Cameograms: A New Technique for Prosthodontic Applications

Authored by Joseph J. Massad, DDS; David R. Cagna, DMD, MS; Russell A. Wicks, DDS, MS; and LeRoy A. Selvidge, DDS

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This case report article discusses and demonstrates a technique to functionally identify specific spatial boundaries within the oral cavity of an edentulous patient, and to relate this information to the prosthetic design for implant overdentures.

**Background**

The term *cameogramming* (coined by Dr. Massad) refers to identifying external surface locations for the structural mass of a complete removable dental prosthesis in situ. Observations of the area lying between synchronous motions of the tongue, muscles of facial expression, and muscles of mastication have been previously described by Sir Welford Fish, referenced as the *dead space*, and then later renamed the *neutral zone* by Beresin and Schiesser. Placing the prosthetic teeth and shaping the facial and lingual cameo surfaces of complete dentures to passively fall within this space (or zone) may create forms differing from more traditional prosthetics that are referenced to anatomic landmarks. In theory, the use of this concept, to delineate the outer surfaces of the restoration to be within the confines of these muscular parameters, can provide a more naturally fitting and functional prosthesis.

The size and shape of an overdenture supported by dental implants will vary, depending on the mechanisms deployed for support and attachment. Each type has specific dimensional requirements that must be contained within the available restorative space. When indicated, the implant-supported, bar-retained overdenture can assume a sizeable prosthetic volume. With the addition of a metallic superstructure, this prosthesis in cross section may occupy 12.0 mm or more of...
vertical space and, in addition, a similar potential amount of horizontal space.¹ ⁸

**CASE REPORT**

**Diagnosis and Treatment Planning**

The patient in this scenario presented with a debilitated dentition, including missing posterior teeth, a prognathic mandibular skeletal jaw relationship, advanced tooth wear, and a closed vertical dimension of occlusion (VDO) (Figures 1 and 2).

Various methods are available to treat patients with failing dentitions, ranging from complete restoration of the remaining teeth to full-mouth extractions and restoration with or without implant support. A comprehensive assessment including extra- and intraoral examinations was completed, then a detailed diagnosis, treatment plan, and realistic prognosis were formulated. The patient’s best interests, incorporating his input, were paramount in considering the treatment options. Discussion included issues of cost, inconvenience, health and age, prosthetics (including aesthetics, serviceability, reparability, longevity, and replacement), and oral hygiene commitment. The patient was given an Oral B Pro 5000 SmartSeries rotary toothbrush with an implant instructional DVD. Prime concerns were determined to be gaining maximal support for function, improving facial profile, and the ability to remove the definitive restorations for cleaning.

Full-mouth restorative procedures were indicated in this case for optimal results. The restorative preference selected for this patient was opposing implant-supported, bar-retained overdentures. The progression of clinical therapy was as follows.

**Stage I: Interim Immediate Dentures**

An analysis was made of the patient’s facial symmetry, midline, and profile, complemented by demonstration software (EdentExam [Unique Dental Apps]). An assessment of lip-to-incisal...
edge relationships was performed, assisted by a measuring device (Massad Esthetic Space Ruler [Nobilium]). Facial shells representing the maxillary anterior teeth (Massad Visionaire Dental Shells [Nobilium]) were selected and placed intraorally for the patient’s evaluation and approval. These tooth facets aided in determining the maxillary incisel edge lengths and a reasonable midline position.

Border extended master impressions were made using a vinyl polysiloxane (VPS) additive layering technique in heat moldable stock trays (Strong-Massad DenPlant LOW TEMP Tray [Nobilium]). Casts were produced from the impressions in type No. 4 die dental stone (FlowStone Fast Set [Whip Mix]) to be used in the construction of complete immediate dentures.

Centric relation and VDO were determined and recorded with the use of a central bearing point device (Massad Jaw Recorder [Nobilium]) attached to formed bases. A VPS interocclusal recording media (Futar Fast [Kettenbach LP]) was used to capture jaw position. Casts were mounted on a semi-adjustable articulator using a face-bow transfer (Denar 330 [Whip Mix]) and the related record.

A rigid-body VPS impression material (Honigum Rigid X-tra Fast [DMG America]) was injected under the lips to the full extent of the labial/buccal vestibules. The patient was instructed to “pucker” the lips outwardly and to smile forcibly to create a functional record (Figures 3 and 4).

The space for the missing mandibular posterior teeth was recorded by using a partial baseplate with a compound wax (Green Wax Impression Compound Stick [Kerr]) shaped to resemble a thin occlusal rim. This wax was heat-softened and then placed into the mouth while the patient swallowed to capture the inward forces of the cheeks and the outward forces of the tongue (neutral zone) (Figure 5).

Functional registration for the mandibular labial/buccal space was also performed anterior to the remaining teeth (Figure 6).

VPS putty (Flexitime Easy Putty [Heraeus Kulzer]) matrices were constructed to surround these functional records, oriented to an indexed position on the master casts (Figures 7 and 8).

The teeth and the surrounding areas on the master casts were reduced to the form of a post-extraction residual ridge. Prosthetic tooth selection was based on previous information obtained in Stage 1. The prosthetic teeth were adapted to the ridge and the putty matrices placed to serve as boundaries for their labial/buccal-lingual orientation (Figure 9).

Wax was added to anatomically develop and finalize the external surfaces of the denture bases also to be consistent with the surrounding putty matrices. The immediate dentures were processed in acrylic resin (Millennium Pour Acrylic Liquid [Keystone Industries]), finished, and polished.

Stage II: Surgery

The immediate dentures and the patient were scanned separately using CBCT (ProMax 3D [Planmeca]). The images were melded to create a digital model for planning optimal osseous recontouring, implant placement sites, and to construct surgical assisted guides (SIMPLANT Guide [DENTSPLY Implants]).

Surgery was then performed, including extractions, bone reduction, multiple osteotomies, and the location of 4 implants in the maxilla and 6 in the mandible (ANKYLOS [DENTSPLY Implants]).

Angling abutments were placed, followed by healing abutments (DENTSPLY Implants) on the implants in the maxillary arch. A resilient lining material (PermaSoft Soft Denture Liner [DENTSPLY]) was used to adapt these to the maxillary denture. The mandibular implants had angling abutments placed along
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with provisional locking screws (SmartFix [DENTSPLY Implants]). The mandibular denture was fixated to the provisional sleeves intraorally using autopolymerizing resin (Jet Liquid, Jet Denture Repair Powder [Lang Dental]).

The interim dentures were adjusted for fit of the intaglio surfaces and occlusion. Final finish and polishing was performed to complete delivery.

**Stage III: Definitive Overdentures**

Several weeks transpired, allowing the patient time to experience his interim restorations. He reported favorable accommodation to his new dentition, with the re-established VDO and changed tooth positions, at rest and during function. After a prescribed period of implant integration, the dentures and previous attachments used during healing were removed. Direct transfer copings (DENTSPLY Implants) were attached atop the angling abutments. Open tray, border extended, master impressions were made using a VPS additive layering technique in heat moldable, modified stock trays (Massad Edentulous LOW TEMP Tray [Nobilium]).

After coping detachment and removal of the impressions from the mouth, implant abutment analogs (DENTSPLY Implants) were fixed to the impression copings. Master casts were poured in type 4 dental stone, and also using a soft cast material (Flowstone FS [Whip Mix]) to surround the implant sites. Pouring was conducted to control movement of the impression analog unit by eliminating vibration and the pressure of spatulation. In addition, the boxing of the impression further defined an accurate functional peripheral denture border.

Resin (Primopattern LC Gel [Primotec]) jigs were constructed and tried in the mouth to verify the casts for accuracy. Record bases and occlusion rims were fabricated on the master casts. Procedures to obtain anterior tooth selection and position, interocclusal records, and a face-bow transfer were performed as before to verify and/or make any modifications as a result of muscular changes from the wearing of the immediate prostheses.

Wax renditions of the definitive dentures were composed using prosthetic teeth (Heraeus Kulzer) adapted to the edentulous ridges and occlusion rims. These were tried in the mouth to confirm aesthetics and occlusion and to gain patient approval.

The completed waxed dentures were scanned using CT on the master casts (ProMax 3D). A digital design was generated for the bars and mandibular superstructure on the casts to be within the confines of the teeth and denture bases (ATLANTIS ISUS [DENTSPLY Implants]) (Figure 10).

The structures were created using a computer-assisted milling machine (ATLANTIS ISUS). The maxillary bar was shaped with a highly polished and rounded tissue radius for easy of hygiene. Three gold clips (Hader [Sterngold Dental]) engaged the bar unit for retention. The mandibular bar comprised a 2-in-one configuration allowing patient removal for ease of hygiene and repairability. This design also prevented the labial flange from extending into the vestibule, which would compromise the intended outline determined by the muscular recording. The mandibular superstructure was fashioned with buccal tube extensions to contain the retentive features (Locking Pin Easy-Snap E [Bredent Medical GmbH]) (Figure 11). The bars and superstructures were attached intraorally and confirmed for fit and position (Figure 12).

Matrices were created to capture the position of the outer surfaces and teeth in the waxed dentures. The wax was eliminated, and the supporting metal structures attached to the master casts. After appropriate block-out, the wax forms and teeth positions were recreated on the master casts. A final try-in with the teeth in wax was performed. An additional cameogram recording was made on the labial/buccal of the maxillary wax denture (Figure 13). This was used to develop the wax to final anatomic detail for the external surface (Figure 14).
The final compound prosthetics were processed and finished and the definitive restorations delivered (Figures 15 to 17).

**CLOSING COMMENTS**

This case demonstrates the value of the cameogram in the treatment planning, design, and construction of implant-supported overdentures. Understanding this proven process can help identify tooth positions, which improve horizontal and vertical overlap posture and reduce food slippage into the lateral vestibular space.

In this presentation, one treatment goal was to create a more aesthetic profile for the patient. Information gained by the upper cameogram allowed the anterior teeth to be placed more labially. Repeated cameograms to define the facial corridor of the mandible indicated the potential for some linguualization of the anterior teeth. An increase in VDO improved the once-excessive freeway space. A combination of these things helped to create a more orthognathic profile for the patient as well as to indicate the spatial boundaries available for the restoration.

In using the treatment option of bar-retained overdentures, contours were controlled with great detail to contain the restoration within the 3-dimensional confines of the restorative space. Often bucco-lingual spatial limits are overlooked. Cameograms are useful in helping to reveal the appropriate boundaries for these restorations to complement the physiologic tolerances and function of the individual patient.

**Acknowledgment**

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**References**

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1. The term cameogramming refers to identifying external surface locations for the structural mass of a complete removable dental prosthesis in situ.
   a. True  b. False

2. Placing the prosthetic teeth and shaping the facial and lingual cameo surfaces of complete dentures to passively fall within this space (or zone) may create forms differing from more traditional prosthetics that are referenced to anatomic landmarks.
   a. True  b. False

3. When indicated, the implant-supported, bar-retained overdenture can assume a sizeable prosthetic volume; however, with the addition of a metallic superstructure, this prosthesis in cross section rarely occupies more than 8.0 mm of vertical space and, in addition, a similar potential amount of horizontal space.
   a. True  b. False

4. In this case report, border extended master impressions were made using a polyether impression material in heat-moldable stock trays.
   a. True  b. False

5. In this case, the immediate dentures and the patient were scanned separately using CBCT.
   a. True  b. False

6. The completed waxed dentures were scanned using computerized tomography on the master casts.
   a. True  b. False

7. In this presentation, one treatment goal was to create a more aesthetic profile for the patient, and information gained by the upper cameogram allowed the anterior teeth to be placed more labially.
   a. True  b. False

8. According to the author, cameograms are useful in helping to reveal the appropriate boundaries for these restorations to complement the physiologic tolerances and function of the individual patient.
   a. True  b. False
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