Implant Placement for Mandibular Overdentures using the Neutral Zone Concept

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Clinical significance
Implant placement and position affects the function and esthetics of implant-tissue supported overdentures. This clinical report describes the position of implant placement determined utilizing the neutral zone concept.

Abstract
Patients: A 56-year-old woman presented with a severely resorbed edentulous mandible, complaining of poor retention and stability of her existing ill-fitting removable partial denture. The original maxillary right lateral incisor and canine were present. A conventional overdenture and implant-retained overdenture were selected for maxillary and mandibular rehabilitation, respectively. The existing mandibular denture yielded an unacceptable position of implant placement. After molding of the denture border and cameo surface was conducted, the existing denture modified using the neutral zone concept allowed proper implant placement.

Discussion: The position of implant placement affects the function and esthetics of an implant-supported overdenture. Preparation of diagnostic and surgical templates using the neutral zone concept facilitates proper implant placement for comfortable dentures. Correctly remolded denture borders and cameo surface allow proper implant placement.

Conclusion: The cameo surface for implant-retained or supported overdentures needs to be prepared appropriately to obtain satisfactory implant position, in terms of esthetics, function, comfort, or patient satisfaction.

Key words: implant, overdenture, neutral zone, cameo surface

Introduction
The neutral-zone denture concept has been shown to improve the stability of complete dentures in patients. Implant placement position affects the function and esthetics of implant-tissue supported overdentures. Preparation of diagnostic and surgical templates using the neutral zone concept facilitates proper placement of implants for complete dentures. This clinical report describes the position of implant placement considered by the cameo surface of a mandibular complete denture. It was shown that correctly remolded denture borders and cameo surfaces facilitate proper implant placement.

Outline of the case
A 56-year-old woman presented with a severely resorbed edentulous mandible, complaining of poor retention and stability of her existing ill-fitting removable partial denture (Fig. 1). The original maxillary right lateral incisor and canine were retained. After informing the patient about the various treatment options available, including new complete denture, implant-retained overdenture or implant supported prosthesis, a conventional overdenture and implant-retained overdenture were selected for maxillary and mandibular rehabilitation, respectively, for economic and anatomic reasons. The existing mandibular denture was duplicated using auto-polymerizing poly methyl methacrylate (PMMA) (Palapress, Heraeus Kulzer Gmbh & Co., Wehrheim, Germany) to fabricate a template for examination by computed tomography (CT). It was proposed to place the two implants between the mental foramina, in the areas of the right and left canines. Temporary sealing material (Temporary Stoping, GC, Tokyo, Japan) was used to create radiopaque makers. However, CT examina-
Position indicated that the placement direction was inclined, and the position was shifted to the lingual aspect (Fig. 2). In addition, the index made with silicone impression (Coltoflax Putty type, Coltene, Altstatten, Switzerland) afforded inadequate space for the retainer and the housing (CM rider, CM, Biel-binne, Switzerland) (Fig. 3).

After molding of the border of the existing denture with modeling plastic impression compound (Impression Tray Compound, GC), a wash impression were made with silicone impression material (Fit-checker, GC) because of its high fluidity (Fig. 4). While the impression was being made, the patient was instructed to swallow and then purse her lips and move her tongue in order to correctly mold the denture borders and cameo surface. The denture flange and cameo surfaces were extended along the labial and lingual sides within physiological limits.

Since the denture labial flange was extended by remolding of the cameo surface, the tentative position of implant placement moved 3 mm towards the labial surface in the existing denture space (Fig. 5). The CT template was modified so that the drilling hole was moved approximately 2 mm towards the labial surface.

The second CT examination showed that the
height of the mandibular bone was 10 mm, and the new implant was positioned vertically in the middle of the alveolar bone (Fig. 6). The surgical template was modified according to the CT template using a drill guide so that the ideal position and direction determined by the CT examination was accurately transferred. A mouth prop was added to the template to restrict its movement during mouth opening (Fig. 7). The two implants (Brånemark implant, MKIII, Nobel Biocare Japan, Tokyo, Japan) (RP $3.75$, 8.5mm) were accurately placed following the surgical template and the mouth prop.

After allowing 3 months of healing and osseointegration, the definitive impression was made with a medium-viscosity silicone impression material (Coltex, Coltene), and the maxillomandibular relationship was registered using the duplicate denture instead of the individual tray and occlusion rim. A bar attachment (CM rider, CM) was selected as a retainer for the implant-retained prosthesis and fabricated in accordance with the manufacturer’s instructions. The plastic pattern was cut to length and joined to the gold cylinders with sufficient hard wax to make a strong joint. The pattern, complete with gold cylinders, was then invested and casted. A cast metal (Co-Cr) framework was fabricated to reinforce the denture base, and then auto-polymerizing PMMA (Palapress Vario, Kulzer) was polymerized. The retainer and implant-retained overdenture were inserted after polishing and finishing (Fig. 8). For the maxillary arch, a conventional overdenture was delivered after removal of the right lateral incisor and a stud attachment was placed on the right canine. The recall of the patient for follow-up and subsequent adjustments as necessary have been performed once every six months.

**Discussion**

The position and direction of implant placement during oral rehabilitation affect the function and esthetics of implant superstructures$^5-9$ and should be determined using a diagnostic and surgical
template of the final prosthesis. Diagnostic and surgical templates for implant-retained and -supported overdentures are usually prepared by duplicating the existing denture. Under other circumstances, a new denture with accurate occlusion and appropriate intaglio and cameo surfaces may be duplicated to prepare the diagnostic and surgical templates.

For complete dentures, an appropriate cameo surface is necessary to obtain proper denture retention and stability. The neutral zone is defined as the potential space surrounding the mandibular denture between the lips, cheeks and tongue. The neutral zone concept has been used to obtain an appropriate cameo surface of dentures. Implant-retained or -supported overdentures also require an appropriate cameo surface to prevent harmful forces from acting on the implant. In these situations, a diagnostic and surgical template should be prepared utilizing the neutral zone concept. In the case of the mandible, if there is a high degree of absorption of the residual ridge bone, it becomes difficult to predict the implant position. In such cases, the neutral zone concept is useful for predicting the correct implant position. Therefore, recording of the neutral zone as part of the diagnostic work-up before implant placement is important. Diagnostic and surgical templates prepared using the neutral zone concept improve the position of implant placement for comfortable dentures. The advantage of recording of the neutral zone is that it enables the most optimal positions for fixtures to be assessed based on the cameo surface. However, the disadvantage is that the process is complicated.

Conclusion

The existing denture did not allow correct implant placement and afforded inadequate space for the retainer. After molding of the border and making impressions on the cameo surface, the existing denture modified using to the neutral zone concept allowed proper implant placement.

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References