

Preprosthetic Surgery

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Introduction

The evolutionary cycle has selected a masticatory system, which is functionally efficient using natural teeth and an omnivorous diet. This system would be designed in a totally different fashion if it were selected based on the model of the complete denture wearer.¹ Dentures are rigid pieces of acrylic resin which are shaped to fit the soft tissue covering of the jaws and be compatible with the functioning and ever changing oral environment. Dentures are subject to the physical laws which form the realities of this oral environment. No denture, regardless of how well it is constructed, can overcome the limitations of the foundation on which it is placed.² In day-to-day practice we encounter many patients for whom an ideal treatment from prosthodontics point of view is not possible without resorting to pre-conditioning of the oral tissues by means of surgical procedures. These procedures constitute the pre-prosthetic surgical preparation.³ A considerable number of complete denture patients endure continuous discomfort with their dentures and seek help from one prosthodontist after another. They in turn construct and reconstruct new dentures at considerable expense of time and money until finally the patient gives up and has recourse to cotton wool inserts or proprietary relining materials convinced by the advice that they are 'dental cripples' and beyond professional help.³ The more major pre-prosthetic operations are not easy to perform and require repetitive experience and surgical skill which is not easy to achieve doing the 'odd' case. It is also essential for the prosthodontist to understand the needs of the complete denture patients and also to understand the aims of surgery and its difficulties.³

Goals of Pre-prosthetic Surgery:

Goals of pre-prosthetic surgery is to modify the oral environment to render it free of disease and to make its form and possibly the function more compatible with the requirements of complete denture wearing.⁴

- Provide a broad and flat ridge form with vertical height (minimum 5 mm) provided by nearly parallel, non-undercut bony walls in maxilla and mandible.
- Provide a firm resilient mucosal covering with nicely shaped buccal and lingual sulci, which are uninterrupted by frenae, scars or redundant tissue folds.
- In the severely bony deficient mandible provide bone bulk for strength and protection for the neurovascular bundles in

bony dehiscenced mandibular canals.⁴

- To render proper jaw relationship in the antero-posterior, transverse and vertical dimensions.³
- Adequate form and tissue coverage for possible implant placement.

By fulfilling these goals as nearly as possible, the resultant stable, properly extended conventional prosthesis should allow wide distribution of functionally generated forces.⁴ This should reduce the incidence and rate of adverse bone and soft tissue changes and permit satisfactory function and aesthetics.

Objectives:

The objective of pre-prosthetic surgery is to create proper supporting structures for subsequent replacement of prosthetic appliance. Principles of patient evaluation and treatment planning.⁵ A thorough evaluation of patient is very important in determining whether that patient is a candidate for surgery and which procedure would be approximate treat the problem.

An experimental and extraoral examination has to be done properly include:

Assessment of existing tooth relationship if any tooth is remaining, Amount and contour of the remaining bone, Quality of soft tissue overlying the primary denture bearing area, Vestibular depth, Location of muscle attachment.

*Jaw relationship and presence of soft tissue or bony pathologic condition other consideration.

- a. Patient's age.
- b. Physical and mental health status.
- c. Financial constraint.

Condition of soft and hard tissues of the alveolar bone must be determined in the evaluation process.

Indications for Preprosthetic Treatment:

Preprosthetic surgery is indicated in those patients with developmental or acquired deformity of the jaws and craniofacial region who are unable to tolerate even a well-constructed prosthesis due to unfavorable soft tissue or hard tissue environment.⁶

Specific Indications for Pre-prosthetic Surgery Include:

1. Complete or partial edentulous secondary to early tooth loss.
2. Naturally occurring reduction of the residual bony ridge.
3. Pain (not remedial by conventional prosthetic measures) due to:
4. Dysfunction (not remediable by conventional prosthetic means) of:

Contraindications for Preprosthetic Treatment:

- Underlying systemic diseases, e.g. cardio-

vascular

- Insufficient quantity of bone.
- Inadequate quality of bone (sclerotic/osteoporotic).
- Unfavorable inter arch relations (vertical, horizontal, transverse).

Preoperati and Postoperative Considerations:

Anaesthesia

All procedures related to oral implantology, must include adequate airway protection, to prevent small components falling into the pharynx or beyond.⁷ The duration and difficulty of the procedure and patient and operator preference determine whether Local Anaesthesia, Sedation, Relative analgesia or General anaesthesia is employed for these cases. Many preprosthetic surgical techniques may be performed under local anesthesia with or without sedation on an outpatient day case basis for e.g. contouring of jaw bone, simple vestibuloplasty, localized augmentation with hydroxyapatite, and insertion of endosseous implants, including guided tissue regeneration techniques.⁸

Preoperative and Perioperative Medication

Drugs prescribed will vary according to local and individual policies and for specific patients, however, those in common use include⁸

- 1) Conventional sedative/ antiemetic premedication plus topical. Anesthetics cream at site of planned intravenous injection.
- 2) Non-steroidal anti-inflammatory drugs.
- 3) Steroids to reduce edema
- 4) Antibiotics.

Soft tissue procedures

Soft tissue abnormalities

Abnormalities of the soft tissue in the denture-bearing and peripheral tissue areas include⁹

1. Excessive fibrous or hypermobile tissue e.g. maxillary tuberosity, mandibular retromolar pad.
2. Inflammatory lesions such as inflammatory fibrous hyperplasia of the vestibule
3. Inflammatory papillary hyperplasia of the palate.
4. Abnormal muscular and frenal attachment, e.g. labial and buccal frenum, mylohyoid muscle attachment (floor of the mouth).

Evaluation of Supporting Soft Tissue:

Assessment of the quality of tissue of the primary denture-bearing area overlying the alveolar ridge is of utmost importance. The amount of keratinized tissue firmly attached to the underlying bone in the denture-bearing area should be distinguished, from poorly keratinized or freely movable tissue. Assessment of vestibular depth should include manual manipulation of the adjacent muscle attachments

The simplest form of alveoloplasty consists of the compression of the lateral walls of the extraction socket after simple tooth removal. However, when multiple irregularities exist, more extensive recontouring often is necessary. A conservative alveoloplasty in combination with multiple extractions is carried out after all of the teeth in the arch have been removed. The specific areas requiring alveolar recontouring are obvious if this sequence is followed.¹⁵

Lateral Palatal Exostosis

The lateral aspect of the palatal vault may be somewhat irregular because of the presence of lateral palatal exostosis. This presents problems in denture construction because of the undercut created by the exostoses and the narrowing of the palatal vault.¹⁶ Occasionally these exostoses are large enough that the mucosa covering the area becomes ulcerated.

Mylohyoid Ridge Reduction

One of the more common areas interfering with proper denture construction in the mandible is the mylohyoid ridge area. In addition to the actual bony ridge with its easily damaged thin covering of mucosa, the muscular attachment to this area often is responsible for dislodging the denture.¹⁷ When this ridge is extremely sharp, denture pressure may produce significant pain in this area. In cases of severe resorption the external oblique line and the mylohyoid ridge area may actually form the most prominent areas of the posterior mandible with the mid-portion of the mandibular ridge actually existing as a concave structure. In such cases augmentation of the posterior aspect of the mandible rather than removal of the mylohyoid ridge may be found beneficial.

Tori Removal

Maxillary Tori

Maxillary tori consist of bony exostosis formation in the area of the palate. The origin of maxillary tori is unclear. They are found in 20 % of the female population, approximately twice the prevalence in males. Tori may have multiple shapes and configurations, ranging from a single smooth elevation to a multiloculated pedunculated bony mass. Tori present few problems when the maxillary dentition is present and only occasionally interfere with speech or become ulcerated from frequent trauma to the palate.¹⁸ Even small tori necessitate removal when they are irregular, extremely undercut, or in the area where a posterior palatal seal would be expected.¹⁸

Mandibular Tori

Mandibular tori are bony protuberances on the lingual aspect of the mandible that usually occur in the premolar area. The origins of this bony exostosis are uncertain, and the lesions may slowly increase in size.¹⁹ Occasionally extremely large tori interfere with normal speech or tongue function during eating, but these tori rarely require removal when teeth are present. After the removal of lower teeth and before the construction of partial or complete dentures, it may be necessary to remove mandibular tori to facilitate denture construction.¹⁹

Augmentation Procedures

Augmentation of the bone is accomplished by building up the deficient jaw bone using autogenous bone, homogenous bone or alloplastic material, e.g. hydroxyapatite. The desired augmentation is achieved by inlay, onlay or interpositional grafting. Augmentation

may also be achieved utilizing the technique of guided tissue regeneration alone or in combination with a bone graft or alloplastic material to correct small bony defects which would otherwise contra-indicate placement of endosseous implants.²⁰

Donor Sites

Autogenous grafts are often used due to their osteoconductive and osteoinductive capacities. They can be harvested from different sites in the body e.g. the iliac crest, the calvaria, the ribs, the mandible. The most appropriate procedure to use depends on the amount of bone needed and surgical preference. The extra oral approach will also produce a permanent cutaneous scar and usually involves general anesthesia with days of hospitalization. Harvesting of bone from intra oral sites such as mandibular ramus/body or symphysis shows acceptable donor site morbidity.²¹ Moreover, the procedure can be made in local anaesthesia and no hospitalization is needed.

Inlay Bone Grafts

Boyne et al described a procedure where by particulated cancellous bone and bone marrow harvested from the iliac crest, was grafted to the floor of the maxillary sinuses below the mucous membrane through a fenestration of the lateral maxillary sinus wall. It has been suggested that a delayed approach, where the bone graft is allowed to heal prior to implant placement, ought to result in higher implant survival.²¹

Onlay Bone Grafts

This procedure is widely used to treat resorbed bony ridges of the upper or lower jaw. This is usually necessary prior to implant placement in order to ensure proper positioning of the implant and esthetics of the future prosthesis. This allows us to place the implants in the right spot to satisfy our pre-established functional and esthetic parameters.²² The procedure involves the sectioning of bony segment from an area of abundant bone to an area of deficient bone. Sections of bone are taken and implants which are to be placed are attached to the bony sections. Then this is transferred to the recipient area and the implants are screwed in place.²²

Vascularized Bone Grafts

Vascularized bone flap methods are mostly used in management and reconstruction of oral malignancies and have resulted in improvements of the treatment results. Surgical ablation of oral tissues, radiotherapy and microvascular tissue reconstruction often precedes the oral rehabilitation.²³ Occlusal rehabilitation often includes fixed or removal prostheses supported by dental implants.

Allogenic and Xenogenic Bone Grafts

Allograft is by definition a bone graft containing living cells, derived from an individual of the same species. They are hardly recommended because they initiate a cell mediated immune response: an allograft may only survive if the donor is a parent or a sibling.²³ A substitute to an allograft is an alloimplant which is bone tissue derived of an individual of the same species and which contains no viable cells. Xenografts are defined as bone derived from living tissue from another species; whereas xeno-implants are bone grafts where all living cells and proteins has been extracted. Consequently a xeno-implant can only be osteoconductive and is replaced by new bone very slowly or to a small extent only. The

combination of autologous cancellous bone marrow and AAA bone is called a composite bone graft. The use of these grafts is often mandatory in small children with insufficient iliac crest and tibia bone. Their success depends on absolute, uninterrupted internal fixation.²³

Mandibular Augmentation Procedures:

Superior Border Augmentation

Superior border augmentation with a bone graft is occasionally indicated when severe resorption of the mandible results in inadequate height and contour and potential risk of fracture.¹³

Indications

- a. When severe resorption of the mandible results in inadequate height and contour and potential risk of fracture.
- b. Neurosensory disturbances from the location of the mental foramen at the superior aspect of the mandible.

Inferior Border Augmentation

Indications for the use of this technique in addition to atrophy of the alveolar ridge include the prevention and management of fractures of the atrophic mandible. However this technique does not address abnormalities of the denture bearing area such as increased interarch distance, superior border irregularities or exposed position of the mental nerve.²³

Pedicle or Interpositional Grafts

A pedicle graft is designed to minimize resorption after healing by maintaining a vascular supply to the augmented bony area through an attached soft tissue pedicle. The visor osteotomy uses a pedicle of suprahyoid and genioglossus muscles on the lingual aspect of the mandible which is repositioned on the superior portion of the anterior aspect of the mandible, effectively improving mandibular height and contour.

Hydroxyapatite Augmentation of the Mandible

Hydroxyapatite (HA) is a dense, nonporous, ceramic material, which, when placed adjacent to bone, functions as an inert biocompatible implant. HA is currently available in many forms including granules of varying sizes (18 to 60 mesh), solid block forms, and solid root form implants. Although some bony growth may occur adjacent to the particles at the area of the interface, the remainder of the particles not directly adjacent to the bone are primarily surrounded by fibrous tissue.²⁴ Histologically, each particles appears to be surrounded in a fibrous tissue capsule with some infiltration of vascular tissue throughout the graft material

Maxillary Augmentation

Onlay Bone Grafting

Maxillary onlay bone grafting is indicated primarily when there is severe resorption of the maxillary alveolus that results in the absence of clinical alveolar ridge an loss of adequate palatal vault.

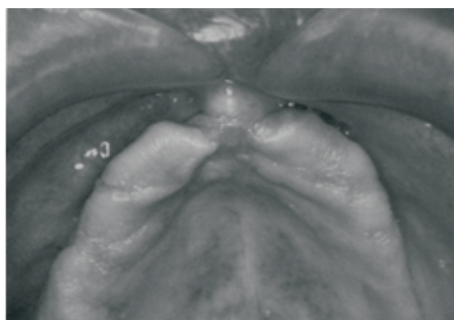
Sinus Lift Procedure

Rehabilitation of the maxilla using implants is frequently problematic due to the extension of the maxillary sinus into the alveolar ridge area. Extension of the maxillary sinus into the alveolar ridge may prevent placement of the implant in the posterior maxillary area due to insufficient bony support. A sinus lift procedure is actually a bony augmentation procedure that places graft materials inside the sinus and augments the bony support in the alveolar ridge

. The lingual aspect of the mandible should be inspected with a mouth mirror in the lingual vestibular area to determine the level of attachment of the mylohyoid muscle in relation to the crest of the mandibular ridge and the attachment of the genioglossus muscle in the anterior mandible.¹⁰

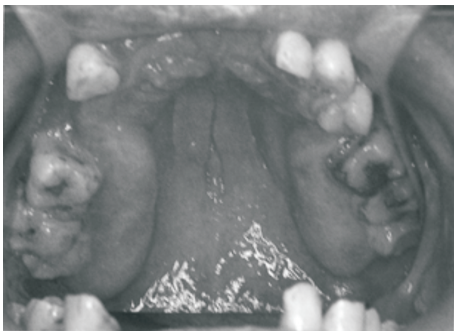
Unsupported Hypermobile Tissue:

Excessive hypermobile tissue without inflammation on the alveolar ridge is generally the result of resorption of the underlying bone, ill-fitting dentures, or both. Before the excision of this tissue, a determination must be made of whether the underlying bone should be augmented with a graft.¹¹If a bony deficiency is the primary cause of soft tissue excess, then augmentation of the underlying bone is the treatment of choice. If adequate alveolar height remains after reduction of the hypermobile soft tissue, then excision may be indicated.⁴



Maxillary Tuberosity Reduction (Soft Tissue)

The primary objective of soft tissue maxillary tuberosity reduction is to provide adequate interarch space for proper denture construction in the posterior area and a firm mucosal base of consistent thickness over the alveolar ridge denturebearing area. Maxillary tuberosity reduction may require the removal of soft tissue and bone to achieve the desired result.¹²If a radiograph is not of the quality necessary to determine soft tissue thickness, this depth can be measured with a sharp probe after local anesthesia is obtained at the time of surgery.¹



²Inflammatory Fibrous Hyperplasia:

Inflammatory fibrous hyperplasia, also called epulisfissuratum or denture fibrosis, is a generalized hyperplastic enlargement of mucosa and fibrous tissue in the alveolar ridge

and vestibular area, which most often results from ill-fitting dentures.¹³ In the early stages of fibrous hyperplasia when fibrosis is minimal, non-surgical treatment with a denture in combination with a soft liner is frequently sufficient for reduction or elimination of this tissue. When the condition has been present for some time, significant fibrosis exists within the hyperplastic tissue. This will not respond to nonsurgical treatment excision of the hyperplastic tissue is the treatment of choice. Three techniques can be used for successful treatment of inflammatory fibrous hyperplasia.

Inflammatory Papillary Hyperplasia of the Palate:

Inflammatory papillary hyperplastic tissue formation in the palate is frequently a result of mechanical irritation and is seen most often in patients who wear prosthetic appliances. Other potential contributing factors to this process include poor hygiene, fungal infection and the associated inflammation.¹¹This condition usually appears as multiple nodular projections in the palatal tissue. Although it was once thought to represent a precancerous condition, this has not been substantiated. Since the process appears to be primarily inflammatory rather than neoplastic, total full-thickness incision is not necessary. In fact in the very early stages, nonsurgical treatment, such as proper denture adjustment combined with a tissue conditioner, may eliminate or reduce this problem. If removal is required, a mucosal excision superficial to the periosteum is recommended and can generally be performed with local anesthetic infiltration in the palatal area. Regardless of the technique used for removal of this tissue, a specimen should be obtained and submitted for histopathology examination.¹¹ However, palatal form and access to the area of excision may limit the use of this scalpel technique in certain situations. Techniques to abrade the superficial layer of palatal mucosa are also effective for treatment.

Labial Frenectomy:

Labial frenal attachments consist of thin bands of fibrous tissue covered with mucosa extending from the lip and cheek to the alveolar periosteum.¹³

Three surgical techniques are effective in the removal of frenal attachments

1. Simple excision
2. Z-plasty
3. Localized vestibuloplasty with secondary epithelialization (preferred when the frenal attachment has wide base).

Soft Tissue Surgery for Ridge Extension Procedurefor Mandible

Transpositional Flap Vestibuloplasty(LIP SWITCH)

A lingual based flap vestibuloplasty was first described by Kajanjian. In this procedure a mucosal flap pedicle from the alveolar ridge is elevated from the underlying tissue and sutured to the depth of the vestibule.¹⁴The inner portion of the lip is allowed to heal by secondary epithelialization.

Vestibule and Floor of the Mouth Extension Procedures:

A procedure of detaching the mylohyoid ridge area and repositioning them inferiorly, effectively deepening the floor of the mouth area and relieving the influence of the mylohyoid muscle on the denture is described by Trauner.¹⁵ Macintosh and Obwegeser later described the effective use of a labial extension procedure to provide maximal vestibular extension to the both buccal and lingual aspects of the mandible.

Relocation of the Mental Nerve

In cases of severe atrophy of the alveolar bone and superior aspect of underlying basal bone, the mental neurovascular bundle may occupy a position at the superior aspect of the mandible resulting in pain as a result of trauma from the denture on the superior portion of the remaining alveolar ridge.

Soft Tissue Surgery for Ridge Extension: Procedurefor Maxilla

Submucosalvestibuloplasty

Procedure of choice for correction of soft tissue attachment on or near the crest of the alveolar ridge of the maxilla, particularly useful when maxillary alveolar ridge resorption has occurred but the residual bony maxilla is adequate for proper denture support.Underlying mucosal tissue is either excised or repositioned, allowing for direct apposition of the labial vestibular mucosa to the periosteum of the remaining maxilla.¹⁶To provide adequate vestibular depth without producing an abnormal appearance of the upper lip, adequate mucosal length must be available in this area. A simple test to determine whether adequate labial vestibular mucosa is present is performed by placing a dental mouth mirror under the lip, elevating the superior aspect of the vestibule to the desired postoperative depth – If no inversion or shortening of the lip occurs, then adequate mucosa is present to perform a proper submucosal vestibuloplasty

Hard Tissue Procedures

Hard Tissue Abnormalities

This includes:

- Irregular alveolar ridges e.g. crestal bone in relation to dentulous or edentulous conditions.
- Palatal exostosis
- Mylohyoid ridge reduction
- Tori removal
- Augmentation procedures
- Sinus lift.

Various Hard Tissue Procedures

Bony Vrecontouring of the Alveolar Ridges

Irregularities of the alveolar bone found either at the time of tooth extraction or after a period of initial healing requires recontouring before final prosthetic construction. The objectives of this recontouring should be to provide the best possible tissue contour for prosthesis support, while maintaining as much bone and soft tissue as possible.

Simple Alveoloplasty Associated with Removal of Multiple Teeth

area.²⁴ In this technique an opening is made in the lateral aspect of the maxillary wall and the sinus lining is carefully elevated from the bony floor of the sinus. Alloplastic material, allogenic bone, autogenous bone or a combination of these materials can be used as a graft source in these areas.²⁴

Implants for Complete Denture Patients

There are various types of dental implants, which can be used in treating complete denture patients:

- Subperiosteal
- Endosseous
- Transosseous
- Submucosal Inserts

Nowadays endosseous implants are widely used both for intraoral and extraoral reconstruction.

Successful Use of Endosseous Implants Depends On:

- Favorable anatomical form and environment
- Biocompatibility
- Favorable long term biomechanical conditions
- Continuous patient co-operation and excellent oral hygiene

There must be adequate bone volume (height and width) to place implants safely without interfering with adjacent anatomical structures (neurovascular bundle, maxillary sinus, floor of nose, adjacent teeth. The position and axial inclination of the implant(s) should take into account local load distribution; it should enable the fabrication of a functional and aesthetic prosthesis and should not interfere with adjacent soft tissues. If these conditions do not prevail, adjunctive surgical procedures such as vestibuloplasty, bone augmentation and osteotomy should be undertaken.²⁵

Immediate Complete Dentures

The decision may be made to insert dentures at the time of tooth removal and bony recontouring. The insertion of a denture after extraction offers immediate psychological and esthetic benefits to patients, whereas alternatively they may be edentulous for some time. The immediate insertion of a denture after surgery also functions to splint the surgical site, which results in the reduction of postoperative bleeding and edema and improved tissue adaptation to the alveolar ridge.²⁶ Surgical treatment for immediate denture insertion can be accomplished in stages with extraction of the posterior dentition in the maxilla and the mandible done before anterior extraction. This allows for initial healing of the posterior areas and facilitates the denture construction.²⁶ Following the initial healing period of the posterior segments, new records are taken, and models are mounted on a semi-adjustable articulator. After replacement of the model teeth with prosthetic teeth, the cast of the alveolar ridge area is then carefully recontoured. Immediate denture surgery generally involves the most conservative technique possible in removal of the remaining teeth. An intraseptal alveoloplasty, preserving as much vertical height and cortical bone as possible, is generally indicated. After the bony recontouring and elimination of gross irregularities is completed, the tissue is approximated with digital pressure and the clear acrylic surgical guide constructed on the presurgical casts is inserted. Any areas of tissue blanching or gross irregularities are then reduced until the clear

surgical guide is adapted to the alveolar ridge in all areas. Incisions are closed with continuous or interrupted sutures.²⁷ The immediate denture with a soft liner is inserted and the occlusal relationships are checked and adjusted as needed. The patient is instructed to wear the denture continuously for 24 hours and to return the next day for a postoperative check.²⁷ Bupivacaine or another similar long-acting local anesthetic, when injected at the conclusion of the surgical procedure, greatly improves comfort in the first 24-hour postoperative period. At that time the denture is gently removed, and the underlying mucosa and alveolar ridge areas are inspected, for any areas of excessive pressure. The denture is cleaned and reinserted, and the patient is instructed to wear the denture for 5 to 7 days and to remove it only for oral saline rinses. Sutures are generally taken out 7 days postoperatively.

Indication of Favourable Outcome

- Patient satisfaction
- Improved function of oral prosthesis which restores - mastication, speech, deglutition and absence of gagging.
- Retained stable implants
- Retardation of jaw atrophy (resorption being retarded by early post extraction insertion of an implant)²⁸

Indication of Unfavourable Outcome

- Prolonged pain (new or increased)
- Prolonged swelling/hematoma/hemorrhage
- Displacement of implant into maxillary sinus/ floor of nose/floor of mouth/ bronchus.²⁸
- Implant misplaced and cannot form basis for restorative development of osteo-dionecrosis.
- Systemic medical surgical complication/ death during operation/ post-operative period.²⁸

Conclusion:

Several of the abnormal conditions existing in the edentulous patient can be corrected surgically, prior to construction of dentures, to enable the patient to function more successfully following prosthetic restoration. Correction of soft tissue abnormalities can substantially improve the patient's ability to function with dentures and solve many of the adjustment problems which confront the prosthodontist. It is often better to correct the soft tissue abnormality rather than to circumvent the problem with an inferior prosthetic restoration. The goal of preprosthetic surgery is to modify the oral environment to render it free of disease and to make its form and function more compatible with the requirements of complete denture wearing. The various procedures which are described for preprosthetic surgery may differ in each patient depending on the overall evaluation of the patient (i.e. systemic and oral conditions). Thus the final outcome may depend largely on an accurate diagnosis treatment plans and evaluation of patient in discussion with the oral surgeon. Failure to establish a good relationship between Prosthodontist the oral surgeon and the patient for the results expected may lead to poor prognosis.

To conclude, every prosthodontist must have awareness and a clear understanding for those surgical techniques that will provide an oral environment more conducive to denture wearing than the one nature provided. This is done with

the understanding that the success of a denture is based as much on the patient's psychology makeup and tolerance as it is on the anatomic form of the patient's oral cavity.

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