-old patient had endured the loss of her remaining upper and lower natural teeth with the goal of creating a specific outcome, only to have her new teeth taken away once again because of a nonfunctional lower prosthesis. Her medical history included breast cancer, Graves' Disease, cervical fusion, osteoporosis, lymphedema, chemotherapy, and radiation treatment, as well as allergies to sulfa and latex. She had had 11 surgeries in the 2 years prior to her visit, which included trips to the hyperbaric oxygen chamber and treatment for cellulitis.

Mandibular flexure has been evaluated using elastomeric impression materials and finite element analysis. Typically, the smaller the mandible in terms of volume, the more flexure. Considering that dental implant-supported restorations were initially considered for maladaptive denture patients, it would be expected that flexure of the edentulous jaw would be an important factor. In a review article on mandibular flexure evaluating 20 articles that met inclusion criteria, the authors concluded that: "The clinical significance of mandibular flexure on the success of dental implant treatment is at this time unclear, and further research

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is needed."¹⁴

Finite element analysis has been developed and applied toward the goal of measuring elastic distortion of the mandible. Specifically, the areas of interest identified were intercuspal position, unilateral group function with and without balancing contacts, and isolated clenching at either the incisal

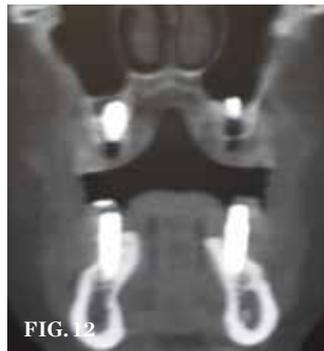
or the molar area. A computer model demonstrated measurable mandibular flexure in the body or corpus of the mandible, at the gonial angle, and at the neck of the condyles.¹⁵ The magnitude of movement related to mandibular flexure was measured in another study as being less than the depressible limit of the periodontal membrane or 0.2 mm.¹⁶

The concern with this patient's lower overdenture supported by four dental implants was the insufficient restorative space to accommodate the components of the attachment system while maintaining the structural durability of the removable prosthesis (Figure 3 through Figure 5).¹⁷ An improvement in the structural durability of the current prosthesis would require increased volume of restorative material for the resin base of the overdenture. The goal was to create a long-term, low-maintenance result for a patient who was forced into treatment for a new overdenture.

The patient was aware of and able to proceed with a fixed hybrid prosthesis; her preference for a new upper and lower overdenture was based on cleansability following insertion. The process of planning and creating a definitive restoration for this patient identified many scenarios in which the Novaloc attachment system could solve most of the restorative challenges for edentulous patients. The low-profile attachment components are the first-choice system for dental implant-related overdenture patients in this practice.

Design features of the Novaloc attachment system include:

- The polyetheretherketone (PEEK) Novaloc attachment demonstrates a longer life span at 0 degrees, 7 degrees, and 12 degrees, representing an improvement over nylon attachments.¹⁸
- The retention insert is designed to work around the external surfaces of the abutment, most likely clean surface creating retention as intended.
- A 15-degree angle correction is available with the Novaloc abutments, accommodating for anatomic variations, standardizing or at least minimizing the accommodation required



(11) The dental implants were positioned outside of the residual alveolar ridge in a manner in which designing a new removable overdenture with the appropriate amount of restorative space would be impossible with the existing fixtures. **(12)** Pretreatment CBCT showing position of the dental implants in the posterior mandible. **(13)** The dental implants were removed to accommodate for placement of four new dental implants, orienting the restorative platform based on the planned position of the lower teeth.

of the attachment.

- The Novaloc design of the PEEK retention insert helps to absorb lateral pressure that occurs on insertion and removal, as well as during function.
- The Novaloc housing is available in traditional titanium or in a white PEEK version that improves the ability to mask color differences within the denture base.

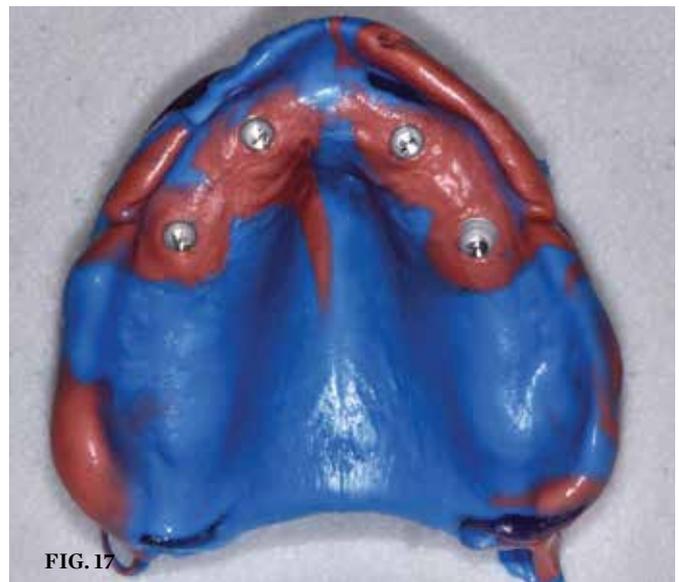
The patient was concerned about the prominent appearance of her upper and lower teeth, which did not “seem right” when she looked at herself in the

mirror. The initial plan was to shorten the incisal edges of the teeth and alter the occlusal plane as well as the midline in an effort to achieve the desired appearance.^{19,20} While the fractured lower prosthesis provided insight as to the reason for the material failure, it was the identification of the desired maxillary tooth position that set the tone for the intended position of the mandibular teeth.

The next step was to verify the restorative treatment plan intraorally with a trial prosthesis (Figure 6 through Figure 8). Once the desired tooth po-

sition was verified, the goal was to plan for enough restorative space to account for the attachment components, the denture base (acrylic and cobalt-chrome frame), and the denture teeth. During the process of finding the desired tooth position, it became clear that more than the incisal edges and occlusal plane required modification; it was the anterior to posterior position of the maxillary teeth (Figure 9 and Figure 10).

To clarify the intended outcome, the upper teeth were set back toward the alveolar ridge, and the patient felt more



(14) CBCT following placement of new dental implants in the posterior mandible. **(15 THROUGH 17)** The impression components for the Novaloc system and the PEEK housings positioned on the Novaloc abutments intraorally that were picked up in the maxillary impression.

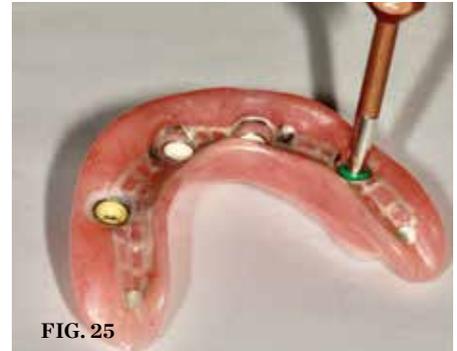
comfortable with the tooth display as a result of these modifications. Restorative space becomes a concern with any attachment system when moving teeth toward the residual alveolar ridge in what would be considered a lip-tooth-ridge (LTR) Class III relationship.²¹ The technical questions involve having enough room to embed the attachment components within the base of the overdenture (Figure 11).

The lower teeth were set to match the upper teeth at the desired vertical dimension of occlusion, creating bilateral and simultaneous posterior tooth contact in

The white color is much easier to mask, particularly in areas where the acrylic denture base is thin and potentially visible.

a fully seated (centric relation) condylar position. The evaluation of the position of the lower teeth also included functional movements of the mandible, focusing on the relationship of the opposing teeth during speech articulation (Figure 12 through Figure 14).

A combination of clinical findings corroborated a plan to remove the existing mandibular dental implants. The four new dental implants would be positioned to optimize the 3-dimensional position of the restorative platform based on the tooth position identified in the trial prosthesis. Straumann® BLX



(18 THROUGH 20) Maxillary overdenture prosthesis incorporating a metal intaglio framework, PEEK Novaloc attachment housings, and the white PEEK Novaloc retention inserts. **(21 AND 22)** The restorative outcome for upper and lower dental implant-supported overdentures using the Novaloc attachment system. **(23 THROUGH 25)** Changing the Novaloc PEEK retention insert was efficient and intuitive working with the Novaloc tool set.

dental implants were placed, creating new osteotomy sites following reduction of the alveolar bone.²²

The Novaloc abutments were selected to account for the thickness of the soft tissues of the residual alveolar ridge, as well as the path of insertion and removal (Figure 15 through Figure 17). At this point, the goal was to construct the definitive prosthesis working with the foundation of the edentulous arch. The restorative design

for the patient's overdenture included an intaglio framework supporting the individual attachments. Due to her experience with the fracture of the initial overdenture, the patient's priority was a durable overdenture. The maxillary framework was designed to accommodate an open palate should the patient change her mind in the future (Figure 18 through Figure 20).

The PEEK attachment housings available in the Novaloc system provide a few

unique advantages over traditional metal housing. The white color is much easier to mask, particularly in areas where the acrylic denture base is thin and potentially visible, and the surface can be treated and bonded to the acrylic denture base, as opposed to relying exclusively on retentive features incorporated into the surface of a metal housing.

Considering restorative options for edentulous patients, the Novaloc low-profile attachment system can be

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incorporated into the restorative design for almost any scenario (Figure 21 and Figure 22). The Novaloc PEEK retention insert has proven to be durable over time, and the retentive qualities are apparent as the patient inserts and removes the prostheses (Figure 23 through Figure 25). The Novaloc housing is designed to allow expansion of the slotted retentive insert, which is most critical on insertion and removal of the overdenture and also serves well during chewing function. A PEEK housing in the Novaloc system provides advantages in the ability to bond the housing while hiding it within the denture base. The 15-degree angle correction available in stock abutments helps to minimize the need for the attachment insert to accommodate for divergence between multiple implants.

Facial landmarks along with the support of the upper lip provide valuable information in verification of tooth position.^{19,20} This information proved most helpful in identifying the direction for the restorative treatment plan including upper and lower dental implant– supported overdentures. Functional prostheses have proven to be an important factor in a patient's perceived quality of life, and while chewing function is important, speech articulation and facial expression deserve focused intention in the restorative outcome. 🌸

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Straumann® Novaloc®

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