

TITLE: Oral prosthetics in management of the head and neck cancer patient

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Head and Neck Surgeons in the past 20 years have seen a rapid progression in surgical technique and technology that has led to resectability of larger and more extensive cancers of the head and neck region. This has led to a larger number of patients with extensive post-surgical defects and subsequent physiological consequences that, without the field of maxillofacial prosthodontics, would lead to decreased patient satisfaction and poorer post-operative outcomes. The maxillofacial patient's quality of life is obviously impacted, which predisposes him to a variety of psychological impairments affecting his ability to withstand the surgical procedures he faces. These patients are often more willing to accept large resections necessary for cure if counseled about prosthetic reconstruction prior to definitive surgery. These patients are ideal for pre-operative referral to a prosthodontist experienced in head and neck cancer patients.

Pre-operative assessment is extremely important in the consideration of these patients. Preoperative examination should be concerned with the disease entity and potential defect that surgical removal of the diseased part will leave. It is important that the surgeon have communication with the prosthodontist as far as extent of disease, anticipated post-operative defects, anticipated post-operative healing time course, and special post-operative care issues of the patient. In addition, pre-operative visits to the prosthodontist will allow evaluation of anticipated remaining oral and facial structures needed to provide support, retention, and stability of prosthesis immediately after surgery and in the future. Remaining natural teeth are perhaps the biggest asset to the maxillofacial prosthetic rehabilitation for intraoral defects. Even diseased teeth can be an asset for temporary prosthetic devices, and overall dental assessment is a pre-operative must. Total occlusion, malposed teeth, presence of prognathic or retrognathic maxillomandibular relationship, and vertical dimension of occlusion should be assessed and noted in the preoperative note. In the common situation of edentulous patients, examination should also include height and width of the residual alveolar ridge. In addition to obtaining a pre-operative history and physical, this visit is an important time to cast the patient. The importance of preoperative casting is designing prosthetics that most accurately reproduce previous physiologic function.

In addition, size of the anticipated defect will allow pre-operative counseling of possible deficiencies in speech, deglutition, and mastication. Maxillary extension of cancers can leave

the patient with large communications between the oral and nasal cavities which cause problems with hypernasal speech, lack of maxillary teeth for mastication, and swallowing difficulties severe enough to mandate gastric tube placement. Resection of cancers involving the mandible can cause speech and masticatory problems. In addition, they can leave severe cosmetic deformities affecting the psychological health of the patient. Resection of portions of the tongue can cause similar problems. Reconstruction of these defects with regional tissue flaps and microvascular flaps will augment prosthetic function in many cases, and plans for these types of reconstructions must be communicated with the prosthodontist during consultation.

Management of the Dentate Maxillectomy Patient

-Preoperative Management

The dental health status of the patient is the first consideration when planning for prosthetic implantation. Often the urgent need for surgical resection will prevent addressing all needs of dental care preoperatively. Regardless, every attempt should be made to treat existing dental disease for two reasons: 1) to reduce the risk of need for dental work during the healing phase of surgery, when manipulation of the surgical site would be problematic, 2) to increase the likelihood that remaining teeth will be retained, and serve as support for the prosthesis itself.

A general principle with regards to the maxillectomy patient is to do all that can be done in the time allowed. Preservation of all possible teeth and vigorous dental hygiene are important in the preoperative period to reduce problems in the postoperative period, when cleaning will be difficult if not impossible. The decision to remove maxillary teeth may come into question if the patient may receive pre and post-operative radiation. It is felt by most prosthodontists that the potential risk of osteoradionecrosis resulting from dental treatment in the maxilla is minimal and well worth the risk when weighed against the potential value of teeth as abutments for an obturator prosthesis. Therefore, all teeth should be retained except those that are grossly carious.

In addition to assessment and preservation of teeth, it is important to obtain maxillary and mandibular molds in the pre-operative period. Two maxillary molds should be obtained, one to be used as a permanent record, and the other for simulation of the anticipated surgical defect to be used as a guide for fabrication of the prosthesis. One copy of the preoperative mold should be kept at all times, and further copies should be made from the original mold.

In addition to assessment and fabrication of obturators for the maxillectomy patient, the prosthodontist can also make suggestions to the surgeon for resections that will make the stability and comfort of the prosthesis better. Of course, total eradication of disease is the primary concern in any patient with cancer. There are, however, several strategies to resection of oral cancers that would add no increase in the chance of recurrence of disease and decrease post-operative morbidity. As with any resection, duration of rehabilitation decreases with the size of the defect. Preservation of any portion of the alveolus or additional non-involved teeth will improve the post-surgical results dramatically. Because retention of alveolus beyond the midline helps to triangulate the defect, weight is distributed to 3 points on the prosthesis instead of two, allowing more stability and less movement of the prosthesis, especially during mastication. Placing the line of resection through the socket of an extracted tooth rather than attempting to cut between roots of adjacent teeth should also be attempted. Cuts between tooth sockets will result

in loss of support for adjacent teeth and lead to loss of uninvolved teeth. In the case where a hemimaxillectomy will be necessary for removal of disease, the incision should bend to exclude the central and lateral incisor. In addition, the medial aspect of the cavity where bone cuts are exposed should be covered with a mucoperiosteal flap. This will help with post-operative healing and shorten the time that is required prior to prosthesis placement. Consideration should be given to remove the coronoid process if it interferes with the obturator on its posterolateral aspect.

In the classic maxillectomy, the cheek is elevated away from the maxillary bones, and the pterygoid muscles and bones are resected. This leaves a denuded surface on the entire cheek flap. If left to heal by secondary intention, the healing time will extend many weeks, and the area will be covered with respiratory epithelium from the nasal cavity and nasopharynx. This epithelium is problematic in two ways 1) the tissue is easily abraded by future prosthesis, 2) this type of epithelium is secretory adding secretions that the patient must clean or have cleaned. If at the time of surgery, a split thickness skin graft is applied to the denuded area, the cavity can be prosthesis bearing in 2 weeks. In addition, the epithelium is less fragile, and does not secrete mucus. Also, because of different healing rates of buccal mucosa and the skin graft, a scar band will form at the junction of the two which can be used to help with retention of the prosthetic. Often, the hard palate will be involved with minimal involvement of the maxillary sinus. At these times, the maxillary sinus mucosa should be stripped, and split-thickness skin grafts should be applied to the sinus. This will prevent the formation of polypoid tissue and mucus and allows the walls to become load bearing areas for prosthetic retention.

-Obturators

Obturators can be divided into three classes: surgical, post-surgical, and definitive. Surgical obturators are those that are placed at the time of surgery. Although there has been some disagreement about the value of surgical obturators, they do offer distinct advantages for the surgeon and the patient. When placed during the operation, they offer an anatomically accurate, clean and stable scaffolding for placement of surgical dressing that will help with retention of the dressing and post-operative comfort. This can also help with retention of skin grafts placed during the surgery. Patients are able to talk immediately post-operatively, and the use of nasogastric tube feedings may be precluded with a barrier between the oral and nasal cavities. Lastly, the patient will be less aware of the defect post-operatively, which helps some patients with the psychological aspects of loss in the immediate post-operative period where the incidence of depression is high.

Design of the surgical obturator is a challenge, and involves communication between the surgeon and the prosthodontist. The preoperative plan should be discussed, and actual anticipated defects should be diagrammed on the preoperative molding. Areas that will definitively be resected should be outlined, as well as areas that may be involved. The type of retention method that the surgeon prefers should be communicated prior to surgery. Clasps around teeth should be avoided as they are often insufficient for load bearing and will add difficulty to intraoperative fitting when the prosthodontist may be unavailable. Methods for retention include circumzygomatic wiring, interdental wiring, suturing, or palatal screwing. In those cases where the extent of resection is in doubt, two options of preoperative prosthetic design are available. Prostheses can be fabricated according to the most conservative line of

resection. This will allow the obturator to be used for larger resections if the surgeon is willing to fill in additional defects with packing. The main advantage to this approach is the elimination of intraoperative adjustments by the surgeon. The other option is to fabricate the prosthesis for the most radical resection so that it will fit best in the worst case scenario. This will preclude the use of packing to fill in defects not covered by the prosthesis, but will also require modification prior to placement if a more conservative approach is taken.

Post-surgical obturators are those prosthetics which are placed immediately after packing removal, used until tissue contracture is minimal, and prior to definitive obturator placement. They are designed with the use of a preoperative cast that is modified to account for resected areas. Time between packing removal and obturator placement should be minimal, as tissue contraction and edema will quickly alter the shape of the defect, making it difficult to insert an obturator. For this reason, it is important to have a postsurgical obturator made prior to removal of packing. It is also important that the prosthodontist be present with the surgeon when packing is removed so the prosthetic can be inserted immediately after inspection of the surgical sight by the surgeon.

The postsurgical obturator differs from the surgical obturator in several ways. Opposed to the flat surface of the surgical obturator, mainly used for support of surgical packing, the postsurgical obturator has a surface that fits the maxillary extent of the defect allowing for more stability and less rotation during mastication and verbalization. It is important that the prosthetic have maximal tooth contact with the remaining teeth. This allows for support and stability of the prosthetic and dissipation of forces generated by the prosthesis. As with the surgical obturator, the addition of teeth should be limited to the aesthetic demands of the patient. Proper occlusive relationships of teeth are nearly impossible in the immediate postoperative period and will likely result in movement of the obturator into and out of the defect with resultant irritation and abrasion of the tissues contacting the obturator. To help prevent this irritation, the maxillary surface of the obturator is fitted with tissue conditioning or soft reline material that is replaced with a more rigid bulb when tissue healing is complete.

It is important to remember that unlike conventional dentures, the patient will not remove the obturator at nights. The obturator remains in place except for brief periods while cleaning the defect and the prosthesis. If the obturator is removed for extended periods of time, the patient may have difficulty reinserting the prosthesis. Patients are instructed to use a soft toothbrush and hand soap to clean the prosthesis. Effervescent types of denture cleansers should be avoided as they will cause blistering of the soft lining materials of the postsurgical prosthesis. In addition, the patient should visit with the prosthodontists monthly for evaluation of the fitting of the prosthesis and cleaning of the maxillary sinus.

The definitive obturator is designed when the surgical sight is stable, approximately 3-12 months after definitive surgery. Casting of the defect must be precise, and the prosthodontist must design a prosthetic that allows maximal distribution of forces to all available teeth, remaining hard palate, walls of the defect, and areas of remaining alveolus. In addition, occlusive relationships must be obtained so that the prosthesis can be cosmetic as well as functional. This is often an ongoing process, and modifications over the next year are often performed if the prosthesis becomes intolerable to the patient. The surgeon must be aware of warning signs that the obturator is no longer functioning, such as liquid reflux into the nasal

cavity, change in the quality or nasality of the voice, or TMJ. When encountering these warning signs, prompt referral back to the prosthodontist is warranted.

Management of the Edentulous Maxillectomy patient.

Often, the patient needing a maxillary resection will have poor or no dentition. These patients are particular challenges for the maxillofacial team due to the difficulty of postoperative rehabilitation. Retention of obturators provides a challenge to the prosthodontists because of the lack of support that adjacent teeth provide for stabilization. In addition, the often thin bone of the edentulous patient demands that stress be distributed to all available portions of the palate. Therefore, stress fractures are common, if not the rule, with ill-fitting obturators. Of the resection techniques described for the edentulous patient, four deserve particular attention.

Maintain as much hard palate as possible. Since the edentulous patient must rely on remnant of the hard palate for primary retention, support, and stability, the surgeon should be encouraged to resect only enough hard palate to allow adequate tumor margins. Especially important is ipsilateral palate preservation, which will allow a tripod effect, as described above. If the anterior alveolus can be maintained, the patient will have better facial and less contracture postoperatively.

Skin graft the cheek flap. As the edentulous patient requires maximal distribution of forces, the cheek will be an area of contact with the obturator. The thick squamous epithelium of a split-thickness skin graft will resist the wear and tear applied by the obturator.

Remove the inferior turbinate. By removing the inferior turbinate, the prosthesis can be contoured to fit into the nasal cavity. This vertical height will resist the rotational forces applied during mastication. In addition, by adding the nasal cavity, a larger surface of bone will be utilized to distribute force during mastication.

Skin graft the maxillary sinus walls. Again, as the importance of the obturator bulb is stressed in the edentulous patient, more force will be applied to the contacting walls. With this added stress, squamous epithelium is necessary to resist non-healing areas of maxilla.

Special Considerations in the Irradiated Patient.

Many patients will receive extended courses of radiation in the treatment of maxillary sinus tumors. The head and neck surgeon in many institutions is the primary care physician for patients with maxillary sinus cancers, and as such must make referrals to appropriate specialists. In addition, he or she must be familiar with the side-effects of each modality, and offer preventative care when appropriate.

The head and neck patient is frequently elderly, has poor dental hygiene, and has limited experience with dentist. It is also well documented that patients receiving radiation have a diminished ability to heal even mild trauma that causes a loss of mucosal integrity and subsequent exposure of devitalized bone. As such, patients who have received radiation heal poorly after tooth extraction. Those surgical sites are predisposed to the feared complication of osteoradionecrosis (ORN). The question of when and how to extract teeth in a patient expected

to receive radiation therapy is highly debated. Many surgeons advocate extraction of all teeth at the time of surgery in the patient scheduled for postoperative radiation, with the rationale being adequate time for healing in the postoperative course will decrease the incidence of ORN. This practice has hindered the ability of the maxillofacial surgeon to properly fit patients with stable obturators that are satisfactory to the patient. Many studies have showed that removal of maxillary teeth in the patient who has received radiation therapy is safe and effective. Literature shows the incidence of ORN can be as high as 30% or as low as 1 % when the surgical plan includes precise techniques and the use of antibiotics. The decision to extract teeth must be balanced against several factors including preoperative dental health, availability of a dentist experienced in the care of the irradiated patient, reliability and motivation of the patient, and expected field of radiation. Certainly this is a difficult decision that must be individualized.

Several complications of radiation therapy are common to the dentist and the head and neck surgeon, and both specialties are able to assist in treatment and prevention of complications associated with, and common in therapy. These complications include:

1) **Mucositis** – this is one of the earliest effects. Side effects of erythema, tenderness, and desquamation are seen as early as 2 weeks postoperatively. A history of smoking and alcohol use are risk factors for the condition. As therapy continues and mucositis worsens, the patient's nutritional status may be compromised due to decreased oral intake. In many cases, this necessitates the placement of a gastrostomy tube for hydration and nutrition. Good oral hygiene has been shown to be beneficial, and patients should be encouraged to use a soft brush and mild tasting toothpaste. Oral rinses with salt and sodium bicarbonate in water or dilute hydrogen peroxide can be tried on a daily basis. Benadryl elixirs, sucralfate solutions, and topical aesthetics have beneficial effects.

2) **Xerostomia** – It is well known that xerostomia is a common side effect of radiation therapy. Salivary flow rates as low as 1% are common after a full 6 weeks of radiation therapy. This decrease in saliva contributes to a continuous risk of dental caries that has led many surgeons to result to total tooth extraction prior to radiation. Several strategies have been designed to prevent dental decay. Use of artificial saliva has been shown to help with patient symptoms and slow the process. In addition, topical application of sodium fluoride is effective in preventing caries. Use of a custom tray facilitates patient compliance. Early in the treatment process the patient should be informed that xerostomia is generally a permanent side effect, and use of fluoride will be required daily for life.

3) **Trismus** – Radiation of maxillary and hard palate tumors often includes the TMJ and muscles of mastication in the field. This results in stiffness of the joint and muscles and decreases the patient's ability to open his or her mouth. Several prosthetics varying in expense and complication have been designed to aid in prevention of fibrosis of the muscles. All appear to have equal efficacy if applied regularly. The least expensive is the use of tongue blades, stacked one on another. Additional tongue blades are added after 3-4 minutes of stretching until maximal opening of the mouth is achieved. This must be done several times a day for several years to prevent permanent trismus. Poor patient compliance leads to failure of this regimen, and leads to fibrosis of the masticatory muscles which is not amendable to stretching.

Conclusion

Treatment of the patient with cancers of the maxillary sinus and hard palate is complex and requires a multidisciplinary team approach. For maximal patient satisfaction and rehabilitation, the maxillofacial prosthodontist must have an active role in the pre and postoperative coordination of patient care. Assistance from this specialty can help with patient satisfaction, success of surgical procedure, prevention of postoperative complications, and improved aesthetic and function results. As treatment coordinator, the Head and Neck Surgeon must be aware of the assistance that the maxillofacial surgeon can offer in the treatment of this difficult and often devastating disease.

References:

Clinical Maxillofacial prosthetics, Thomas D. Taylor, DDS, MSD, 2000, Quintessence Publishing Co., Illinois, USA

Maxillofacial Prosthetic Rehabilitation Combined with Plastic and Reconstructive Surgery, Compendium of Continuing Education in Dentistry, King et al, 1993 Nov

Prosthetic Management and Rehabilitation of an Extensive Intraoral and Facial Defect, The International journal of prosthodontics, Yazdanie, Manderson, 1989 Nov-Dec

Maxillofacial Prosthetics, Current opinion in dentistry, Grisius, 1991 Apr

Use of Implants for Prosthetic Rehabilitation after Cancer Treatment: Clinical Experiences, Journal of investigative surgery, Visch et al, 1994 Jul-Aug

Maxillofacial Prosthetics: Rehavilitation of Head and Neck Cancer Patients, Quintessence Of Dental Technology, Thomas Vergo, Regis Andrews, May 1984

Maxillofacial Prosthetics and the Head and Neck Cancer Patient, Cancer, Norman Schaaf, 1984, Volume 54

Surgical Techniques to Enhance Prosthetic Rehabilitation –Oral and Dental Oncologic Principles, Michael E. Decherd, Pou, Dr. Quinn's Online textbook, Dec 1999

Maxillofacial Prosthetics, Volume 4, William R. Laney, DMD, MS, 1979, PSB publishing Company