# ORAL CANCER BACKGROUND PAPERS

## Chapter VIII: Functional Rehabilitation

Working Draft

# Introduction

The cosmetic, functional, and psychosocial results of oral cancer treatment may combine to produce devastating effects on patients, especially if the tumor is extensive or the treatment particularly aggressive. Indeed, oral cancer is noted for the toll it exacts from patients, from both the disease itself and the effects of its treatment. A variety of functions can be affected, including speech, deglutition, management of oral secretions, and mastication. Thus, maxillofacial prosthetic rehabilitation is a cornerstone of efforts to restore the head and neck cancer patient's oral functions and cosmesis following surgery to pre-treatment baselines.

Each year a proportion of new head and neck cancer patients will require maxillofacial prosthetic intervention. Most of these patients will be rehabilitated at major teaching institutions or designated cancer centers that include a multidisciplinary team. Perhaps half of new patients will be treated with definitive radiation without surgical intervention, but these patients also will require dental intervention (see Chapter VII) and follow-up throughout their lifetime. Thus, multidisciplinary teams are essential for head and neck cancer patients, especially as their treatment may result in loss of oral functions and cosmetic deformities.

With recent changes in the modalities of cancer treatment and reconstruction (e.g., the introduction of brachytherapy and microvascular free flap transfers), rehabilitation of the oral tissues takes on a new dimension. Conventional maxillofacial prosthetic rehabilitation usually will not be enough to restore the resultant hard or soft tissue defects. Thus, a multidisciplinary surgical team that includes dentists will increasingly be instrumental in the reconstruction of head and neck patients. The ultimate goal of rehabilitation, however, will remain the restoration of oral functions and cosmesis with the aim of providing an acceptable quality of life.

Successful rehabilitation and quality of life go hand in hand. Because patients vary in attitudes and adaptation, it is very difficult to predict the patient's eventual quality of life prior to initiating treatment for an oral tumor. Furthermore, the use of newer techniques at surgical reconstruction makes the maxillofacial prosthodontist's task even more challenging. It is important for the dental team to be experienced and to identify for the medical and surgical oncologists realistic goals and objectives for rehabilitation. At major cancer centers with rehabilitative teaching programs, it is not uncommon for the surgically resected head and neck patient to require 20-25 appointments for appropriate rehabilitative care in a 1-year period.

With multidisciplinary cancer therapy (ablative surgery, reconstructive surgery, radiation therapy, and/or chemotherapy) available, rehabilitative dentistry is essential for improving quality of life. Treatment plans for rehabilitative dentistry should be included in the overall cancer treatment plan; in many instances, the sequelae of ablative head and neck surgery and radiation therapy could be alleviated, minimized, or even eliminated altogether if there were appropriate planning for

maxillofacial prosthetic and other dental interventions before treatment begins.

## A. State of the Science

The strategy and techniques of rehabilitation of a head and neck cancer patient are directly related to the location of the cancer and to the extent and type of surgical intervention and radiation modalities used. Oral carcinomas not detected and evaluated in their early clinical stages usually invade contiguous structures, thereby setting the stage for extensive surgical procedures that are generally followed by radiation therapy.

Removal of extensive segments of the tongue, floor of mouth, mandible, and hard and soft palate as well as the regional lymphatics usually mandates extensive rehabilitative management.[1,2] Generally, maxillofacial prosthodontists restore maxillary resections with obturator prostheses. However, in many instances a soft palate speech bulb-obturator retained in the maxillae (for restoration of velopharyngeal function) or a palatal augmentation prosthesis (if tongue function is lost) is required for optimal rehabilitation. Currently, rehabilitation of a maxillectomy and/or soft palate defect via an obturator prosthesis is most effective in restoring function. Recent advances in microsvascular free flap tissue transfers have been used successfully to reconstruct composite defects of the mandible, buccal mucosa, and tongue.[3]

Current rehabilitative practice is centered in five principles:[4,5]

1. The process of rehabilitation begins at time of initial diagnosis and treatment planning.
2. The dentition should be preserved if possible.
3. Rehabilitative treatment plans should be based on fundamental principles of prosthodontics, including a philosophy of preventive dentistry and conservative restorative dentistry.
4. Surgery before prosthetic rehabilitation may be indicated to improve the existing anatomic configuration after ablative cancer surgery, reconstructive surgery, and/or radiation therapy.
5. Multidisciplinary cancer care is required to achieve the best functional, physical, and psychologic outcomes.

The need to treat tumors expediently often delays planning for rehabilitation. However, without a highly interactive and dynamic dialogue among health care providers during the initial treatment planning process, efforts to provide optimal rehabilitative care are impaired. Other health professionals—including social workers, vocational rehabilitation counselors, nurses, nutritionists, occupational therapists, physical therapists, speech pathologists, and dental hygienists—are also vital members of the team.[5] Because a team of this breadth is not typically encountered in the community setting, comprehensive rehabilitation is best managed in a medical center venue.

Factors affecting the cancer surgical treatment plan for oral cancer patients include the following:[1]

- prognosis and systemic status of patient;
- potential size and site of defect;
- potential nature of functional and/or cosmetic defect;
- adjunctive therapy (e.g., chemotherapy or radiation) that may compromise the surgical result; and
- anticipated changes to function and cosmesis, based on the cancer surgery and the availability, accessibility, and cost of rehabilitative procedures.

Planning for patients who need rehabilitation of the maxillofacial complex includes consideration of surgical defects associated with the maxilla, mandible, tongue, soft palate, and facial region, including the patient with a combined orofacial abnormality. The role and impact of radiation and chemotherapy also need consideration (see Chapter VII).[4]

Specific abnormalities result directly from the extent and nature of cancer treatment as well as the patient's functional and psychological ability to respond to changes induced by therapy.[6] Thus, rehabilitation may be directed to hypernasality, mastication and deglutition dysfunction, control of oral secretions, compromised interarch relations, speech deficits (tongue disarticulation), salivary gland dysfunction, and/or cosmetics.

In recent years there have been significant advances in some of the strategies for rehabilitating the oral cancer patient. These include fundamental qualitative improvements in biomaterials (including osseointegrated implants), microvascular free flap tissue transfers, and hyperbaric oxygen technology (by which gas highly concentrated in oxygen is delivered under increased pressure to patients).

Still, long-term success depends in large measure on effective follow-up protocols. The traditional idea that a patient's original maxillofacial prosthesis will adequately support his or her lifelong needs is no longer valid.[7] The prosthesis needs ongoing evaluation, adjustment, and usually replacement over time. Most removable extraoral prostheses need to be remade every 2 to 3 years; removable intraoral maxillofacial prostheses require regular maintenance and generally need replacement every 5 to 7 years. In addition, the ongoing long-term sequelae of radiation therapy for head and neck cancer require the dentist to keep the periodontium in optimal condition. Furthermore, restorations of abutment teeth used to retain an intraoral maxillofacial prosthesis must be sound and noncarious, and implant prostheses in this population require extensive maintenance for optimal functional results.

The standard of care for patients receiving a palatal resection (maxillectomy, palatectomy and/or soft palate resection) includes three stages of maxillofacial prosthetic intervention:

1. Immediate placement of a surgical obturator prosthesis (inserted in the operating room, usually by the maxillofacial prosthodontist, at completion of surgery to separate the oral cavity from

nasal cavities created by cancer surgery).
2. Placement of a provisional or interim postsurgical obturator prosthesis (inserted after the surgical obturator and packing is removed 7 days postoperatively, worn in the postoperative healing period).
3. Placement of a definitive postsurgical obturator prosthesis.

Major technologic advances have occurred in recent years in osseointegration[8] (the process by which natural bone attaches to the metal or ceramic component of an implant), thereby facilitating the use of dental implants. Brånemark et al. have pioneered the modern-day use of this technology,[9] in which implant materials capable of bearing forces produced during normal function interface both structurally and functionally with bone. Dental implants are now being used in both oral and extraoral settings and have significantly improved the restoration of both form and function to the oral and craniofacial region. Potentially, implant-borne prostheses can be used in the majority of intraoral and extraoral defects. However, in patients with intraoral defects, the most useful implant sites usually are not within the radiation treatment volume. An emerging exception appears to be the case of fibula free flaps, where implants are used to restore segmentally resected mandibles prior to post-surgical radiation. For extraoral prostheses, bioadhesives have traditionally been used to enhance retention, but they have considerable limitations.[8,10] Indeed, patients and clinicians often become frustrated by the difficulty of achieving optimal effects with adhesives. Both experience and specialized education can improve the clinician's ability to provide these components of extraoral and intraoral rehabilitative care.

The characteristics of successful osseointegration include: (1) biocompatible implant materials; (2) non-traumatic, aseptic surgical procedures; (3) an initial healing period in which functional loading of forces is deferred; and (4) stress-reducing prosthodontic procedures.[8,11] Patients should be selected with great care, and proper maintenance and follow-up are imperative. Successful osseointegration can permit the restoration of masticatory function following mandibular fibula free flap microvascular transfers.[12,13] Osseointegration in the maxillary-resected patient[14] and implant-retained facial prostheses have become acceptable in major cancer centers worldwide.[15-21]

## B. Emerging Trends

Rehabilitative practices for oral and maxillofacial surgery patients have made important advances during the past several decades.[22] Relevant research on biomaterials has been transferred directly to the clinical setting;[23] these materials permit effective functional and cosmetic management of many patients with facial and intraoral defects who would otherwise experience lifelong disfigurement and dysfunction. In addition, important advances in imaging modalities, adhesives, implant materials, bone grafting, microvascular free flap tissue transfers, and hyperbaric oxygen have collectively

enhanced rehabilitation outcomes. Still, these new modalities require outcome assessments to measure their effects on patient rehabilitation.

Both the 1989 National Institutes of Health (NIH) consensus development conference on oral complications and its therapies[24] and the First International Congress on Maxillofacial Prosthetics (1994)[25] emphasized multidisciplinary cancer treatment, including specialists in maxillofacial prosthetics, oral medicine, and oral and maxillofacial surgery. Professionals and the public need to be educated about multidisciplinary cancer treatment, through additions to dental and medical curricula, postgraduate training, and continuing education programs; and educational programs delivered by public health agencies at local, state and national levels.

Future clinical and laboratory research on the use of osseointegrated implants and other prostheses in the presence of irradiated bone is expected to continue to refine the selection criteria for patients.[6] Although the concern about osteoradionecrosis as a theoretic risk in such settings is real, risk is minimal in the maxilla, even in segments receiving more than 6,000 cGy. Even in the mandible, the prime implant site (symphysis) is not usually included in the high-dose field; if it is included, the dose is generally limited in the setting of field size reductions or use of brachytherapy.

A history of high-dose radiation to oral bone does not per se eliminate prosthetic placement of osseoimplants at irradiated sites. Patients who have previously undergone head and neck irradiation still may be candidates for osseointegrated implants. The most likely limiting factors appear to be the ability to maintain viable appositional bone associated with the implant and the problem of the patient with a poor prognosis for tumor control. Selection of patients for osseointegrated systems must be based on careful consideration of their biologic and psychologic status. Because long-term, comprehensive monitoring of patient status is essential, the patient must commit to periodic comprehensive oral evaluations.

Both basic research and clinical experimentation with osseointegrated implants in irradiated bone must be priorities. In addition, planning for the future must include training adequate numbers of experienced professionals to meet the growing need for osseointegrated systems. It is important that educational training programs include the use of osseoimplants in irradiated bone to meet the evolving needs of the head and neck cancer patient.

## C. Opportunities and Barriers to Progress

Strategies for improving the rehabilitation of the oral cancer patient and reducing the volume of rehabilitative services needed include addressing risk behavior and detecting oral malignancies early. Opportunities exist to do the following:

- enhance primary cancer management by adding new radiation protocols, using combined-modality therapy, and reducing acute or chronic injury to normal, contiguous tissues (see Chapters VI and VII);

- continue to foster research related to the complete rehabilitation of the patient, including investigations on reconstructive techniques, timing of the rehabilitation process, implants, and prostheses;

- enhance professional education at the predoctoral and postdoctoral levels, so that the gold standard of multidisciplinary management becomes available to more patients; and

- establish graduate training programs that combine traditional specialties for more comprehensive rehabilitation of the head and neck cancer patient, e.g., maxillofacial prosthetics and clinical oral medicine.

Major barriers to capturing the opportunities described above are as follows:

- limited technology and standards of care to protect normal tissues while maximizing direct exposure of the tumor to cytoreductive interventions.

- increasing demands on health center faculty to model and deliver new educational programs that are both didactically and cost effective.

- limited national fiscal resources to extend reimbursement coverage for rehabilitative care; prevailing trends are to maintain or even reduce the scope of current reimbursement.

- limitations in the National Cancer Institute's Cancer Education Program and the American Cancer Society's Advanced Clinical Oncology Fellowship Awards.

- inadequate exposure to oncology principles in undergraduate dental and medical school curricula.

- limited funding for graduate dental education in major cancer institutes to train future members of the dental oncology team.

Several university-based cancer centers include dentists in rehabilitative services during the initial treatment planning phase, as cancer treatment is being rendered, and during an appropriate follow-up period. This strategy capitalizes on traditional dental graduate training programs that are hospital-based and usually permits restoration of head and neck cancer patients to near-normal form and function. In private practice, however, it is difficult to create such dental teams and the interaction they require. Thus, the gap between the level of care offered in institutional settings and that offered

in private offices continues to widen. Unfortunately, this gap threatens the long-term quality of life of many patients.

In specialized private practice settings, patients are frequently not informed that they need oral rehabilitation services independent of their primary oncology care. However, if patients are managed by a multidisciplinary cancer team, they can easily be directed to the rehabilitation services they require.

Effective management of the acute and chronic sequelae of oral cancer, including its biologic, psychologic, social, and economic components, should be centered in prevention rather than in crisis-oriented responses.[2,26,27] Unfortunately, except at selected health centers, comprehensive management is not routinely implemented for long-term patient care. Dental generalists can manage some oral sequelae to head and neck cancer treatment, but they should have specific education and experience in managing the survivor of head and neck cancer.

Many of the major health care programs currently reimburse only a fraction of the costs of these medically based rehabilitative services, regardless of the professional qualifications of the provider. Whether reimbursement for maxillofacial prosthetic rehabilitative services will be better in the future remains uncertain. Development of more analyses that address the cost of prevention of complications versus management of acute lesions, analogous to models proposed for oral management of patients with hematologic malignancies,[22,28] might be useful. In most instances, medically necessary dentistry (prophylaxis, endodontics, extractions, and restorations) for the head and neck cancer patient is essential to prevent long-term sequelae from radiation to oral hard and soft tissues. Patients also need their dentists to maintain or provide optimal conditions and support for the abutments required to retain a maxillofacial prosthesis. Finally, they require periodic oral examinations and other medically necessary dental treatment.

Osseointegration, which emerged in the 1970s and 1980s as an effective alternative for patients who otherwise would have relied upon adhesives or nonimplant retentive designs, is also affected by its low reimbursement and high cost. Thus, few patients with modest or low incomes can benefit from procedures that use osseointegration. However, many insurance carriers are beginning to recognize the value of osseointegrated implants for retaining and supporting maxillary obturators, as well as the benefits of mandibular dentures in patients who have had mandibular reconstruction with a graft or fibula free flap. Still, insurance approval rates are generally low at present and are uncertain in the future.

Considerations for the research agenda include the following:

- improved radiation delivery systems that protect an increased percentage of normal oral

hard and soft tissues (see Chapter VI);

- topical or systemic interventions to protect normal tissues or enhance healing of damaged tissues;

- improved technology for the placement of prostheses, including osseointegration in previously irradiated tissues;

- improved prevention and management of osteoradionecrosis, including enhanced hyperbaric oxygen therapy protocols or new, superior modalities that promote angiogenesis and neovascularization;

- health services research on the cost-effectiveness of current and emerging interventions; and

- oral function assessment designed to determine which strategies are most effective in rehabilitation and medically necessary dentistry.

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