Preprosthetic Surgery: Review of Literature

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Following the loss of natural teeth after extraction, the bone begins to resorb. The results of this resorption are accelerated by wearing dentures and tend to affect the mandible more severely than the maxilla. Besides, general factors include the presence of nutritional abnormalities and systemic bone disease such as osteoporosis; endocrine dysfunction may affect bone metabolism. Preprosthetic surgical treatment must begin with a thorough history and physical examination of the patient. Sometimes, there are contraindications to surgery because the patient suffers from serious general disease. Specific attention should also be given to laboratory tests which could inform us as to a degree of bone resorption. Successful treatment with removable prosthesis is dependent on many factors. One component that can profoundly affect treatment success is the condition of the denture-bearing tissues. Every effort should be made to ensure that both the hard and soft tissues are developed in a form that will enhance the patient’s ability to wear a denture. It is the responsibility of the practitioner to carefully evaluate and identify the need for any alteration of the denture-bearing areas and to educate the patient as to the importance of accomplishing this vital procedure.

Keywords: Alveolar ridge, Alveoloplasty, Prosthesis, Ridge augmentation

INTRODUCTION

Preprosthetic surgery is defined as the surgical procedures designed to facilitate fabrication of prosthesis or to improve the prognosis of prostodontic care. Preprosthetic surgery involves operations aiming to eliminate certain lesions or abnormalities of the hard and soft tissues of the jaws so that the subsequent placement of the prosthetic appliances is successful. For many years, preprosthetic oral surgery consisted of the removal of teeth and the reduction of humps, bumps, and sharp edges. During the last 15 years, there has been renewed interest in preprosthetic surgery which has fostered the development of many new techniques.

Willard¹ (1853) credited with being the first American dentist to do the reduction of interdental gingival papillae and alveolar margins after dental extractions. This procedure permitted earlier construction of artificial dentures. In 1876, Beers² advocated “excisions of alveolus after extraction of teeth.” He also specifically described the cutting away of the bone if the alveolar process is unnaturally prominent. Preprosthetic surgery emerged from a ridge trimming service to a truly reconstructive surgery when Kazanjian³ reported on the prototype of labiobuccal vestibuloplasty procedures to provide an additional denture-bearing surface for increased denture stability. His technique was modified by Godwin⁴ (1947), Clark⁵ (1953), and Obwegeser⁶ (1963) using skin grafts. Most procedures were centered on soft tissue corrections that allowed prosthetic devices to fit more securely and function more comfortably.

OBJECTIVES

The objective of preprosthetic surgery is to create proper supporting structures for subsequent replacement of prosthetic appliance. Some of the characteristics of this ideal form which provide for maximum support and stability and minimum interference with function are:

Ridges that are broad and flat with a vertical height (minimum 5 mm) provided by nearly parallel, non-undercut, bony walls. A firm resilient mucosal covering with nicely shaped buccal and lingual sulci which are uninterrupted by frena, scars, or redundant tissue folds. An interarch distance of minimum 16-18mm, that allows room for the denture and its components, is required. In the severely bony deficient mandible, it is essential to provide bone bulk for strength and protection for the neurovascular bundles in bony dehisced mandibular canals. Ideally an arched palatal vault has to be provided. To deliver a post-tuberosity (hamular) notch that enhances the posterior border seal and resistance of the denture to anterior dislodging forces and freedom from neoplastic disease.

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

**DISCUSSION**

Preprosthetic surgery is essentially the surgical preparation of either a fully edentulous or partially edentulous mouth before construction of dentures. It has developed from simple dentoalveolar correction of irregularities, exostosis, and hyperplastic tissues, to various vestibular lowering procedures, to major surgery of onlay and inlay augmentation and then into an era of scientifically tested and successful implants. Depending on the problem involved surgery may vary, but the objectives of surgery are to eliminate disease, conserve oral structures wherever possible and to provide best residual tissue to withstand masticatory stresses, maintain function and retain esthetics for denture patient. Loss of teeth results in a gradual resorption of the alveolar ridge which poses a major problem for denture patient. The general pattern of this resorption has been described by Tallgren7 (1972). The denture-bearing area progressively reduces causing loss of retention and stability of the prostheses. The degree of resorption of alveolar bone in the mandible is four times as high as that in the maxilla. The other problems include bony undercuts, exostosis, palatal and lingual tori, lack of bone height and width, soft tissue deficiency and redundancies, and inappropriate soft tissue attachment. A thorough evaluation outlining the problems to be solved and a detailed treatment plan should be developed. Patient’s past medical history and current medical status must be reviewed with particular attention to allergies, drug idiosyncrasies, hemorrhagic tendencies or systemic disorders that would require hospitalization, complicate anesthetic procedures, increase surgical risk or possibly even contraindicate the contemplated surgical procedure. Clinical examination of hard and soft tissues, radiographic survey (panoramic and lateral cephalogram), and if indicated advanced imaging techniques such as computed tomography should be used to enumerate any pathologic lesion of hard and soft tissues which should be attended before actual treatment planning. One way to evaluate the status of supporting tissues is to compare the patient’s ridge of ideal shape and form that has adequate bone support, resilient mucoperiosteum, with no bony prominences, spicules and undercuts, and no pathologic lesions. Preservation of alveolar ridge and preparing the alveolar ridge for denture construction should be done.

Preprosthetic surgical procedures include basic procedures such as alveoloplasty, frenectomy, vestibuloplasty, reduction of tori and exostosis, reduction of hyperplastic mucosa, and sophisticated techniques such as augmentation of ridge through grafts, osteotomies and distraction osteogenesis, and implants.

**Alveoloplasty**

Shaping of alveolar process is alveoloplasty which is indicated after almost every tooth extraction, whether it is single or multiple. Willard,1 in 1853, reduced the alveolar margin after dental extraction. In 1876, Beers2 described alveolectomy where a large portion of alveolus is removed with forceps. Molt,8 in 1923, performed alveoloplasty retaining the interdental septum. Dean,9 in 1936, performed alveoloplasty by removing interseptal bone and collapsing buccal cortical plate. Obwegeser10 modified this technique in 1966, by fracturing both labial and palatal cortices to reduce premaxillary protrusion.

**Maxillary Tuberosity Reduction**

There can be vertical or lateral excess of the maxillary tuberosity. Vertical excess interferes with proper orientation of occlusal plane and teeth setting. The lateral excess limit the thickness of the buccal flange of denture between itself and the coronoid process and also cause problems in path of insertion. Examination of mounted diagnostic cast is mandatory to assess the amount of removal. Careful radiographic evaluation should be done to rule out any chance of sinus perforation. The reduction is initiated with an elliptical incision and reflection of mucoperiosteum to expose the tuberosity. Bone is removed with rongeurs or burs. Smooth the area with bone file and irrigate with copious amount of saline. The wound is closed primarily.

**Prominent Mylohyoid Ridge Reduction**

Resorption in ridge height of posterior mandible makes the mylohyoid ridge prominent and limits the extension of the denture in this area. This is a common area of painful denture irritation. At times, the toxicity of the mylohyoid ridge itself can cause problems with denture retention. Gillies11 (1956) states that the mylohyoid ridge should be reduced whenever the ridge is found to be at the same level as or a higher level than the alveolar process.

**Exostoses and Tori**

Buccal exostoses are usually encountered on the buccal side of the upper ridge. They interfere with proper adaptation of the flanges and border seal. They also impede with proper flange contouring and teeth setting. They are managed by surgical reduction. Torus palatinus or palatal torus is a benign, slowly growing, bony projection of the palatine processes of the maxillae and occasionally of the horizontal plates of the palatine bones. Their etiology is unknown. Heredity, superficial trauma, malocclusion, and functional response to mastication have been suggested as possible etiological factors. It is usually composed of
cortical bone. Some may also contain cancellous bone. The surgical removal of the palatine torus is indicated in case of traumatized overlying mucosa, torus completely filling the palatal vault and extending onto the soft palate beyond the post dam area or presence of deep bony undercuts or interference with speech and deglutition and psychological causes.

Torus mandibularis or mandibular torus is an exostosis that usually occurs bilaterally on the medial surface of the body and alveolar process of the mandible. They are generally located in the canine-premolar region but are also found as multiple bony nodules extending from the incisor to the molar region. The etiology of mandibular tori is unknown, but they are thought by some to be a functional reaction to masticatory stresses. Mandibular tori are composed of dense cortical bone with minimal amounts of a medullary core. The overlying mucoperiosteum is very thin, as it is on the entire medial surface of the mandible. Laceration or traumatic ulceration of the mucosa is not uncommon. Mandibular tori are removed (1) when they become so large that they cause speech impairment or difficulty in eating, (2) when the covering mucosa ulcerates as a result of trauma and fails to heal, and (3) to facilitate the construction of removable partial and complete dentures.

Reduction of Genial Tubercles
As the mandible begins to undergo resorption, the area of the attachment of the genioglossus muscle in the anterior portion of the mandible may become increasingly prominent. In some cases, the tubercle may actually function as a shelf against which the denture can be constructed, but it usually requires reduction to construct the prosthesis properly. Before a decision to remove this prominence is made, consideration should be given to possible augmentation of the anterior portion of the mandible rather than reduction of the genial tubercle. If augmentation is the preferred treatment, the tubercle should be left to add support to the graft in this area. Local anesthetic infiltration and bilateral lingual nerve blocks should provide adequate anesthesia.

SOFT TISSUE PROCEDURES

Hyper Mobile Ridge
Hypermobile ridge tissue results from resorption of the residual ridge under an ill-fitting denture with unbalanced occlusion. It is most commonly seen in anterior part of knife edge mandibular ridge. In anterior maxilla, this usually results from anterior hyper occlusion of maxillary complete denture opposing mandibular natural teeth or Class I removable partial denture. Although removal of such redundant crystal tissue is almost always necessary, any possibility of bony augmentation should be considered before excision. In every case, the attached tissue should be preserved. The management of such hypermobile tissue includes elimination of inflammation by giving a period of tissue rest, occlusal correction of complete denture by the new interocclusal record and remounting, good oral hygiene and denture hygiene, or by mucostatic impression technique to minimize irritation from dentures. It can also be managed by a surgical correction which includes simple trimming of the excessive tissue but not disturbing the attached tissue, electrosurgery, subperiosteal dissection. However, the mucoperiosteal reflection should be minimal to reduce post-operative bone resorption.

The vertical and lateral soft tissue excess at the maxillary tuberosity may interfere with proper orientation of occlusal plane, border seal of the post molar pocket area, and the path of insertion. In such cases, removal is accomplished by sharp dissection or electrosurgery. However, if the tissue is firm and does not interfere with thickness of denture flange, path of insertion and denture stability, removal is not indicated.

Frenectomy
High attached frena can cause loss of border seal that deprives the retention of the upper denture. The deep labial notch on the denture to accommodate such prominent frena will weaken the denture and increase the chance of midline fracture. The correction is achieved by diamond excision, Z-plasty, or V-Y-advancement technique. Prominent lingual frenum can cause various problems such as instability of lower denture. As a tongue function test, the patient should be able to touch the upper lip with the tip of the tongue without dislodging the lower denture. Otherwise, frenectomy is indicated. After frenectomy, the lower denture is inserted as a stent to prevent post-operative relapse. A prominent buccal frenum rarely interferes with denture function, as it is compressible and flaccid and not strong enough to dislodge the denture. Hence, they require surgical correction only rarely.

Epulis Fissuratum
Epulis fissuratum is the hyperplasia of sulcular epithelium due to chronic irritation from an ill-fitting denture or denture that has settled due to resorption. The hyperplasia is in the form of 2-folds one outer and another one inner and the sulcus in between may be ulcerated.

Papillary Hyperplasia
Papillary hyperplasia is the result of ill-fitting denture, low-grade infection with Candida or due to the presence of palatal relief chamber in the denture. These are seen as intensely red soft polypoid masses of multiple papillary projections. Most of the lesion will resolve itself with sufficient tissue rest, oral hygiene, and denture hygiene. Any residual lesions that fail to resolve require surgical removal. The various methods available are electrosautery,
sharp excision, cryosurgery, laser excision, laser ablations, and curettage with large rotary burs.

**Mental Nerve Repositioning**

In patients with gross atrophy of the mandibular alveolar process, the mental foramen may be found at or near the crest of the residual ridge. When this occurs, the mental nerve may be subjected to pressure from a denture flange. Patients with this condition often complain of a dull, burning sensation or a sudden sharp, severe pain of short duration is similar to the pain of trigeminal neuralgia. The pain may be initiated during mastication; it may also be produced by digital pressure on the mental foramen. Some patients complain of both pain and numbness in the lower lip. For many patients, these symptoms can be eliminated merely by relieving the denture to avoid pressure on the mental foramen. However, in some cases, relief of the denture flange alone is not sufficient to provide relief. In these instances, the mental foramina should be enlarged, and the neurovascular bundles surgically repositioned.

**Ridge Extension Procedures**

Vestibuloplasty is the surgical procedure designed to restore alveolar ridge heights by lowering muscle attachment on the buccal, labial, and lingual aspects of the residual ridges. Kazanjian,12 in 1935, described a method for deepening the vestibule in which a labial flap pedicled off the alveolar process was used to cover the newly exposed bone while the lip surface was permitted to reepithelialize. The major disadvantage of all these procedures is that scar contracture on the labial aspect results in loss of vestibular depth. To overcome this disadvantage Clark5 (1953) recommended a vestibuloplasty procedure in which the flap is pedicled off the lip, rather than the alveolar process. To limit the regression that occurs after Clark’s vestibuloplasty, Tortorelli13 (1968) recommended horizontal fenestration of the periosteum along the base of the newly created vestibule. Howe14 (1966) and Kethley and Gamble15 (1978) have described a modification of Kazanjian’s vestibuloplasty termed as “lip switch procedure,” in which a labial mucosal flap is developed and extended to the crest of the ridge from an initial lip incision. In 1959, Obwegeser16 described a technique for vestibuloplasty in the areas where enough bone and healthy mucosa exist but where muscle attachments are close to the crest of the alveolar ridge. This technique is termed as submucosal vestibuloplasty. When adequate mandibular height exists, this procedure increases the anterior vestibular area, which improves denture retention and stability. The primary indications for the procedure include adequate anterior mandibular height (at least 15 mm), inadequate facial vestibular depth from mucosal and muscular attachments in the anterior mandible, and the presence of an adequate vestibular depth on the lingual aspect of the mandible. These techniques provide adequate results in many cases and generally do not require hospitalization, donor-site surgery, or prolonged periods without a denture. Disadvantages include unpredictability of the amount of relapse of the vestibular depth, scarring in the depth of the vestibule, and problems with adaptation of the peripheral flange area of the denture to the depth of the vestibule.

In addition to the attachment of labial muscles and soft tissues to the denture-bearing area, the mylohyoid and genioglossus muscles in the floor of the mouth present similar problems on the lingual aspect of the mandible. Trauner17 described detaching the mylohyoid muscles from 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. The technique for extension of the labial vestibule is a modification of a labially pedicled supraperiosteal flap described by Clark.3 After the two vestibular extension techniques, a skin graft can be used to cover the area of denuded periosteum. The combination procedure effectively eliminates the dislodging forces of the mucosa and muscle attachments and provides a broad base of fixed keratinized tissue on the primary denture-bearing area. Split-thickness skin grafting with the buccal vestibuloplasty and floor-of-mouth procedure is indicated when adequate alveolar ridge for a denture-bearing area is lost, but at least 15 mm of mandibular bone height remains. The remaining bone must have adequate contour so that the form of the alveolar ridge exposed after the procedure is adequate for denture construction. If gross bony irregularities exist, such as large concavities in the superior aspect of the posterior mandible, they should be corrected through grafting or minor alveoloplasty procedures before the soft tissue procedure. The technique has the advantage of the early covering of the exposed periosteal bed, which improves patient comfort and allows earlier denture construction. In addition, the long-term results of vestibular extension are predictable.

Maxillary alveolar bone resorption frequently results in mucosal and muscle attachments that interfere with denture construction, stability, and retention. Because of the large denture-bearing area of the maxilla, adequate denture construction and stability can often be achieved after an extensive bone loss. However, the excess soft tissue may accompany bony resorption, or soft tissue may require modification as an adjunct to previous augmentation surgery. Several techniques provide additional fixed mucosa and vestibular depth in the maxillary denture-bearing area. The submucosal vestibuloplasty as described by Obwegeser18 may be the procedure of choice for correction of soft tissue attachment on or near the crest of the alveolar ridge of the maxilla. This technique is particularly useful when maxillary alveolar ridge resorption has occurred, but the residual bony maxilla is adequate for proper denture
support. In this technique, the underlying submucosal tissue is either excised or repositioned to allow direct apposition of the labiovestibular mucosa to the periosteum of the remaining maxilla. To provide adequate vestibular depth without producing an abnormal appearance of the upper lip, adequate mucosal length must be available in this area.

When insufficient labiovestibular mucosa exists and lip shortening would result from a submucosal vestibuloplasty technique, other vestibular extension techniques must be used. In such cases, a modification of Clark’s vestibuloplasty technique using mucosa pedicled from the upper lip and sutured at the depth of the maxillary vestibule after a supraperiosteal dissection can be used. The denuded periosteum over the alveolar ridge heals by secondary epithelialization. Moderate discomfort can occur in the post-operative period, and a longer healing time is required (6-8 weeks) before denture construction.

Ridge Augmentation

Augmentation involves on laying or inlaying a graft material onto or into the atrophic alveolar bone. The various techniques range from simple subperiosteal tunneling to extensive osteotomies which increase appreciably the postsurgical morbidity. To increase the residual alveolar ridge, several options such as bone grafts, allografts, and distraction osteogenesis have been proposed. The indication of each option varies according to site, amount of residual alveolar bone, cause of resorption and compliance of the patient. Autogenous bone grafts are widely considered the gold standard for severe ridge deformities. In case of severe atrophy, iliac crest and calvarial bone grafts can be used to harvest a significant amount of autogenous bone. Membranous bone is superior to endochondral grafts in maintaining volume and a higher tendency to resorption of the iliac onlay grafts compared with the calvaria is due to the different embryonic origin.

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 or when the treatment plan calls for placement of implants in areas of insufficient bone height or width. The use of autogenous corticocancellous blocks of iliac crest bone was described by Clementschisch,19 in 1948, for superior border augmentation. Currently, these blocks of bone are frequently secured to the mandible with small rigid fixation screws, minimizing graft mobility. Tissue-guided regeneration with the use of a membrane is often combined with the bony augmentation. In some cases, implants can be placed at the same time the bone graft augmentation is completed. Sanders and Cox20 reported the first clinical use of an inferior border technique for augmentation of the atrophic mandible. This technique is rarely, if ever, used on occasion the augmentation of mandibular bulk with inferior grafting is accomplished using iliac crest bone grafts, secured with rigid fixation. Indications for the use of this technique, in addition to atrophy of the alveolar ridge area, included the prevention and management of fractures of the atrophic mandible. However, this technique does not address abnormalities of the denture-bearing areas, such as the increased interarch distance, superior border irregularities, or exposed position of the mental nerve, which result from mandibular atrophy.

In visor osteotomy, the mandible is split buccolingually, and the lingual cortical plate is repositioned superiorly. Horizontal osteotomy with interpositional graft was designed to permit elevation of the superior aspect of the ridge to a predetermined height and grafting of the resulting defect. Corticocancellous iliac crest and cancellous marrow serve as sources for the graft. Corticocancellous blocks are formed to a predetermined size for augmentation and are inserted between the pediced bone and the mandible. Commonly, one block is used in the midline, two in the cuspid regions, and two in the molar regions. The void between the cortical struts and at the graft interface with the mandible is packed with corticocancellous chips and cancellous marrow. Baker and Connole21 (1977) have described a technique for the direct augmentation of the maxilla with a contoured rib. The interpositional bone graft is an osteotomy performed splitting the superior and inferior dimensions of the residual jaw and bone is grafted into the osteotomy. The techniques include Le Fort osteotomy in maxilla and horizontal sandwich technique for the anterior mandible. The procedure for interpositional augmentation of the atrophic maxilla was first reported by Farrell et al.,22 in 1976, Bell et al.23 (1977), and Bell and Buckles24 (1978). Le Fort I osteotomy is described by Bell and McBride25 (1977). Interpositional bone grafting in the maxilla is indicated in the bone-deficient maxilla, where the palatal vault is found to be adequately formed but ridge height is insufficient. Anteroposterior and transverse discrepancies between the maxilla and mandible can also be corrected by interpositional bone grafting techniques. Interpositional grafting techniques provide stable and predictable results by changing the maxillary position in the vertical, anteroposterior, and transverse directions and may eliminate the need for secondary soft tissue procedures. Disadvantages of this type of procedure include the need to harvest bone from an iliac crest donor-site and possible secondary soft tissue surgery. However, an extension of the maxillary sinuses into the alveolar ridge may prevent placement of implants in the posterior maxillary area because of insufficient bony support. A sinus lift procedure is a bony augmentation procedure that places graft material inside the sinus and augments the bony support in the alveolar ridge area. 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.
Allogeneic bone, autogenous bone, or a combination of these materials can be used as a graft source in these areas.

Total maxillary osteotomy with interpositional bone grafting procedure should be considered when patients lack both anterior and posterior bone but has good palatal vault form. Patients who demonstrate a relative Class III deformity secondary to bone loss and maxillary transverse deficiency should also be considered for this procedure. The palatal vault osteotomy and elevation can be achieved by different surgical approaches. A total maxillary osteotomy with palatal vault elevation or a palatal vault osteotomy can be performed. Both provide increased stability and palatal vault depth by relying on pseudo augmentation of the alveolar ridge. The total maxillary osteotomy with palatal vault elevation allows for placement of interpositional bone grafts, if desired. The palatal vault osteotomy was originally described by Charest and Goodyear.26

MAXILLOMANDIBULAR RIDGE RELATIONSHIPS

When the teeth are lost, an abnormal ridge relationship result that complicates construction of prosthetic appliances. In totally edentulous patients, the interarch space and the anteroposterior and transverse relationships of the maxilla and mandible must be evaluated with the patient’s jaw at the proper occlusal vertical dimension. This determination in the diagnostic phase may require the construction of bite rims with proper lip support. Lateral cephalometric radiographs are also necessary in this evaluation to confirm the clinical impression. Segmental alveolar surgery in the partially edentulous patient supraeruption of teeth and bony segments into an opposing edentulous area may decrease interarch space and preclude the construction of an adequate fixed or removable prosthetic appliance in this area. If segmental surgery is to be considered, the models can be cut and teeth repositioned in their desired location. The dentist responsible for the final prosthetic restoration of the patient must make the final determination of the placement of the segments on the articulated models. After model surgery, a splint is fabricated to locate placement of segments precisely at the time of surgery and to provide stability during the post-operative healing period.

Corrective surgery for an edentulous protrusive mandible, with few exceptions, should be performed on the ramus or ramus-body portion of the jaw. Maximal denture-bearing surface and the transverse dimension of the mandibular ridges should be maintained. Extraoral subcondylar osteotomy is indicated for considerable correction (>12 mm) and for significant mandibular asymmetry. This approach gives ready access for removal of the coronoid process, stripping of the internal pterygoid muscle and modification of proximal and distal bony segments to ensure good approximation and permits wiring of the segment to produce a force vectored to seat the condyle in the glenoid fossa. Intraoral subcondylar osteotomy is a reasonable procedure when the setback is no >10 mm. Sagittal osteotomy is an excellent technique for correction of mandibular protrusion. The total setback should not exceed 10 mm, and the correction should be symmetric. If significant mandibular asymmetry is present, another technique should be chosen, or the procedure must also be designed to utilize body osteotomies to correct the asymmetry. To permit unimpeded retrusion of the distal segment and to prevent displacement of the proximal segment, the internal pterygoid muscle must be detached from the proximal segment.

The retrognathic mandible, though less frequently a prosthetic or orthodontic problem than prognathism, deserves consideration, for its correction can provide an optimal jaw relationship that will enhance prosthetic reconstruction. Sagittal osteotomy, as described for correction of prognathism or arching osteotomy, is the procedures that yield the most predictable results. Variations of the arcing ramus osteotomy procedure are the “L” osteotomy and the “C” osteotomy with modification by the sagittal splitting of the inferior border of the mandible. Maxillary malrelationships commonly fall into one or more of four categories: (1) Retrusión, (2) protrusion, (3) vertical deficiency, and (4) vertical excess. The maxillary protrusion is frequently associated with anterior maxillary vertical excess. A retrognathic position of the maxilla may represent a true skeletal deformity or may be a relative retrusion secondary to severe resorption of the alveolar process. An occasionally associated problem is that of a deficient transverse dimension. Edentulous Class III jaw relationships historically have been managed by mandibular setback procedures, however, maxillary osteotomies used to change skeletal relationships have proved stable and reliable. Therefore, after confirmation by appropriate analysis, the retusive maxilla is best corrected using a Le Fort I osteotomy. The edentulous maxillary bone is usually thin and even in minimal advancement corticocancellous grafts are indicated and applied as an onlay along the osteotomy sites and as a block interposed between the tuberosities and the pterygoid plates. If vertical deficiency coexists, vertical height may be gained by interpositional grafting.

Although a less common finding, protrusion or vertical excess or a combination of the two can impede prosthetic efforts. Le Fort I osteotomy for correction of vertical excess is an excellent procedure and has the added advantage of versatility whereby individual segments may be altered in the transverse, anteroposterior, or superior plane. Epker and Woldford27 described a procedure for superior repositioning of the maxilla leaving the nasal floor intact; however, in the edentulous patient, this tends to compromise the depth of the palatal vault. In most instances, bone grafting of
osteotomy sites is unnecessary with superior repositioning of the maxilla.

**Implants**
In recent years, dental rehabilitation of edentulous patients using implant-supported prosthesis has presented a significant treatment alternative to conventional restoration with a meaningful improvement in masticatory function and well-being of edentulous patients. Ideal conditions for implant success are residual bone height more than 10 mm and width more than 6 mm, normal maxilla-mandibular relation, and healthy peri-implant soft tissues. The use of autogenous bone grafts with osseointegrated implants seems to significantly reduce bone resorption.

**Lasers**
Today, increasingly versatile and sophisticated lasers are available. These lasers vary in an application based on the choice of different technologies, materials (gas, solids, semi-conductors, colorants, etc.), and a diversity of wavelengths. These various wavelengths have made it possible for laser technology to become a safe, simplified, and effective component in current oral surgery. As the laser has the ability to vaporize soft tissues without bleeding, the wound heals without scar formation and without any deformation of the healed site. Moreover, there is no need for sutures, which is the most important effect in the field of preprosthetic surgery, as any loss in vestibule lengths provoked by the suture is avoided. This wavelength is perfectly adapted for patients requiring soft tissue preparation management.

**Alveolar Distraction Osteogenesis**
In larger defects, alveolar distraction osteogenesis is an alternative treatment for bone and soft tissue reconstruction. This process is based on the concept of bone distraction along a vector that is transverse to the long axis of the bone, which results in bone formation. It was later applied to the human mandible, and more recent clinical reports have shown that alveolar distraction osteogenesis is effective for treating severe forms of alveolar ridge atrophy. A primary advantage of distraction osteogenesis is that there is no need for additional surgery at the donor site. Another benefit is the coordinated lengthening of the bone and associated soft tissues. To obtain successful results both hard and soft tissues should be lengthened and widened. Alveolar distraction osteogenesis is the best technique for soft tissue lengthening in a defective alveolus. Especially in moderate and severe defects, this technique enables restoration of soft tissues with desired quality and volume.

**Tissue Engineering**
Tissue engineering, the science of growing living human tissue for transplantation, opens new perspectives in medical care and will have a positive influence in the field of preprosthetic surgery. Cell culture technology, originally described for cultured skin and mucosal grafts, has opened a new era in the field of oral reconstructive surgery. The major advantage of cell culture is the expansion of a small biopsy specimen into the transplantable mucosal tissue by two to three orders of magnitude within a few weeks. Palatal mucosa was cultured and transplanted to replace gingival mucosa and demonstrated that 4 months later the grafts had formed a well-differentiated keratinizing mucosa similar to the palatal mucosa in situ. Studies on production of *ex vivo* introraal skin/mucosal graft gave promising results, however, the complexity of the procedure, time, and cost is questioned when simple and fast autogenous grafting techniques are possible. The absence of donor-site morbidity should be considered as the most advantageous point of *ex vivo* produced grafts.

**CONCLUSION**
Preprosthetic surgery is a rapidly changing area of dentistry. Knowledge of the range, capabilities, and limitations of the commonly used surgical procedures is a must for anyone treating a patient who will receive complete denture prosthesis. It cannot be overemphasized that the establishment of a clear treatment plan and close coordination of all specialties involved in the reconstructive effort are essential to achieve the best overall result.

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