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Prosthetic Management for Hemimandibulectomy- A Review

Dr. Karn Anjali Yateendra[1]; Dr. Rajesh Kumar[2]; Dr. Sunil Kumar MV[3]

[1]Final year Postgraduate, Dept of prosthodontics, Jaipur Dental College
, [2]Professor & Head of the department, Dept of prosthodontics, Jaipur Dental College;
[3]Professor, Dept. of prosthodontics, Jaipur Dental College,

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Abstract: Unilateral mandibular discontinuity from surgery or trauma causes deviation of the mandible toward the defect, which leads to loss of occlusion on the normal side. These resections also impair speech, swallowing, and salivary control, and result in facial asymmetry and disfigurement. A key objective of treatment is to restore acceptable occlusal function. In edentulous patients, maxillomandibular fixation or stabilizing projection can be facilitated, whereas in dentate patients, the presence of residual teeth assists in repositioning the mandibular fragments, and this process can be further supported by the use of guidance prostheses. Such prostheses play a crucial role in retraining the mandible after partial mandibulectomy, helping to re-establish functional occlusion and allowing for an earlier shift to a near-normal, definitive restoration. This paper reviews various mandibular guidance prostheses employed in managing mandibular deviation in both edentulous and partially dentulous patients.

Keywords: *Hemimandibulectomy, Mandibular Defects, Guding Prosthesis, Palatal Ramp, Deviation.*

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I. INTRODUCTION

The mandible is a horseshoe-shaped bone that articulates with the base of the skull through two specialized temporomandibular joints (TMJs). These are diarthrodial joints, characterized by discontinuous articulation between two bones, allowing a wide range of motion guided by muscle activity and restricted by ligamentous support. [1]

Rehabilitating patients with maxillofacial defects involving partial or complete mandibular resection presents one of the greatest challenges in maxillofacial prosthodontics. [1] Segmental mandibulectomy results in considerable morbidity, as there is loss of mandibular support for the teeth, tongue, and lips, leading to impaired mastication, speech, swallowing, airway protection, and oral competence. Additionally, patients often experience facial disfigurement, as the mandible serves as a key aesthetic structure. A thorough understanding of oncologic treatment protocols, advanced imaging, surgical reconstruction techniques, and the application of Osseo integrated implants significantly enhances the predictability and success of prosthetic rehabilitation.

Managing these defects continues to be a significant challenge for head and neck reconstructive surgeons. Ideally, reconstruction should re-establish a stable mandibular arch that articulates properly with the maxilla, restoring preoperative occlusion and facial aesthetics. It should also preserve oral competence to support clear speech and normal swallowing, while enabling dental rehabilitation for functional mastication.

II. CLASSIFICATION OF MANDIBULAR DEFECTS

➢ *Cantor and Curtis classification (1971) [4,5]:*

- *Class I:*
  Mandibular resection involving alveolar defect with preservation of mandibular continuity.

- *Class II:*
  Resection defects involve loss of mandibular continuity distal to the canine area.

- *Class III:*
  Resection defect involves loss up to the mandibular midline region.

- *Class IV:*
  Resection defect involves the lateral aspect of the mandible, but is augmented to maintain pseudo-articulation of bone and soft tissues in the region of the ascending ramus.

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- *Class V:*
  Resection defect involves the symphysis and para-symphysis region only, augmented to preserve bilateral temporomandibular articulations.

- *Class VI:*
  Similar to class V, except that the mandibular continuity is not restored.[5]

➢ *Jewer's and Boyd's classification (1993)* [5]
Based on Jewer's classification (1989), the mandible was divided into three segments. Here, the mucosal component was added by Boyd.

H stands for lateral defects of any length up to midline, including condyle,

C for defects involving the central segment containing 4 incisors and 2 canines,

L constitutes lateral defects excluding the condyle. Lower-case letters describe soft tissue component: **s**: skin deficit,

m: mucosa deficit,

o: absence of mucosa and skin component.

➢ *Brown's classification (2016)* [5]
It is based on the principle that the mandible has four corners: two vertical corners that make the angles of the mandible, and two horizontal corners that are centered at the canine teeth on each side in the dentate mandible, and are roughly 7 mm anterior to the mental foramen in the edentulous jaw.

➢ *Class I (angle):*
Lateral defect not including the ipsilateral canine or condyle.

➢ *Class Ic (angle and condyle):*
Lateral defect including condyle
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➢ *Class II (angle and canine):*
Hemimandibulectomy including ipsilateral but not contralateral canine or condyle.

➢ *Class IIc (angle, canine, and condyle):*
Hemimandibulectomy including condyle.

➢ *Class III (both canines):*
Anterior mandibulectomy includes both canines but neither angle.

➢ *Class IV (Both Canines and at Least One Angle):*
Extensive anterior mandibulectomy including both canines and one or both angles.

➢ *Class IVc (Both Canines and at Least One Condyle):*
Extensive anterior mandibulectomy including both canines and one or both condyles. A drawback of this new classification is that soft tissue defects and type of mandible, in terms of dentate status, have not been incorporated.

➢ *Cordeiro et al.'s classification (2017):*

- Type I: Anterior (any defect that includes the mandibular symphysis).
- Type II: Hemi mandible (includes the body, angle, and ascending ramus, with or without the condyle).
- Type III: Lateral (includes one or two of the body, angle, and ascending ramus, but not all three).

Soft tissue subclassification:

- A: no soft-tissue defect,
- B: intraoral structure or mucosal lining defect only,
- C: skin defect only,
- D: both intraoral structures/lining and skin defect.

Based on five zones of intraoral structures (buccal mucosa, floor of mouth, palate, tongue, and pharynx), subclassification of B1 and B2 was created, that is:

- Excision of two or fewer zones is denoted B1.
- Excision of three or more zones is denoted B2.

When the bony and soft-tissue deficit designations are combined, a streamlined classification system of 13 defect types emerges: IA, IB, IC, ID, IIA, IIB1, IIB2, IIC, IID, IIIA, IIIB, IIIC, and IIID.

➢ *Physiologic Considerations*

- Deglutition
- Speech
- Mandibular movement and mastication
- Saliva control
- Respiration

➢ *Psychosocial Factors*
Postsurgical speech slurring, psychological distress, and radiation-induced erythema of the facial tissues can often stigmatize mandibulectomy patients, giving rise to unfavorable first impressions. In addition, many of their challenging social interactions stem from the persistent societal fear of 'contamination' associated with cancer and mortality.

➢ *Diagnostic Considerations*
Providing mandibulectomy patients with an accurate prognosis is critical, as treatment may involve multiple additional surgical procedures, significant morbidity, and outcomes often less desirable than anticipated. This information is essential for informed decision-making and treatment commitment.

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➢ *Prosthetic Considerations*

- Location and extent of the mandibular defect
- Presence of remaining natural teeth or pre-existing implants
- Available mouth opening
- Degree of post-mandibulectomy rotation and deviation.

➢ *Challenges in Treatment of Mandibular Defects:*

- Radical mandibular surgery has an unfavourable impact on swallowing, speaking, mandibular motions, mastication, saliva control, breathing, and psychic functioning. [5]
- Larger lesions involving the lips, prevent functional lip seal and salivary control.
- Radical surgery also leads to speech impairment due to restricted motion of the tongue and lack of linguopalatal contact.
- Radiation induced xerostomia leads to delayed food processing, bolus formation, difficulty in swallowing, and compromised laryngeal protection.
- The absence of posterior support and insufficient vertical overlap results in compromised interocclusal stability.
- The loss of tissues associated with the surgical resection leads to mandibular deviation toward the defect side.

III. PROSTHETIC MANAGEMENT

➢ *Resected Edentulous Mandible*

- *Mandibular resection denture with stabilizing projection on the resected side:*

A denture design can be planned to utilize the retentive and supportive structures of the remaining mandibular segment, while also providing additional stabilization by extending an “outrigger” projection into the reduced vestibular area on the resected side. [5]

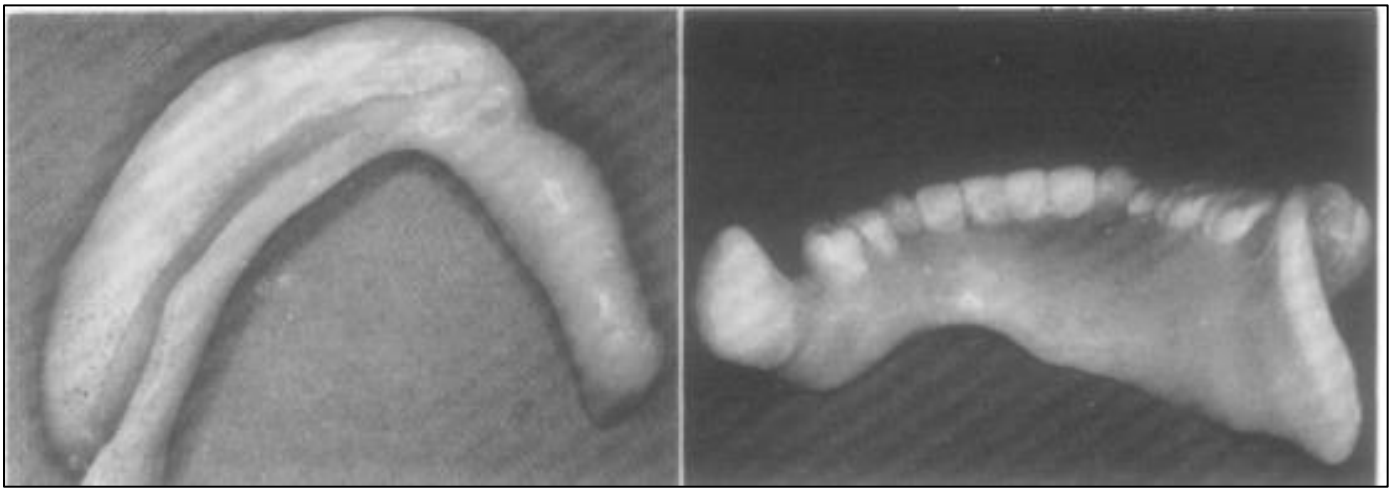

Fig 1 (a) Tissue surface of the mandibular resection denture displaying the stabilizing projection on the resected side. (b) Posterior view of the mandibular resection denture illustrating the dimensions of the stabilizing projection on the resected side.

- *Two-piece Gunning splint as a mandibular guide appliance:*

A sectional two-piece Gunning splint can be employed immediately after mandibular resection to provide stabilization and limit postsurgical deviation through maxillomandibular fixation. In this case, the patient was able to continue using the splint as a training device during the fabrication of complete dentures. Even after five years of denture use, the patient could still successfully guide the mandible into centric occlusion. Although not commonly practiced today, this approach remains effective in preserving proprioceptive awareness of intercuspal position during the initial healing phase, particularly in completely edentulous patients with minimal soft tissue loss following tumor resection. [13]

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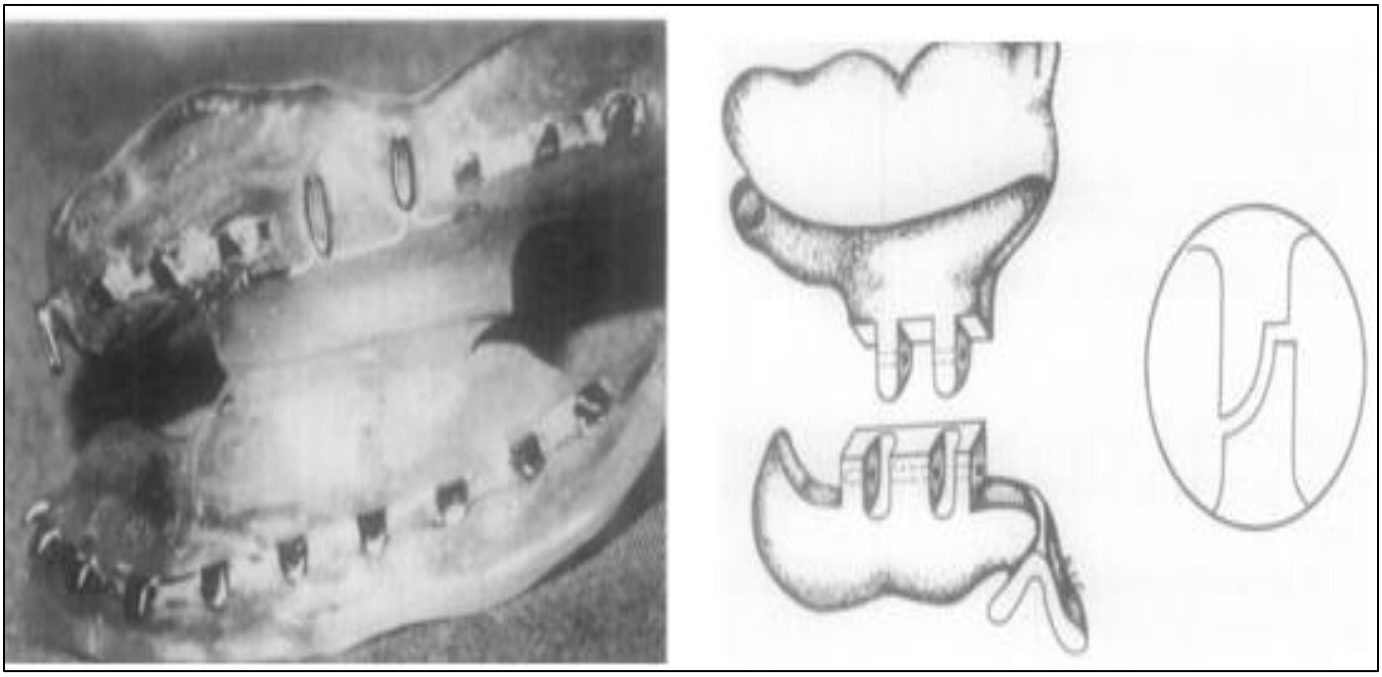

Fig 2 U-shaped indices of the maxillary component of the splint key into the mandibular component and are rigidly fixed with stabilizing pin, arch bars, or both.

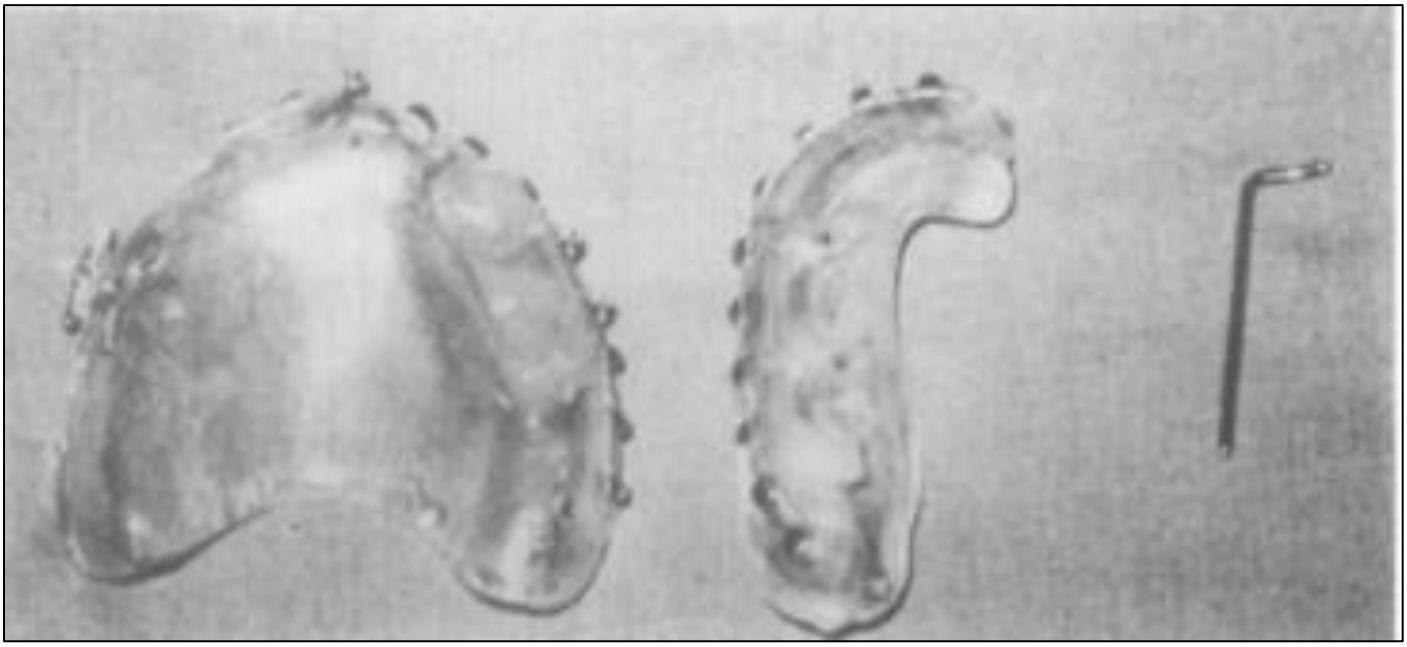

Fig 3 Component of a two-piece Gunning splint.

➢ *Dentulous Resected Mandible:*

- *Guiding Flange Prosthesis*

Mandibular guidance therapy is typically initiated once the immediate postoperative sequelae have resolved, usually around two weeks after surgery. Early initiation of therapy is associated with better outcomes. Guidance appliances may be constructed for either the maxilla or the mandible, using acrylic resin or cast in chrome-cobalt alloy. The flange is usually extended 7–10 mm laterally and superiorly along the buccal surfaces of premolars and molars on the non-defect side. [18]

- *Role of Guide Flange Prosthesis: [19]*

✓ Severe mandibular deviation towards the side of the resection
✓ The guide appliance has an inclined palatal plane that forces the mandibular stump into a correct occlusion.
✓ Restoration of an adequate occlusion favourable to the various oral functions.

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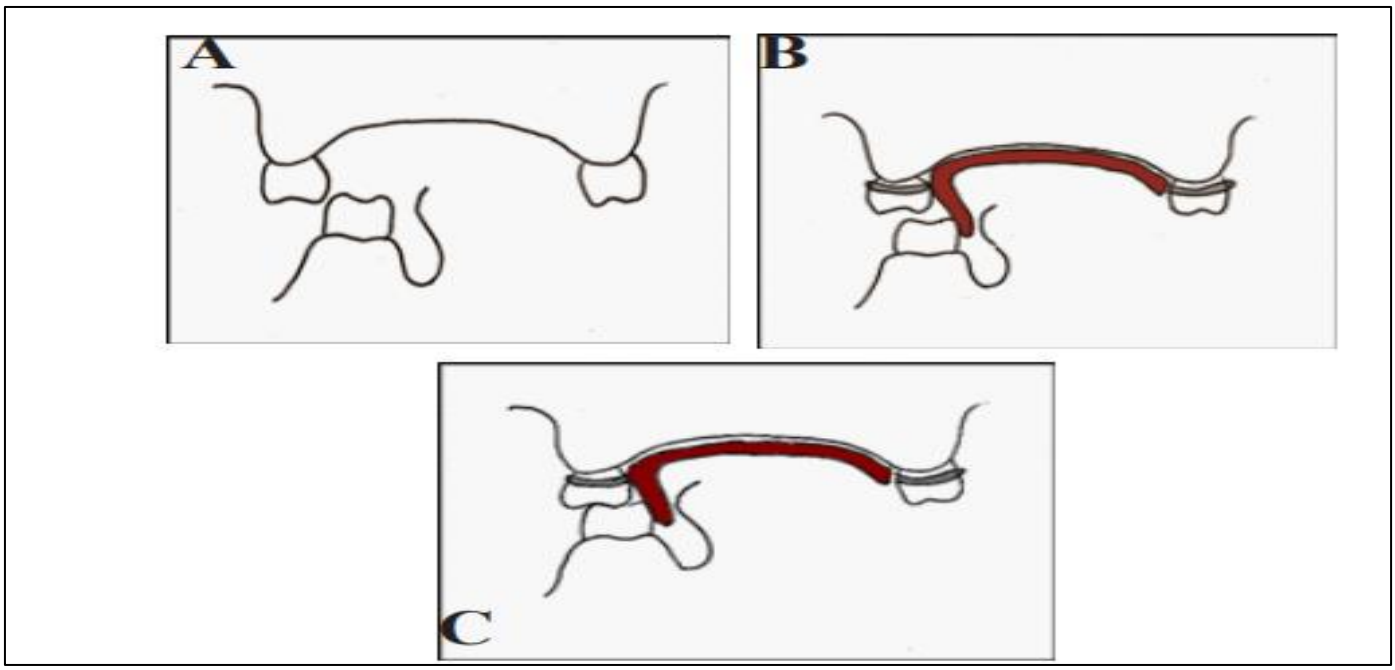

Fig 4 Guiding Flange Prosthesis

Fig 5 A 22-gauge orthodontic wire used for the maxillary prosthesis following the contour of buccal teeth surfaces below the height of contour and two pin heads. The mandibular prosthesis was retained by making a buccal flange of the prosthesis and an additional retentive feature of an orthodontic band on the mandibular left second molar.

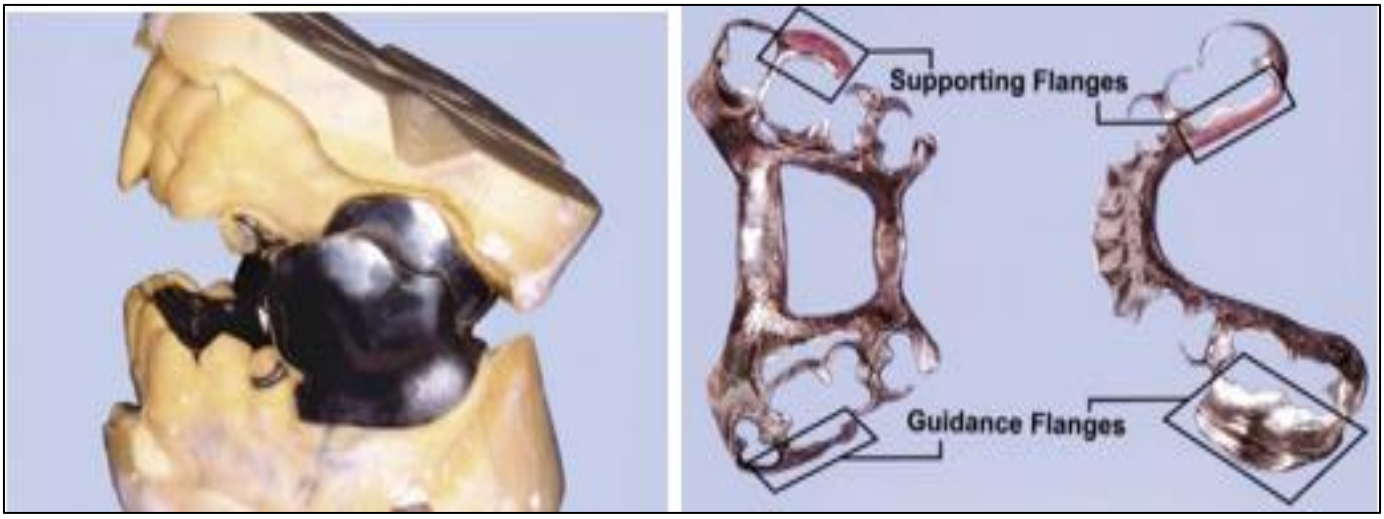

Fig 6 Cast Metal guidance flange prostheses

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- *Palatal Ramp*

It is a widened maxillary occlusal table that can be used in patients who are unable to achieve an ideal mediolateral position of the residual mandibular segment and establish acceptable occlusal contacts, even with the aid of guidance prostheses. In such cases, a palatal ramp or a widened occlusal table created by arranging a double row of maxilla ry teeth provides an occluding surface for the natural or prosthetic teeth of the residual mandible, thereby facilitating mastication. [12]

Fig 7 Palatal Ramp Prosthesis

- **Twin Occlusion Prosthesis:**

Acrylic teeth were arranged on the palatal aspect of the maxillary teeth on the non-resected side, creating a dual row of teeth. This helps in facilitating stable occlusion and improved masticatory efficiency. [14,15]

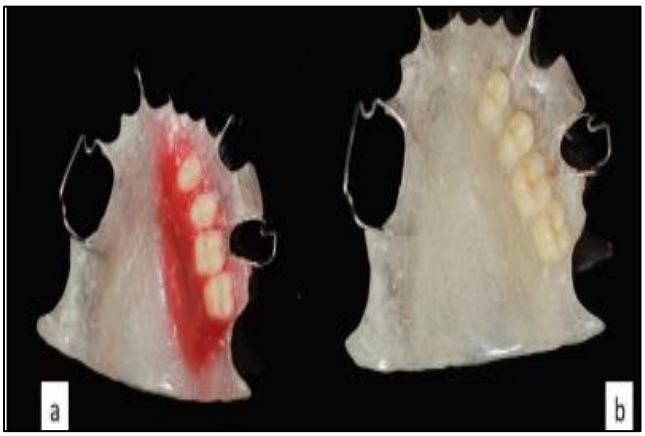

Fig 8 Twin Occlusion Prosthesis

- *Acrylic Splint Herbst:*

This appliance may also be used to establish a proper maxillomandibular relationship.

It comprises acrylic splints in both arches, with a tube incorporated into the upper splint that engages a sleeve attached to the lower hard splint. This design prevents mandibular deviation, while the hinge mechanism between the tube and sleeve permits functional opening and closing movements during mastication. [20

Fig 9 Acrylic Splint Herbst

- *Vacuum Formed PVC Splints*

After the removal of intermaxillary fixation, early progression to a more definitive appliance can be done by using an intermediate vacuum-formed PVC appliance. This appliance consists of upper and lower splints.

The upper splint should include all present teeth and the palatal vault to provide maximum lateral stability; the lower splint should comprise the teeth plus the vestibular flanges, which will act as guide planes for the mandible during closure. The two splints are then inserted onto the arches and fused in this position by interposing a further layer of the heated polymer. The appliance may also be worn at night. This appliance needs to be replaced by a more definitive acrylic or metal appliance once the patient adapts to the path of closure as it has a relatively short shelf life.

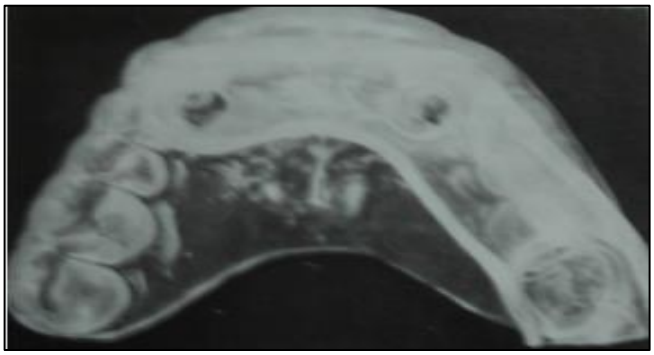

Fig 10 Vacuum Formed PVC Splints

IV. DISCUSSION

Mandibular hemi-section results in deviation of the remaining segment of the mandible towards the resected side due to the unbalanced influence of the internal pterygoid muscle. It also leads to the rotation of the residual mandible in an inferior direction, caused by the pull of the suprahyoid musculature and gravity due to the loss of anchorage of elevator muscles. The amount of deviation and rotation depends on the extent of tissue loss.

Simple guidance prostheses help to restore acceptable occlusal function by retraining, enabling the patient to achieve and maintain a functional occlusal relationship during the post-operative healing phase of the mandible after partial mandibulectomy.

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The outcome of the prosthesis is when the patient can consistently bring the maxillary and mandibular teeth into proper contact without continued dependence on the guidance prosthesis.

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