

Stepwise technique for developing a successful Prosthodontic design for a Geriatric Mandibular Resection Patient

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ABSTRACT

This report describes the continued treatment of a geriatric patient with a mandibular lateral discontinuity defect and existing mandibular implant-retained removable complete prosthesis opposing a maxillary complete denture. The purpose is to present a method of addressing patient concerns about existing esthetics and function using provisional restorations that permit gradual alterations to confirm operator and patient approval prior to fabrication of definitive prostheses. This technique allows the dentist to better accommodate the loss of dexterity, decreased adaptability, and other problems often complicating design of dental prostheses for aging patients.

Keywords: resection, surgery, radiation, cancer, geriatrics, prosthodontics

Introduction

As the geriatric segment of the population increases in both number and proportion, and with the increasing incidence of cancer associated with aging, dentists can expect to see a greater number of oral cancer survivors. Along with improved methods for treating the primary disease, rehabilitation of these patients has been greatly enhanced by the use of implant prosthodontics. Even with advanced techniques, however, restoration of the oral cancer patient remains a complex and challenging task for all disciplines involved. Proper maintenance, revision and replacement of the prosthesis are crucial to preserve remaining supporting tissues,

which are often severely compromised by cancer therapy.

Case report

The patient was a 77 year old Caucasian male, (Fig. 1) who initially presented to the Faculty Group Practice Clinic at the College of Dental Medicine, Georgia Health Sciences University (now Georgia Regents University) in December, 2008. His chief complaint was, "... the way the lower teeth push my lip out, and I can't seem to chew foods I'm supposed to eat." Further discussion revealed that the patient also felt that the existing prostheses accentuated his mandibular defect, (Fig. 2) and revealed an excessive amount of the mandibular teeth

compared to his natural ones. The present maxillary complete denture and mandibular implant-retained removable complete prosthesis (IRRCP) were inserted in 2003. (Fig. 3)



Fig.1 Preoperative frontal view with existing prostheses



Fig.2 Preoperative left profile view with existing prostheses



Fig.3 Intraoral view of existing prosthesis at initial visit

The patient underwent soft tissue excision and left lateral mandibular resection surgery, with subsequent radiation therapy for squamous cell carcinoma of the floor of the mouth in 2001. He was diagnosed with duodenal ulcer in 2007, and was undergoing active treatment at this visit. His physician felt that the patient was either not spending enough time chewing his food, or that the present dentures had lost their “fit” or “sharpness” and prevented proper mastication. He suspected that this was a contributing factor to development of the duodenal ulcer. His prescription medications were lansoprazole (30 mg), amoxicillin (500 mg), clarithromycin (500 mg) in combination twice per day for 14 days, for duodenal ulcer and *Helicobacter pylori* (*H. pylori*) infection. The patient had completed 7 days of the 14 day antibiotic regimen at first visit, and reported marked improvement in ulcer symptoms in subsequent appointments. His last general physical examination was performed 2 months prior to this appointment. He described his overall health as fair. The patient reported using chewing tobacco for approximately 35 years, and quit one month after diagnosis of oral cancer in 2001. He drank alcohol occasionally prior to his duodenal ulcer, but stopped since it made the ulcer symptoms worse.

Examination revealed obvious asymmetry in the lower facial third when viewed from the anterior. (Fig. 1) There was a marked deviation of the chin point and remaining mandible to the left at rest, with deflection increasing as opening progressed to maximum. Range of motion was good, with no temporomandibular joint (TMJ) signs or symptoms with movement of the functional (right) side. No movement was discernible at the left TMJ. The TMJ capsules were nontender and symmetrical.

Atrophy of the remaining masticatory musculature on the left side was evident, and right and left muscle palpation results were negative.

Intraoral inspection revealed moderate-to-severe resorption of the maxillary residual ridge, with acceptable conformation of the vestibules and frenal attachments. (Fig. 4)



Fig.4 Occlusal view of the maxillary residual ridge at initial visit.

No movement or impingement of the left condylar remnant into the buccal vestibule, that could potentially compromise a new maxillary complete denture, was evident either at rest or with mandibular motion. The maxillary right buccal vestibular width was adequate to accommodate a reasonable denture base thickness in all but extreme right nonworking movement, and the patient had no signs or symptoms that would indicate a problem in this area with the existing prosthesis. The left buccal vestibule was erythematous and slightly tender. An overextension of the complete denture in the corresponding area was found with disclosing wax (Disclosing Wax, Kerr Corp, Orange, CA) and relieved at this visit. Severe resorption of the mandibular residual ridge was evident (Fig. 5) with the anticipated superior, posterior and medial rotation of the remaining mandibular segment commonly seen with unrepaired

lateral resection.^[1] Tongue mobility, bulk and positioning, as well as oral motor control and sensory function were good. A graft was evident in the left floor of the mouth, with appropriate positioning. During masticatory function and clenching, only a slight rotation of the mandible was noted in the frontal plane. Xerostomia and long-term mucosal and skin radiation effects were noted.



Fig.5 Existing mandibular implant supported bar

Four 3.7 mm. diameter Zimmer Screw Vent implants were present in the anterior mandible, supporting a Hader bar with 10 mm. distal cantilever extensions for attachment retention on the most posterior abutments. Adequate bone support of the implants was confirmed initially by radiographic examination (Fig. 6), and later percussion testing after bar removal.



Fig.6 Panoramic radiograph showing lateral resection of left mandible and implants with attached bar

Inadequate width of attached gingiva was present around the implants, but the patient declined any periodontal treatment beyond standard prophylaxis. The polymer Hader clip inserts exhibited wear, but the patient reported no problems with retention or stability of the prosthesis. Examination of the mandibular prosthesis showed that the anterior teeth were placed well forward of the labial vestibular depth, and substantiated the patient's complaint of excessive lip support.

Insertion of the prostheses revealed an excessive vertical dimension of occlusion, as shown by prominent tooth display in both arches, the patient straining to keep the lips together at rest, and disproportionate lower third of the face yielding a stretched appearance. The dorsum of the tongue at rest was positioned well below the occlusal plane of the mandibular prosthesis, and may explain some of the masticatory problems reported by the patient. If the occlusal plane is set too far superiorly in the conventional mandibular removable complete dental prosthesis, the tongue is unable to move the bolus onto the occlusal surfaces of the teeth for mastication.^[1] Since tongue function is often compromised in the mandibular resection patient,^[2] the deleterious effects of placing the occlusal plane too high can be even more pronounced.

Because of the number of problems noted with the existing prostheses, it was felt that they should be replaced rather than modified. This approach also allowed them to be kept as a reference, should a change in design prove unacceptable. Since the patient had been using them with at least some degree of success over the previous 5 years, it was also felt that the unaltered existing prostheses provided an

exit strategy should the patient reject all of the proposed changes.

Conventional techniques were used for preliminary and final impression procedures in two successive appointments, and the master casts were completed. Appropriate infection control measures were employed throughout treatment, but are omitted here for clarity. At the second appointment, since the existing implant supported bar might prove suitable for use with the new mandibular prosthesis (if acceptable after all revisions), a secondary cast was formed with implant analogs fastened to the bar with laboratory screws, and the bar secured within the prosthesis by the existing Hader clips. (Fig.



Fig.7 Implant analogs and bar secured within existing IRRCP for fabrication of the duplicate prosthesis

Blockout was formed with water-soluble modeling clay (Play-Doh, Hasbro, Inc, Pawtucket, RI), to protect the bar and attachment assemblies during pouring of the stone (Microstone, Whip Mix Corp, Louisville, KY).

The original mandibular prosthesis was removed from the bar/cast following setting. The prosthesis was then reproduced in tooth- and pink-colored autopolymerizing acrylic resins (Jet Tooth

Shade 4/1 Kit and Jet Denture Repair Resin Package, Lang Dental Mfg Co, Wheeling, IL) with a duplicating flask (Denture Duplicator Flask, Lang Dental Mfg Co). The reproduction was then trimmed and fitted to the assembled bar and secondary cast by removal of surface imperfections and relief of the bar areas to permit complete seating on the cast/bar assembly. Additional relief was provided in the Hader attachment areas, and 2 new housings with inserts were placed on the distal bar cantilever segments. The undercut areas around the adjacent implant components and bar were blocked out with utility wax. These were picked up within the duplicate denture with autopolymerizing acrylic resin (GC Pattern Resin LS, GC America Inc, Alsip, IL), ensuring correct orientation of the reproduction denture on the cast. The patient was cautioned that either a new bar or entirely different retentive mechanism might have to be used with the implants to avoid the risk of breaking the new mandibular prosthesis in final form. The existing maxillary complete and mandibular duplicated interim dentures were inserted and the vertical dimension confirmed to be the same as the presenting measurement. (Fig. 8) This was to be the starting point for alterations at the following appointment.



Fig.8 Existing maxillary complete removable dental prosthesis with duplicated mandibular prosthesis at original occlusal vertical dimension, with lips fully relaxed

The following steps were completed at the third appointment. The conventional maxillary record base and occlusion rim were adjusted for appropriate lip support and contours, the level and angulation of the occlusal plane established, and the facebow transfer record completed. The maxillary master cast was mounted on the articulator, and the mandibular reproduction denture fitted with pressure indicating paste and disclosing wax. The maxillary record base and occlusion rim were removed from the articulator, reinserted, and the mandibular occlusal plane level and angulation modified to produce a reasonable vertical dimension. Since the maxillary contours and levels had been established first, all further refinements of vertical dimension, interocclusal distance, and occlusal plane level were to be accomplished on the reproduction denture. The mandibular bar was reconnected to the implants at the appropriate torque, and the fit of the reproduction in the bar and soft tissue areas confirmed intraorally. Despite acrylic resin material being more difficult to adjust than wax, the use of this more durable material permitted alterations to be tested by the patient in actual function over several weeks. Once tentative occlusal plane level was established, the 6 mandibular anteriors were removed from the reproduction as a block, and repositioned temporarily with sticky wax (Kerr Sticky Wax, Kerr Corp), with adjustment according to prosthodontic principles and patient esthetic desires. (Fig. 9) The segment was then reattached with pink autopolymerizing acrylic resin (Jet Denture Repair Resin Package, Lang Dental Mfg Co), and the base recontoured, finished and polished. The reproduction was then placed intraorally, and a polyvinylsiloxane (Kerr Extrude XP Putty, Kerr Corp)

interocclusal record made for mounting the mandibular cast. The mounting was verified with a second interocclusal record. The denture tooth molds and shades were chosen. Lingualized nonbalanced occlusion was selected to address the patient's concern about poor food penetration. The patient's original definitive mandibular prosthesis was returned to him, with the understanding that he not uses it again during current treatment.



Fig.9 Repositioned mandibular anterior tooth segment showing proposed alteration to reduce excessive lip support

The fourth appointment was the insertion of the maxillary trial denture and evaluation of the function and esthetics of the mandibular reproduction denture. The patient approved the appearance and felt that he was eating better with the modifications that had been completed on the mandibular form, but requested that the labial and lingual anterior areas be further reduced. Upon doing so, the base material became excessively thin in several areas adjacent to the bar. At this time, the patient was reminded of the possibility of the bar being eliminated, and that an appropriate alternate attachment for the existing space was required. The Locator attachment system (Zest Anchors LLC, Escondido, CA) was selected because of its small vertical profile, while providing a

range of retentive force with the different inserts. Because of the highly variable mandibular positioning and significant deviation to the left observed, a flat plane (platform) extension was to be added to the palatal of the posterior teeth on the right side of the maxillary denture to provide more potential occlusal contacts. (Fig. 10) The maxillary complete denture set up was sent to the laboratory for processing, finishing and polishing after selection of the base resin shade.



Fig.10 View of replacement maxillary prosthesis with palatal platform to maintain occlusal contacts with mandibular displacement toward the resected side

At the fifth appointment, Locator abutments (Zimmer-Paragon Screw-Vent 3.7mm Abutment and components, Zest Anchors LLC) with appropriate gingival cuff heights were fitted to the mandibular implants and tightened to the specified torque value. The attachment caps with processing inserts were picked up intraorally in the mandibular interim denture after application of the blackout spacers, with autopolymerizing acrylic resin (GC Pattern Resin LS, GC America Inc). Locator abutment analogs were fitted to the attachments, and a new master cast poured. While the new mandibular master cast was setting, the intaglio and periphery of the processed maxillary denture were fitted and adjusted with conventional

procedures. The mandibular interim denture was removed from the new master cast, and a new centric relation record made with the maxillary prosthesis seated on the remount cast. The facebow record orientation of the maxillary cast was preserved by the laboratory, and the mounted remount cast was provided with the completed maxillary denture. The mandibular cast was indexed, mounted after placement of the interim denture, and the mounting verified. The occlusal adjustment was completed on the articulator, finishing and polishing of the adjusted areas performed, and the patient instructed in the use and care of the new prosthesis and attachments. The interim denture was given to the patient with the processing inserts, since he had some difficulty with removal of the denture at this time.

When the patient returned for the sixth appointment, he reported that the anatomical form of the new maxillary teeth felt too sharp and was irritating his tongue, although it did provide improved food penetration. He also noted that the palatal platform interfered with normal tongue movements in speaking, and asked that it be removed. Because of the number of changes involved, it was decided to remake the maxillary denture at the same time that the definitive mandibular prosthesis was to be processed. Monoplane occlusion with negative occlusal anatomical form was selected as an alternative occlusal scheme for the patient. The new maxillary denture would be used as a processed denture base following indexing and removal of the teeth and excess base resin. The patient was dismissed with only the original maxillary prosthesis, and was scheduled to pick up the mandibular interim denture the

following day after completion of laboratory procedures.

To provide a record of the patient-approved tooth positioning and arrangement, putty matrices (Reprosil Putty Polyvinylsiloxane Impression Material, DENTSPLY Caulk, Milford, DE) were made of the prostheses on the indexed casts. Locator attachment caps with laboratory inserts were fitted to the Locator abutment analogs on the cast after removal of the prosthesis. The denture teeth were attached to the matrix with sticky wax. The prostheses were waxed to proper contours and occlusion, processed, and finished and polished. The patient returned the next day for the mandibular interim prosthesis to use with the original maxillary complete denture until the definitive prostheses were returned from the laboratory.

At appointment seven, the maxillary and mandibular definitive prostheses insertion was completed using conventional procedures. The laboratory was able to preserve the mandibular cast for use in remounting. A centric relation record was made, the mandibular cast mounted, verified, and the clinical remount and occlusal adjustment completed. The care and use instructions were reviewed with the patient, and he was appointed for a 24 post-insertion visit.

The patient returned the following day for the eighth appointment, with one adjustment needed for relief of the maxillary labial frenum notch. All other denture bearing areas appeared normal, and the patient felt that he would have minimal tongue soreness with the new maxillary tooth form, and more confidence in speaking with the platform removed. The patient was reminded that, with his radiation therapy, it was important to be aware of any soreness either below or

adjacent to the new prostheses, so that adjustment could be performed as soon as possible. The patient was to return in one week.

At the ninth appointment, the patient was doing well, with no soreness reported or observed. The patient had begun to notice the mandibular prosthesis loosening while eating, and mentioned that he felt that he could now place and remove the mandibular well enough to use the more retentive Locator inserts. The 4 black processing inserts were changed to the blue 1.5 pound retention inserts. The patient was appointed for the one month post-insertion recall visit.

The patient returned for the next scheduled appointment, and he stated that he could no longer get the mandibular prosthesis to seat completely. Examination revealed that the attachment matrices were filled with food debris that prevented them from engaging the male retentive features. The debris was removed, and use of single tufted brush (Butler End-Tuft Toothbrush, Sunstar Americas Inc, Chicago, IL) was shown to the patient with a hand mirror, and the method reinforced by having the patient demonstrate correct brush use. Once the attachment components could fully re-engage, the patient had adequate retention. No pressure sores were observed, and use and care instructions reviewed with the patient once again. He was appointed for a 3 month recall visit, and reminded to contact us as soon as he had any problems or concerns.

From the 3 month recall visit until the present time, approximately 3 years after completion of definitive treatment, the patient has done well with the prostheses, and continued to have oral prophylaxis and examination done at 6 month intervals. The Locator attachment

inserts have been replaced annually, but no increase in insert retention has been requested. The Locator abutment torque values are also checked during the yearly visits. Slight wear of the resin denture teeth has been noted since insertion, and the patient is being monitored closely for changes in occlusal vertical dimension.

The patient feels that he is better able to chew with the present design, although he must often remind himself to spend more time to properly triturate meats and fibrous foods. A short time after the new prostheses were inserted and adjusted, his physician noted an improvement in the patient's diet, and no recurrence of the duodenal ulcer has been seen to date.

Discussion

In addition to the disabilities produced by surgery, radiation and/or chemotherapy, the dentist treating the geriatric oral cancer patient is also confronted with the problems of aging. These include loss of dexterity, decreased adaptability, loss of coordination, greater incidence of chronic disease, and increasing use of prescription and over-the-counter medications. All of these factors have been shown to have significant negative effects on the oral health of the geriatric population overall, and their impact on the older oral cancer survivor may be intensified in an already compromised environment. Dramatic changes in a relatively successful prosthesis design, even those requested by the patient and/or deemed reasonable or necessary by the clinician, may not be tolerated by the aging patient.^[3] Smaller, stepwise alterations are recommended to allow for the reduced adaptive and recuperative capabilities seen in many of these patients. An additional benefit of limiting revisions to

a provisional prosthesis is that the dentist has not made any changes to the original, should the patient reject his efforts.

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