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PRE-PROSTHETIC JAW BONE SURGERY

Minsk BSMU 2021

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ЧЕЛЮСТНО-ЛИЦЕВОЙ ХИРУРГИИ

Т. Гурбанов

**КОСТНЫЕ ПРЕПРОТЕТИЧЕСКИЕ
ОПЕРАЦИИ**

PRE-PROSTHETIC JAW BONE SURGERY

Учебно-методическое пособие



Минск БГМУ 2021

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ББК 56.6я73

Г95

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Рассматриваются вопросы, связанные с хирургической подготовкой полости рта к протезированию, способы проведения костных предпротетических операций.

Предназначено для студентов 4–5-го курсов стоматологического факультета, врачей-интернов, обучающихся на английском языке.

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Introduction

One of the sections of maxillofacial surgery is prosthetic surgery, the purpose of which is to eliminate pathology that prevents physiological articulation and the creation of anatomical and physiological prerequisites for normalization of occlusion and restoration of the aesthetic and functional integrity of the dental-jaw system.

Surgical preparation of the oral cavity for prosthetics is an integral part of the work of the maxillofacial surgeon, ranging from simple procedures such as compression of the extraction socket and repositioning of the cortical bone and before alveolar bone augmentation and dental implantation. This area of surgery depends on new scientific achievements promoting osteoreparation and osseointegration.

Objectives for pre-prosthetic jaw bone surgery:

- no evidence of intraoral and extraoral pathological conditions;
- proper interarch jaw relationship in the anteroposterior, transverse, and vertical dimensions;
- alveolar processes that are as large as possible and of the proper configuration;
- no bony or soft tissue protuberances or undercuts;
- adequate palatal vault form;
- proper posterior tuberosity notching;
- adequate attached keratinized mucosa and adequate vestibular depth;
- protection of the neurovascular bundle;
- adequate bony support and attached soft tissue covering to facilitate implant placement when necessary.

Diagnosis and treatment planing

1. History:

- age;
- complaints;
- medical history.

2. Physical examination (Fig. 1):

- undercuts;
- bony prominences;
- sharp ridges;
- ridge form;
- ridge parallelism;

- tuberosity notching;
- maxillo-mandibular relation;
- dentition.



Fig. 1. Examination of inter-arch relationships in proper vertical dimension often reveals lack of adequate space for prosthetic reconstruction

3. Investigations.

Radiographic (Fig. 2):

- gen condition of dentition;
- bone resorption;
- proximity to imp structures;
- maxillo-mandibular relation.

Lab investigations patient selection.

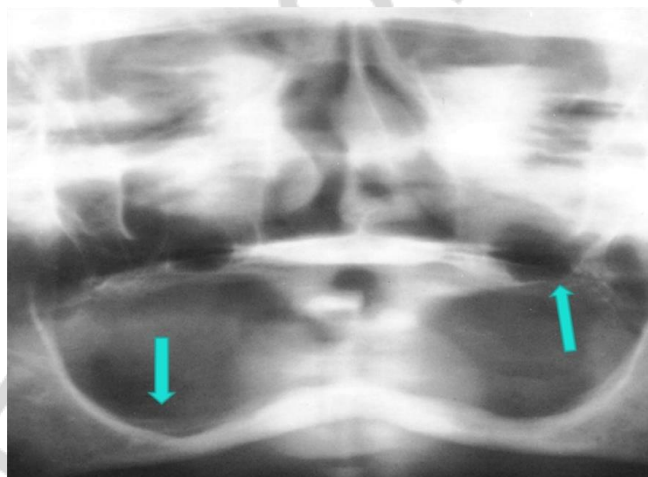


Fig. 2. Radiograph demonstrating atrophic mandibular and maxillary alveolar ridges

Classification of bone pre-prosthetic surgical operations (Modified from Peterson and Kruger)

I) Basic preprosthetic surgical procedures

A. Bony recontouring of alveolar ridges:

- simple alveoloplasty associated with removal of multiple teeth;
- intraseptal alveoloplasty;
- maxillary tuberosity reduction;
- buccal exostosis and excessive undercuts;
- lateral palatal exostosis;
- mylohyoid ridge reduction;
- genial tubercle reduction.

B. Tori removal:

- maxillary tori;
- mandibular tori.

II) Advanced pre-prosthetic surgical procedures:

A. Mandibular Augmentation:

- superior border augmentation;
- inferior border augmentation;
- pedicled or interpositional grafts;
- hydroxyapatite augmentation of the mandible.

B. Maxillary Augmentation

- onlay bone grafting;
- interpositional bone grafts;
- maxillary hydroxyapatite augmentation;
- tuberoplasty.

Basic pre-prosthetic surgeries

Alveoloplasty

Surgical procedure which intends to recontour the alveolar ridge.

Alveolotomy: partial removal of alveolar bone.

Alveolectomy: complete removal of alveolar bone.

Alveoloplasty: shaping of the alveolar bone.

Indications:

- presence of sharp bony margins;
- knife edge ridge;
- sever undercuts;
- maxillary protrusion alveoloplasty;
- reduction of mylohyoid ridge and lingual alveolar crest;
- elimination of labial mandibular undercut.

Types of alveoloplasty:

– *simple alveoloplasty* — easiest & quickest method, involves compression of cortical plates with fingers, reduction in socket width (Fig. 3);

– *labial and buccal cortical alveoloplasty* — alveoloplasty eliminates buccal irregularities and undercut areas by removing labiocortical bone (Fig. 4);

– *Dean's interseptal or Thoma's intracortical* — this technique is best used in an area where the ridge is of relative regular contour and adequate height but presents an undercut to the depth of the labial vestibule (Fig. 5);

– *Obwegeser's technique* — modification of Dean's interseptal or Thoma's intracortical technique, using a separation bur to cut the cortical plate. In case of extreme protrusion both cortical plates are fractured inwards (Fig. 6).

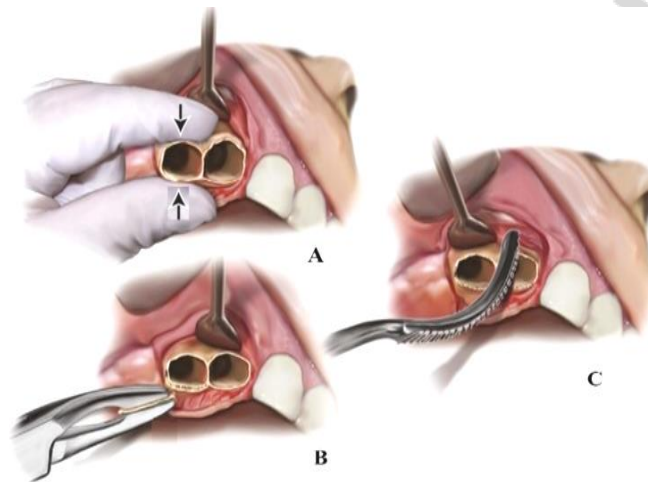


Fig. 3. Simple alveoloplasty:

a — compression of palatal and labial plates; *b* — ronger removal of sharp bone;
c — bone smoothing using bur or file

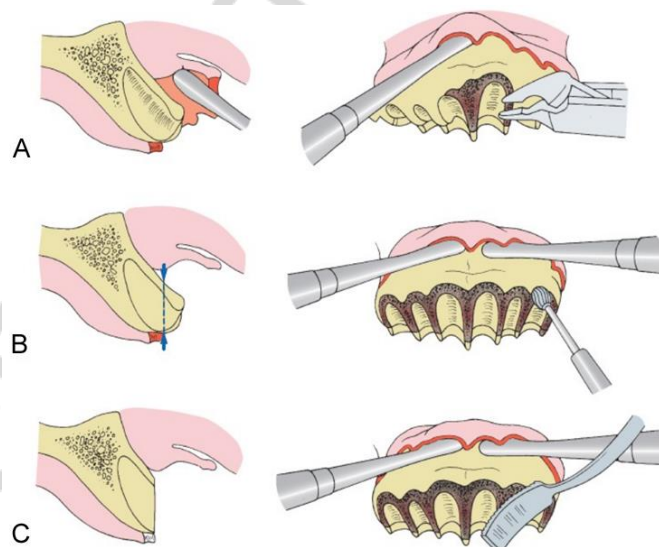


Fig. 4. Labial and buccal cortical alveoloplasty:

a — reduction of labial and buccal cortical bone; *b* — large bone bur used to produce the final desired contour; *c* — bone smoothing

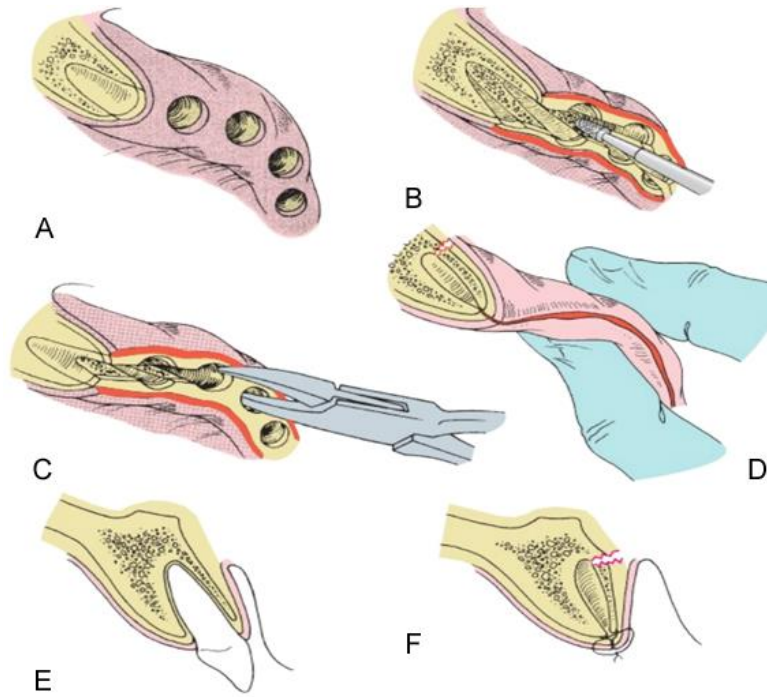


Fig. 5. Dean's interseptal or Thoma's intracortical crush technique:
a — reduction of labial/alveolar prominences; *b* — muscle attachments are undisturbed;
c — intact periosteum; *d* — preserve cortical bone; *e* — less post-op resorption; *f* — suture

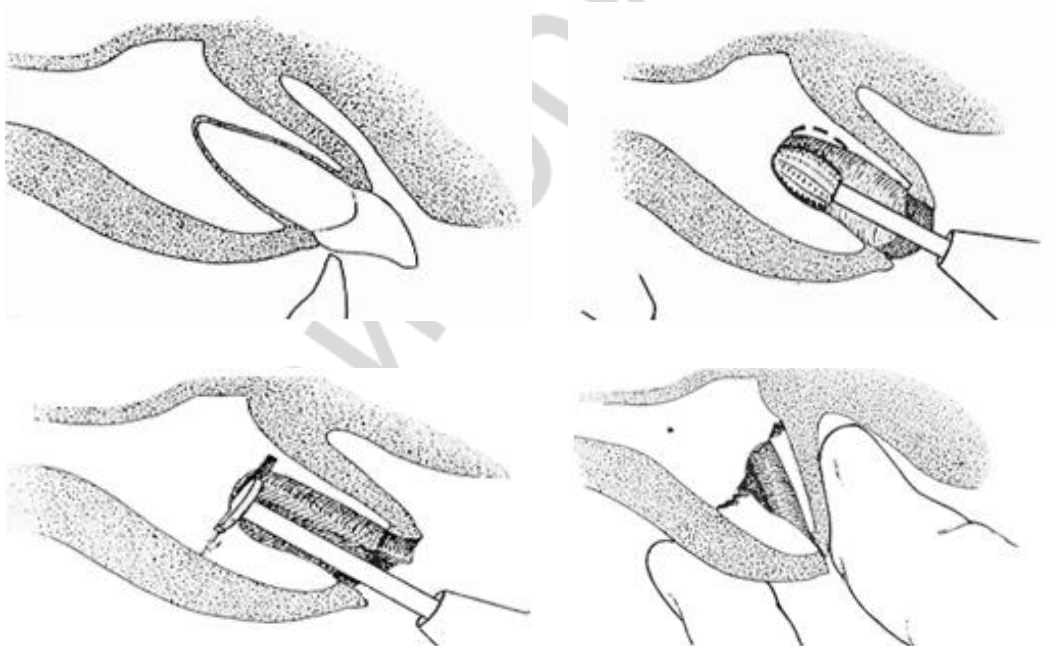


Fig. 6. Obwegeser's technique

Maxillary tuberosity reduction

Indications:

- reduced interridge distance;
- to prevent displacement of denture;
- to reduce severe bilateral undercuts.

Incision placed on the lateral side rather on the crest. In case of thick fibrous tissue — excised. Care should be taken not to perforate into the sinus (Fig. 7).

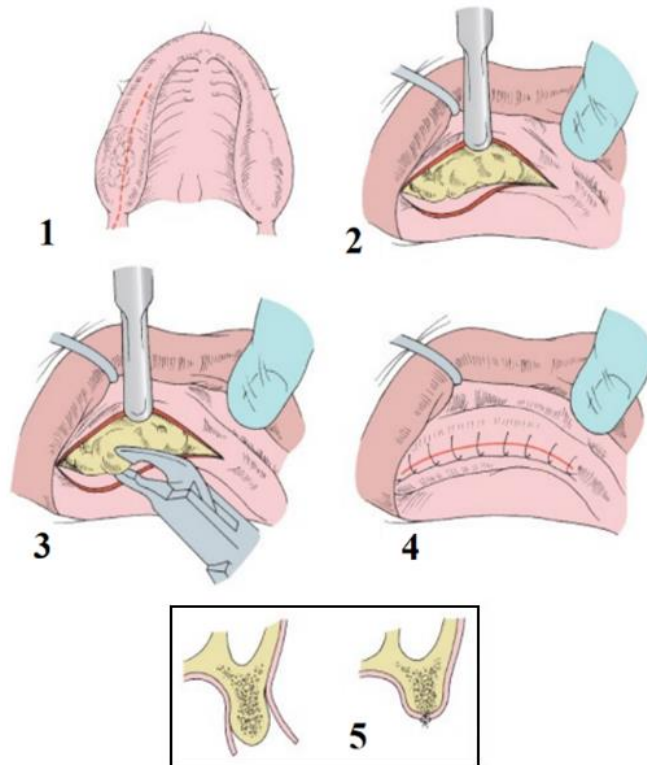


Fig. 7. Maxillary tuberosity reduction:

1 — incision extended along crest of alveolar ridge distally to superior extent of tuberosity area; 2 — elevated mucoperiosteal flap provides adequate exposure to all areas of bony excess; 3 — rongeur used to eliminate bony excess; 4, 5 — tissue reapproximated with continuous suture technique

Buccal exostoses and excessive undercuts

Commoner in the maxilla than the mandible. Although large areas of bony exostosis generally require removal. Small undercut areas are often best treated by filling with either autogenous or allogenic bone material or with an alloplastic material such as hydroxyapatite (Fig. 8).

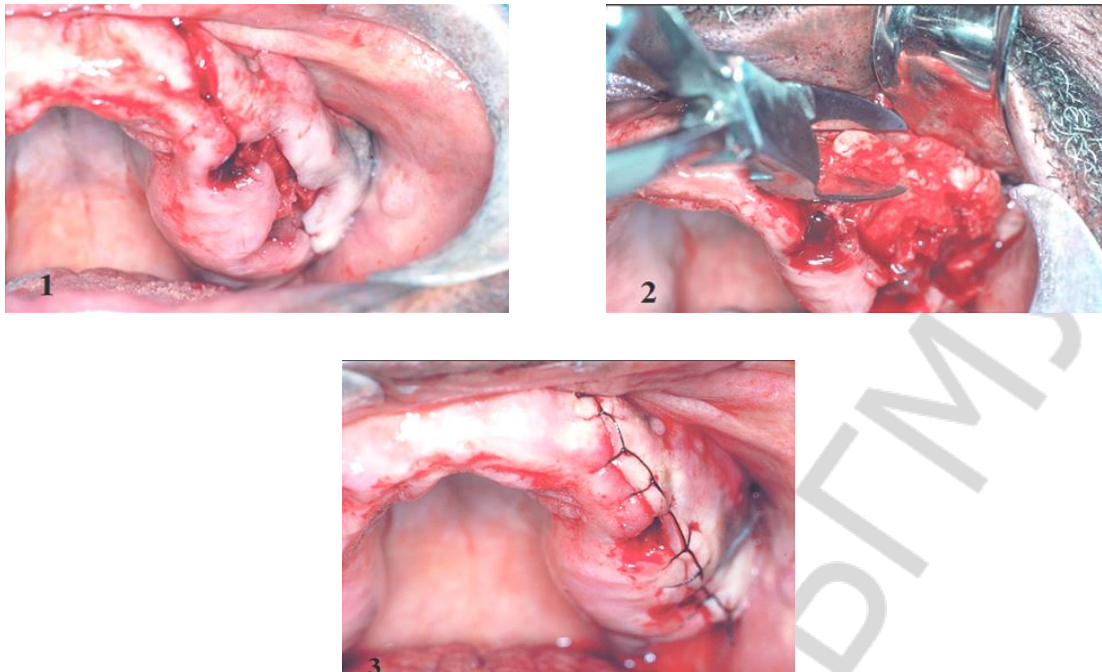


Fig. 8. Buccal exostoses and excessive undercuts:

1 — gross irregularities of buccal aspect of alveolar ridge; 2 — exposure and removal of buccal exostosis with rongeur; 3 — soft tissue closure using continuous suture technique

Lateral palatal exostosis

Lateral palatal exostosis present a problem in denture construction because of the undercut created by the exostosis and the narrowing of the palatal vault. Occasionally they are large enough that the mucosa covering the area becomes ulcerated (Fig. 9).

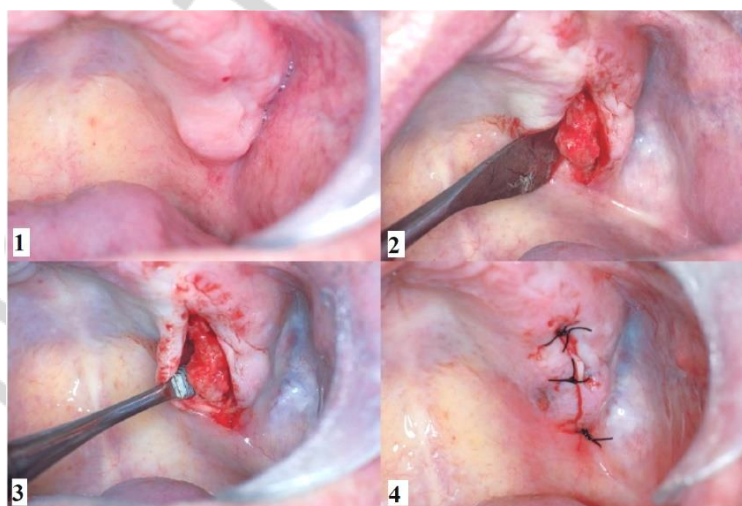


Fig. 9. Removal of palatal bony exostosis:

1 — small palatal exostosis that interferes with proper denture construction in this area; 2 — crestal incision and mucoperiosteal flap reflection to expose palatal exostosis; 3 — use of bone file to remove bony excess; 4 — soft tissue closure

Mylohyoid ridge reduction

The mylohyoid ridge is one of the more common areas interfering with proper denture construction. In addition to the actual bony ridge, which easily damages thin covering of mucosa, the muscular attachment to this area often is responsible for dislodging the denture when this ridge is extremely sharp, denture pressure may produce significant pain in this area. On Fig. 10(1) cross-sectional view of posterior aspect of mandible, showing concave contour of the superior aspect of ridge from resorption. Mylohyoid ridge and external oblique lines form highest portions of ridge. (This can generally best be treated by alloplastic augmentation of mandible but, in rare cases, may also require mylohyoid ridge reduction). Fig. 10(2) shows crestal incision and exposure of lingual aspect of mandible for removal of sharp bone in mylohyoid ridge area. Rongeur or bur in rotating handpiece can be used to remove bone. Fig. 10(3) shows bone file used to complete recontouring of mylohyoid ridge (Fig. 10).

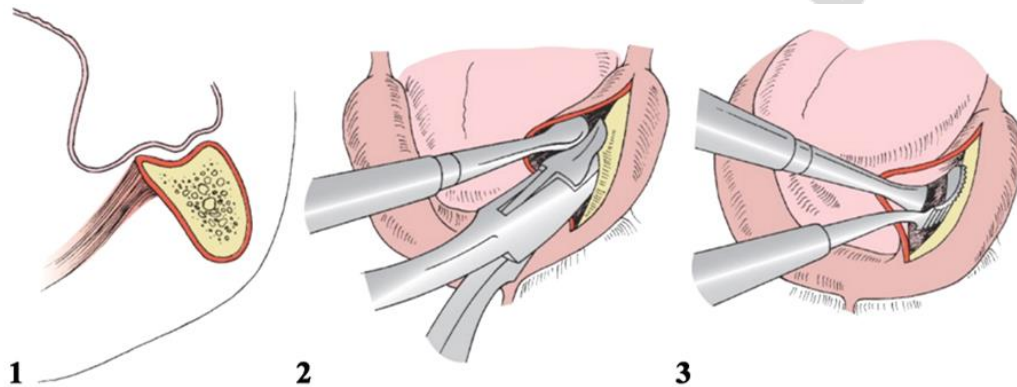


Fig. 10. Mylohyoid ridge reduction

Palatal torus removal

In the patient requiring complete or partial conventional prosthetic restoration, tori may be a significant obstruction to insertion or interfere with the overall comfort, fit, and function of the planned prosthesis. In the maxilla, bilateral greater palatine and incisive blocks are given. A linear midline incision with posterior and anterior vertical releases or a U-shaped incision in the palate followed by a subperiosteal dissection is used to expose the defect. Rotary instrumentation with a round acrylic bur may be used for small areas; however, for large tori, the treatment of choice is sectioning with a cross-cut fissure bur. Once sectioned into several pieces, the torus is easily removed with an osteotome. Closure is performed with a resorbable suture. Presurgical fabrication of a thermoplastic stent, made from dental models with the defect removed, in combination with a tissue conditioner helps to eliminate resulting dead space, increase patient comfort (Fig. 11).

Indications for removal: an extremely large torus filling the palatal vault; a torus that extend beyond the posterior dam area; traumatized mucosa over the torus; deep bony undercuts interfering with denture insertion and stability; interference with function (speech, deglutition); psychological considerations (malignancy phobia).

Complications: postoperative hematoma, perforation of the floor of the nose, necrosis of the flap, wound dehiscence.

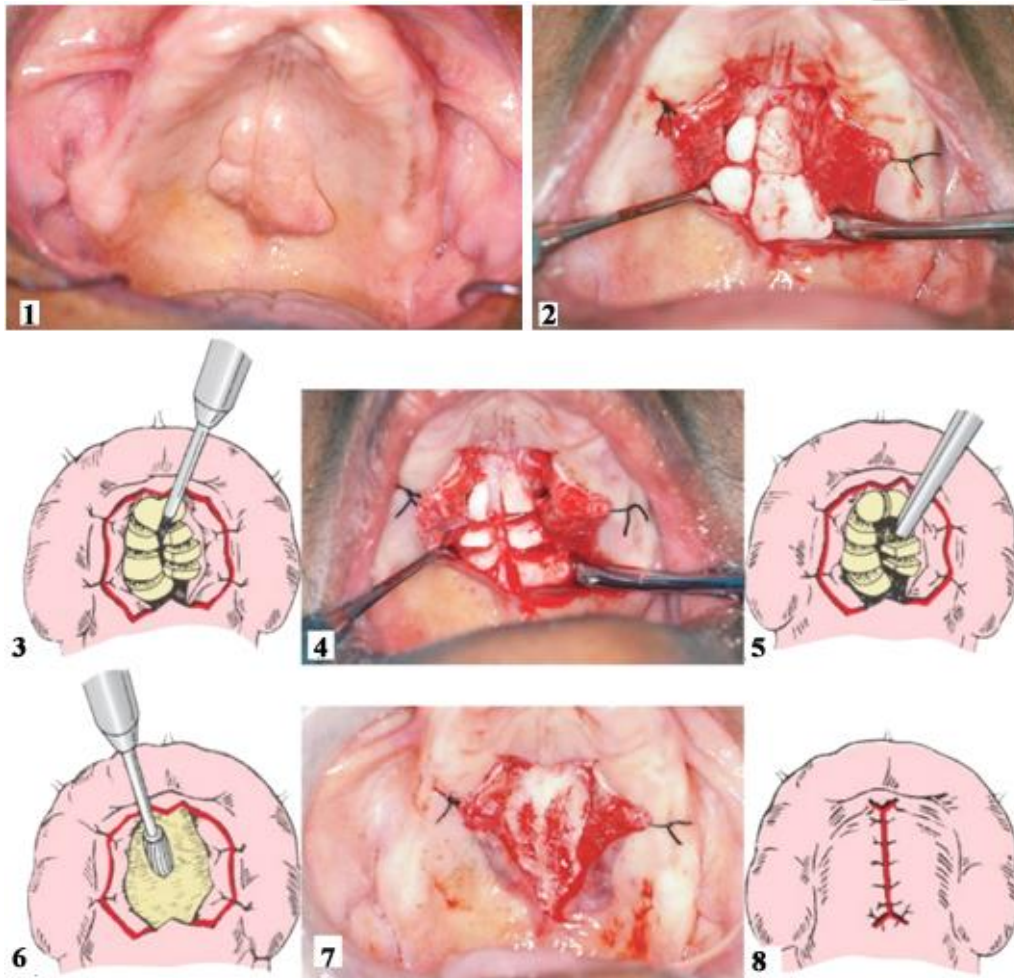


Fig. 11. Removal of palatal torus:

1 — typical appearance of maxillary torus; 2 — mucoperiosteal flaps retracted; 3 and 4 — sectioning of torus using fissure bur; 5 — small osteotome used to remove sections of torus; 6 and 7 — large bone bur used to produce the final desired contour; 8 — soft tissue closure

Mandibular torus removal

Torus mandibular is an exostosis found on the lingual surface of the mandible opposite the canine and premolars region. Present in 8 % of the population, with equal frequency in males and females. Usually bilateral, (80 % of affected patients), may be single, multiple or lobulated.

Indications for removal: tori causing lingual undercuts and interfering with lingual flange extension of the planned prosthesis. When the mucosal covering is ulcerated. Large tori interfering with speech and deglutition.

Technique: after bilateral lingual and inferior alveolar anesthesia incision extending from 1 to 1.5 cm beyond each torus (Fig. 12.1 and Fig. 12.2) When the torus has a small pedunculated base, a mallet and an osteotome is used to cleave the tori from the medial aspect of the mandible. The direction of the initial bur is parallel to the medial aspect of the mandible to prevent fracture of the lingual or inferior cortex (Fig. 12.3). A bone file used to smoothen the lingual cortex (Fig. 12.4 and Fig. 12.5). Palpation is done to check for proper contour and presence of any undercuts. Continuous suturing (Fig. 12.6).

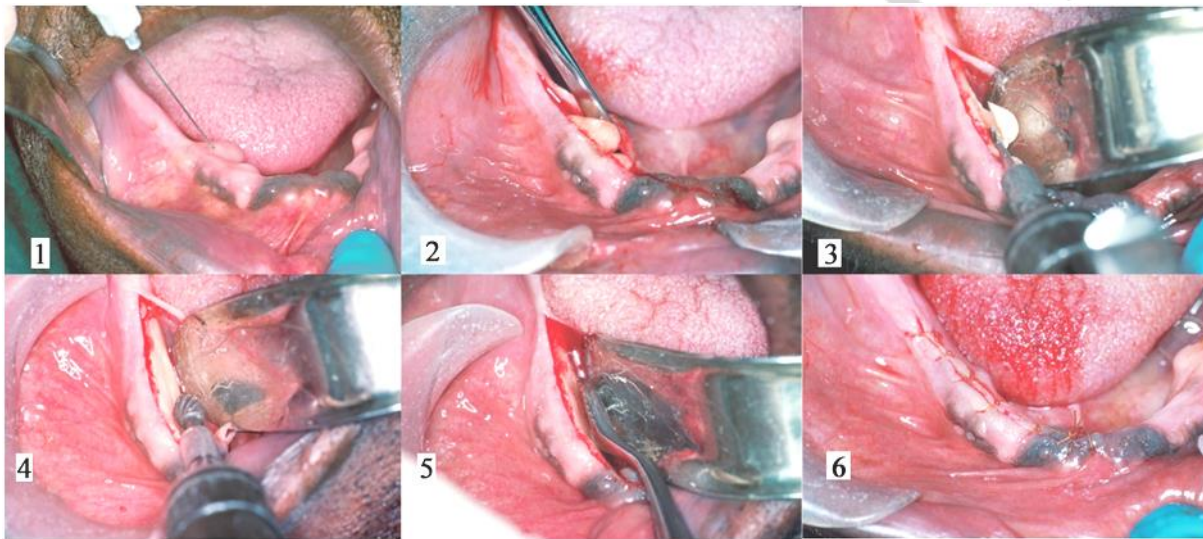


Fig. 12. Removal of mandibular torus

Advanced Pre-prosthetic Surgeries

Mandibular augmentation

Superior border augmentation (Fig. 13)

Indications: severe resorption of the mandible in inadequate height and contour and potential risk of fracture; neurosensory disturbances from the location of the mental foramen.

Disadvantages: high morbidity associated with removal of ribs; need for soft tissue surgery at a later date; necessity of the patient to forego denture wearing to allow 6–8 months of healing after surgery; possibility of significant postoperative resorption of the graft.

Inferior border augmentation. (Fig. 14)

Indications: atrophy of the alveolar ridge area (less than 5–8mm); prevention and management of fractures of the atrophic mandible.

Disadvantages: does not address abnormalities of the denture bearing areas such as increased inter — arch distance superior border irregularities exposed position of the mental nerve which result in mandibular atrophy. These disadvantages combined with the morbidity of rib harvesting make this a seldom used technique.

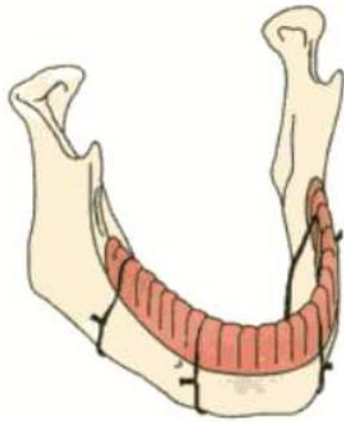


Fig. 13. Superior border augmentation



Fig. 14. Inferior border augmentation

Pedicle or inter positional grafts (Sandwich Technique)

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. A horizontal osteotomy is performed, splitting the residual mandible and bone is grafted into the osteotomy gap (Fig. 15).

Indication: significant mandibular atrophy with absence of adequate bone in the denture bearing area and a bucco lingual width of the mandible of approximately 15 mm.

Disadvantages: because of the viability of the repositioned segment, and the immediate vestibuloplasty performed at the time of surgery, denture construction can usually take place within 3–5 months.

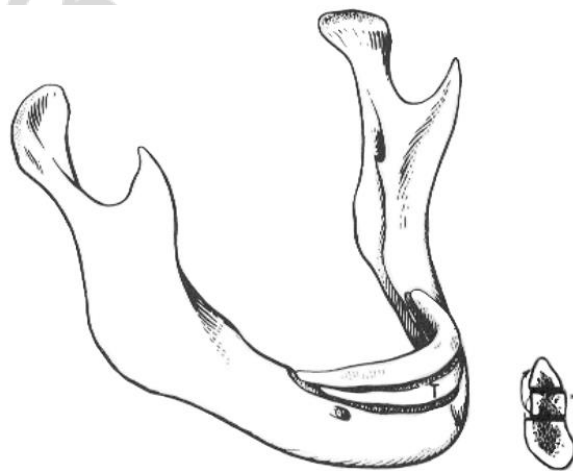


Fig. 15. Pedicle or inter positional grafts (Sandwich Technique)

Visor osteotomy

Goal: To increase the height of the mandibular ridge for denture support. Visor osteotomy consists of central splitting of mandible in buccolingual dimension. The lingual segment is raised along a greater length of the mandibular body and free chips of bone are added to the lateral aspect of the raised bony segment.

Maxillary augmentation

Onlay bone grafting (Fig. 16)

Indications: severe resorption of the maxillary alveolar resulting in the absence of a clinical alveolar ridge and loss of adequate palatal vault form.

Advantages: development of increased height and form of the alveolar ridge and the palatal vault area; the anteroposterior position of the maxilla can be corrected.

Disadvantages: need for a secondary donor site; extensive post operative resorption; postoperative secondary soft tissue procedures; delay in wearing dentures for 6–8 months.

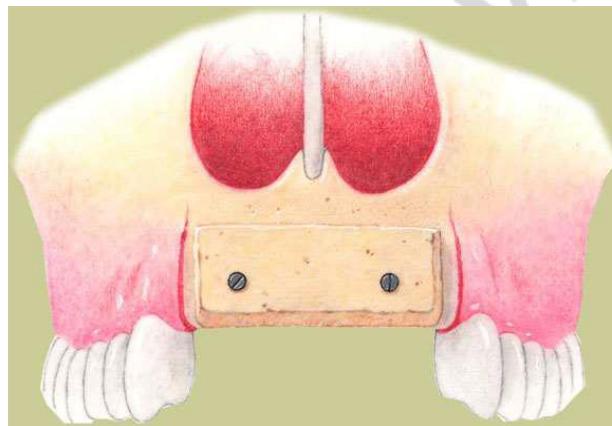


Fig. 16. Maxillary augmentation

Inter positional bone grafts (Fig. 17)

Indications: in a bony deficient maxilla where there is adequate form to the palatal vault but insufficient ridge height, particularly in the zygomatic buttress and posterior tuberosity areas.

Advantages: stable and predictable results by changing maxillary position in the vertical, anteroposterior and transverse directions; may eliminate the need for secondary soft tissue procedures.

Disadvantages: need to harvest bone from the iliac bone crest; possible secondary soft tissue surgery.

Procedure: the lateral maxillary and lateral nasal walls and pterygoid maxillary suture area separated using surgical saws and osteotome and the maxilla is

down fractured. Bone grafts obtained from the iliac crest are shaped and wired in place in the lateral maxillary areas.

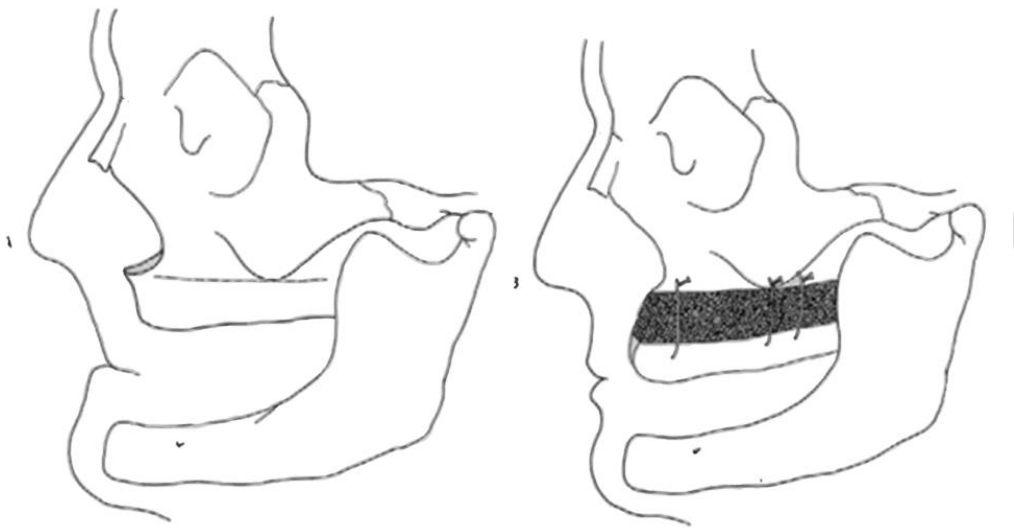


Fig. 17. Inter positional bone grafts

Maxillary hydroxyapatite augmentation

Hydroxyapatite grafting has become the primary method of maxillary augmentation.

Procedure: a single midline incision is usually sufficient. When inadequate, bilateral vertical maxillary incisions in the canine promolar area can be used; subperiosteal tunnels are created over the crest of the alveolar ridge and preloaded syringes are inserted into the most posterior aspect of these tunnels. Hydroxyapatite particles are injected and molded to the desired height and contour, and the incision are closed with a horizontal mattress suture.

Tuberosplasty

The tuberosity — hamular notch area prevents denture displacement and aids the peripheral seal of the maxillary denture.

Procedure: tuberosplasty is performed through a transverse incision, approximately 5mm posterior to the hamular area exposing the pterygomaxillary junction. A curved osteotome inserted into the depth of the notch fractures and displaces the pterygoid plate area from the posterior aspect of the maxilla.

Exposed bone in the tuberosity pterygoid plate area is allowed to heal by secondary intention. Brisk hemorrhage may be encountered when the pterygoid plates are fractured.

Complications: dehiscence with extrusion of particles; abrasion through the mucosa with extrusion of the HA implant; infection; abnormal color is noted under the mucosa; mental nerve neuropathy.

Augmentation using Ti mesh

The use of particulate bone with membrane coverage allows for both horizontal and vertical augmentation of the mandible. The membrane is designed to prevent infiltration of the particulate graft with connective tissue and allow bone to infiltrate into the particulate graft mass rather than connective tissue, with the formation of sufficient bone (Fig. 18).

Disadvantage: premature exposure of the membrane through the mucosa; infection Used for ant maxillary combination syndrome.



Fig. 18. Augmentation using Ti mesh

Conclusion

It is always hoped that the results of Preprosthetic surgery are acceptable both surgically and prosthodontically. In these instances, a team approach is needed with the surgeon and prosthodontist serving as equal members of the team. 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 surgeries.

Educational tests

1. The first class of alveolar arch insufficiency is this?

- a) the alveolar ridge is atrophied to the level of the body of the jaw, narrow, concave in the distal sections, pointed. Usually there is an excess of tissue on the maxillary arch;
 - b) the alveolar ridge is sufficient in height, but insufficient in width;
 - c) the alveolar ridge is insufficient in height and width with a sharp "cutting" edge;
 - d) atrophy of the body with thinning of the lower jaw and a flat upper jaw.
- The correct answer isb.*

2. The second class of insufficiency of the alveolar arch is it?

- a) the alveolar ridge is atrophied to the level of the body of the jaw, narrow, concave in the distal sections, pointed. Usually there is an excess of tissue on the maxillary arch;
 - b) the alveolar ridge is sufficient in height, but insufficient in width;
 - c) the alveolar ridge is insufficient in height and width with a sharp "cutting" edge;
 - d) atrophy of the body with thinning of the lower jaw and a flat upper jaw.
- The correct answer is c.*

3. The third class of alveolar arch insufficiency is this?

- a) the alveolar ridge is atrophied to the level of the body of the jaw, narrow, concave in the distal sections, pointed. Usually there is an excess of tissue on the maxillary arch;
 - b) the alveolar ridge is sufficient in height, but insufficient in width;
 - c) the alveolar ridge is insufficient in height and width with a sharp "cutting" edge;
 - d) atrophy of the body with thinning of the lower jaw and a flat upper jaw.
- The correct answer isa.*

4. The fourth class of alveolar arch insufficiency is this?

- a) the alveolar ridge is atrophied to the level of the body of the jaw, narrow, concave in the distal sections, pointed. Usually there is an excess of tissue on the maxillary arch;
 - b) the alveolar ridge is sufficient in height, but insufficient in width;
 - c) the alveolar ridge is insufficient in height and width with a sharp "cutting" edge;
 - d) atrophy of the body with thinning of the lower jaw and a flat upper jaw.
- The correct answer isd.*

5. What is the indication for a root tip resection?

- a) marginal periodontitis;
- b) tooth decay;

- c) tooth pulpitis;
 - d) chronic apical periodontitis with the presence of periapical changes.
- The correct answer is d.*

6. What is the indication for a root tip resection?

- a) tooth decay;
- b) radicular cyst;
- c) tooth pulpitis;
- d) erosion of the tooth.

The correct answer is..... b.

7. What is not an indication for a root apex resection?

- a) a radicular cyst involving 1/4 of the root length;
- b) a radicular cyst involving 1/3 of the root length;
- c) chronic apical periodontitis with the presence of periapical changes and unsuccessful conservative treatment;
- d) chronic apical periodontitis with the presence of changes in the area of tooth bifurcation.

The correct answer isd.

8. What is not an indication for a root apex resection?

- a) chronic apical periodontitis of the frontal group of teeth with the presence of a broken instrument in the apical third;
- b) a radicular cyst involving 1/3 of the root length;
- c) longitudinal fracture of the tooth root;
- d) chronic apical periodontitis with the presence of periapical changes and unsuccessful conservative treatment.

The correct answer is..... c.

9. What is an indication for tooth root amputation?

- a) chronic apical periodontitis of incisors and fangs with the presence of a broken instrument in the apical third;
- b) a radicular cyst in the area of incisors and fangs involving 1/3 of the root length;
- c) longitudinal fracture of the tooth root;
- d) chronic apical periodontitis of molars with the presence of a broken instrument in the apical third.

The correct answer isd.

10. What is an indication for tooth root amputation?

- a) chronic apical periodontitis of incisors and fangs with the presence of a broken instrument in the apical third;
- b) tooth decay of the tooth radicular cyst in the area of incisors and canines involving 1/3 of the root length;
- c) longitudinal fracture of the tooth root;
- d) a radicular cyst in the region of the 13 tooth involving 1/3 of the length.

The correct answer isd.

11. What is not an indication for tooth root amputation?

- a) chronic apical periodontitis of the 16 tooth with the presence of a broken instrument in the apical third of the buccal-medial root;
- b) the presence of an intraosseous pocket in the region of the buccal-distal root of the tooth 16, with normal bone in the region of the remaining roots;
- c) the presence of an intraosseous pocket in the region of the palatine root of the tooth 16, with normal bone in the region of the remaining roots;
- d) chronic apical periodontitis of the 16th tooth with periapical changes in the region of the buccal-distal root and ineffective conservative treatment.

The correct answer isc.

12. What type of tooth engraftment during replantation is the most physiological?

- a) fibrous;
- b) periodontal;
- c) periodontal fibrous;
- d) osteoid.

The correct answer isb.

13. What type of tooth engraftment during replantation is the most unfavorable?

- a) fibrous;
- b) periodontal;
- c) periodontal fibrous;
- d) osteoid.

The correct answer isd.

14. Requirements for an implanted tooth?

- a) the tooth should have a well-preserved crown;
- b) the roots of the tooth should not be very curved or diverge;
- c) the tooth should not be affected by a deep carious process;
- d) all of the above.

The correct answer is d.

15. Replantation is not a contraindication to surgery:?

- a) pathological conditions that inhibit the regeneration processes (diabetes, alcoholism, drug addiction);
- b) tooth decay during its removal or processing;
- c) the tooth is not affected by the carious process;
- d) acute inflammatory diseases of the apical and marginal periodontium.

The correct answer isc.

16. During replantation surgery, the remains of the ligamentous apparatus of the tooth:

- a) delete;
- b) do not delete;
- c) partially removed;

d) retain at the incisors.

Correct answer..... b.

17. The tooth prepared for replantation is:

- a) in a humid environment — immersed in a solution of sodium chloride;
- b) in a dry environment;
- c) in a sterile box;
- d) a and c.

Correct answerb.

18. What groups of indications of tooth extraction are distinguished:?

- a) rehabilitation;
- b) functional and analitic;
- c) rehabilitation and prosthetic;
- d) aesthetic;
- e) all of the above.

The correct answer ise.

19. What is related to sanitation indications of tooth extraction?

- a) odontogenic inflammatory processes that cannot be radically cured without tooth extraction;
- b) an incorrectly located tooth (usually the third molar or canine) traumatic the mucous membrane, making it difficult to chew;
- c) single teeth preventing good stabilization of the removable denture;
- d) supernumerary and (or) abnormally located teeth.

The correct answer isa.

20. What are the aesthetic indications of tooth extraction?

- a) odontogenic inflammatory processes that cannot be radically cured without tooth extraction;
- b) an incorrectly located tooth (usually the third molar or canine) traumatic the mucous membrane, making it difficult to chew;
- c) single teeth preventing good stabilization of the removable denture;
- d) supernumerary and (or) abnormally located teeth.

The correct answer isd.

Situational Tasks

Task 1

Patient I., 22 years old, went home from study. On the street, tripped on a curb. Fell and knocked out a tooth 1.1. The patient immediately went to the surgeon to the dentist. On examination: Tooth 1.1 in the hole is absent, freely lies in the oral cavity. A tooth without cavities, fillings, chips and bridges. Periodontal ligament saved. The bony walls of the tooth socket 1.1 saved.

1. Conduct a rationale for the diagnosis.
2. Make a diagnosis.
3. Make a treatment plan.

Task 2

Patient M., 34 years old, at a dentist appointment spoke about recurring pain that intensifies when biting on a tooth 46. An examination of the oral cavity revealed: a large carious cavity, tooth 46 was previously treated for complicated caries. Tooth percussion is painless. Palpation in the area of the transitional fold in the projection of the roots of the tooth 46 is painless. On the dental radiograph it is determined: the distal root is sealed to the radiological tip. There are no periapical changes in the distal root. The mediolingual canal is partially filled. A broken dental instrument is noted. The medialbuccal canal is full length plated. Periapical changes are noted in the region of the apex of the medial root 46 (a lesion of bone tissue 0.5x0.5 cm). The patient is somatically healthy.

1. Conduct a rationale for the diagnosis.
2. Make a diagnosis.
3. Make a treatment plan.

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Учеб ание

Гурбанов Тимур

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PRE-PROSTHETIC JAW BONE SURGERY

Учебно-методическое пособие

На английском языке

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