CLASSICAL ARTICLE

Basic principles of obturator design for partially edentulous patients. Part II: Design principles

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It has been proposed that partially edentulous maxillectomy dental arches be classified into six groups.[1] The design of the metal framework for maxillary obturators varies greatly in each group. However, the design objective is to select the most suitable components to resist the various forces acting on the obturator prosthesis without applying undue stress on the remaining teeth and soft tissue structures.

SYSTEM OF FORCES

Although the pattern of forces affecting the obturator prosthesis are complex because of their concurrent occurrence, these forces may be categorized as vertical dislodging force, occlusal vertical force, torque or rotational force, lateral force, and anterior-posterior force.

The weight of the nasal extension of the obturator exerts dislodging and rotational forces on abutment teeth. Obviously, then, it would be desirable that the weight of the obturator be minimal. Direct retention and extending the buccal wall of the nasal extension superiorly help resist such forces.

Occlusal vertical force is activated during mastication and swallowing. Wide distribution of occlusal rests will help counteract such force. Preservation of teeth or part of the residual ridge across the midline will greatly improve obturator stability. Maximum support should be planned through utilization of full palatal coverage.

Stress created by lateral forces is minimized by the proper selection of an occlusal scheme, elimination of premature occlusal contacts, and wide distribution of stabilizing components. If the medial wall of the defect is covered by a palatal flap, it can help in resisting lateral forces.

Anterior-posterior movement is counteracted by the inclusion of guiding planes on the proximal surfaces of abutment teeth.

RETAINER DESIGN

Retainers are probably the most important components contributing to the success of the obturator prosthesis. Properly designed retainers reduce the stresses transmitted to the abutment teeth while retaining the obturator in place. It is essential that the basic principles of clasp design be followed. These principles are:

1. *Passive placement*. Clasp arms should be passive until activated by functional stress.
2. *Retention*. The minimum retention needed to maintain the obturator in place without the application of external force should be provided.
3. *Stabilization*. A bracing component should oppose each retainer.
4. *Encirclement*. The clasp should cover more than 180 degrees of the circumference of the tooth in either a continuous or interrupted manner.
5. *Support*. Stops should be provided so that tissueward movement, which can strip gingiva or abutment teeth, can be prevented.
6. *Movement*. Minor amounts of movement of the base should be accommodated without transmitting torque to abutment teeth

Stabilization and indirect retention components must be strategically positioned to effectively retard movement of the nasal extension portion away from its terminal position. This in turn will reduce the stress to which the abutment teeth are exposed.

Class I design

In classical maxillectomy resection, the dentition and the alveolar bone are removed along the midline. Preservation of the alveolar bone adjacent to teeth abutting the defect has been recommended by Desjardins.[2]

The design can be either linear or tripodal (Figs. 1 and 2). Two or three anterior teeth are splinted whenever possible, and support is derived from the central incisor and the most posterior abutment tooth. If the

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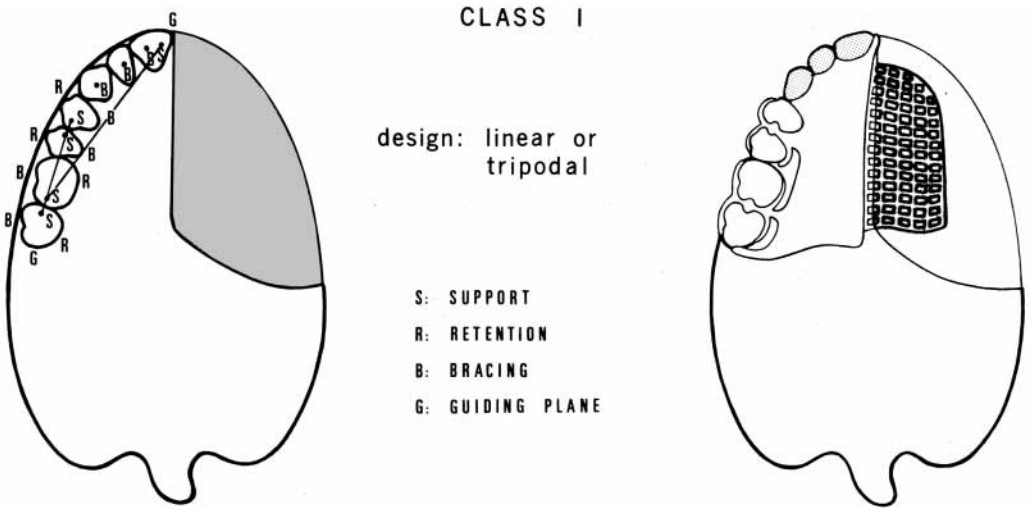

Fig. 1. Two basic designs are recommended for a Class I maxillary defect, either linear or tripodal. Diagonally opposed retention/bracing is used in the former, and buccal retention is used in the latter.

Fig. 2. A metal framework with a linear design at the try-in stage for a Class I maxillary defect. Note that retention and bracing are diagonally opposed.

dental arch is curved, the principle of effective indirect retention is utilized by the location of a rest on the canine, or on the distal surface of the first premolar in a tripodal design.

Direct retention is obtained either from the labial surface of the anterior teeth with a gate design or an I-bar on the central incisor. Posterior retention is placed on the buccal surface of the molars, and bracing is located palatally.

If the anterior teeth are not included in the design, a linear design is recommended. Miller[3] states that a unilateral design requires bilateral retention and stabilization on the same abutment teeth. A diagonally opposed retention and stabilization system can be utilized. Support is located in a linear fashion, and retention is located on the buccal surfaces of the premolars and the palatal surfaces of the molars. Stabilizing components are placed on the palatal surfaces of the premolars and buccal surfaces of the molars.

Class II design

In this classification, the premaxilla on the defect side is maintained. The bilateral design is similar to a

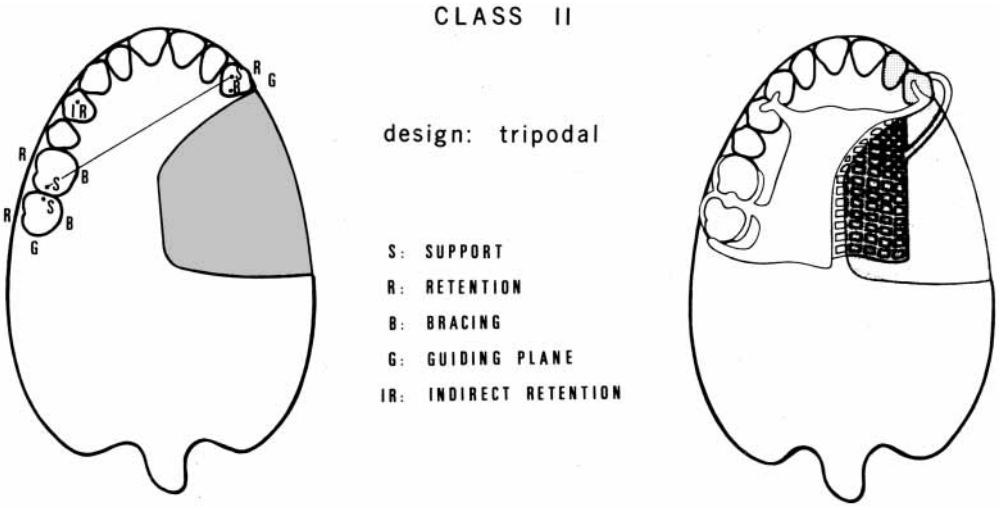

Fig. 3. In Class II design, the teeth next to the defect are splinted. Retention is placed buccally on all abutment teeth, and indirect retention is located on the opposite side of the defect. Guiding planes are on the proximal surfaces of the second molar and the tooth next to the defect.

Fig. 4. A Class II obturator prosthesis.

Kennedy Class II removable partial denture design. A tripodal design is recommended. Splinting of the two teeth adjacent to the defect is advisable.

Primary support is placed on the tooth nearest the defect as well as the most posterior molar on the opposite side. An indirect retainer is positioned as perpendicular to the fulcrum line as possible. Guiding planes are located proximally on the distal surface of the anterior tooth and the distal surface of the molar (Figs. 3 and 4). Retention on all abutment teeth is located on the buccal surfaces, and stabilizing components are placed on the palatal surfaces.

Class III design

The defect is located on the central portion of the palate, and all of the dentition is preserved. The design is based on quadrilateral configurations. Support is widely distributed on both premolars and molars (Figs. 5 and 6). Retention is derived from the buccal surfaces and stabilization from the palatal surfaces.

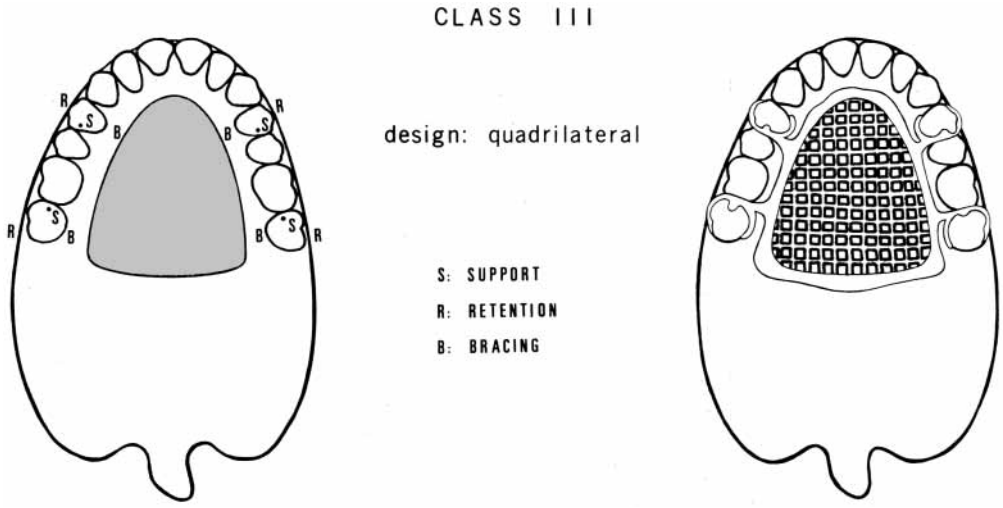

Fig. 5. In Class III retention, bracing and support are derived from four widely separated abutment teeth.

Fig. 6. A Class III obturator prosthesis in place.

Class IV design

The defect includes the premaxilla on the nonsurgerized side. The design is linear. Support is located on the center of all remaining teeth. Retention is located mesially on the premolars and palatally on the molars. Stabilizing components are palatal on the premolars and buccal on the molars (Figs. 7 and 8).

Class V design

The anterior teeth are preserved, and the posterior teeth, hard palate, and portions of the soft palate are resected. Splinting of at least two terminal abutment teeth on each side is suggested. I-bar clasps are placed bilaterally on the buccal surface of the most distal teeth, and stabilization and support are located on the palatal surfaces. This is basically a tripodal configuration. A gate prosthesis is a viable alternative for these patients (Figs. 9 and 10).

Class VI design

Anterior palatal defects, the least frequently occurring class, are caused by trauma more often than by surgery. In such defects, two anterior teeth are splinted bilaterally and connected by a transverse splint bar. A clip attachment may be used without an elaborate partial framework. If the defect is large, or the

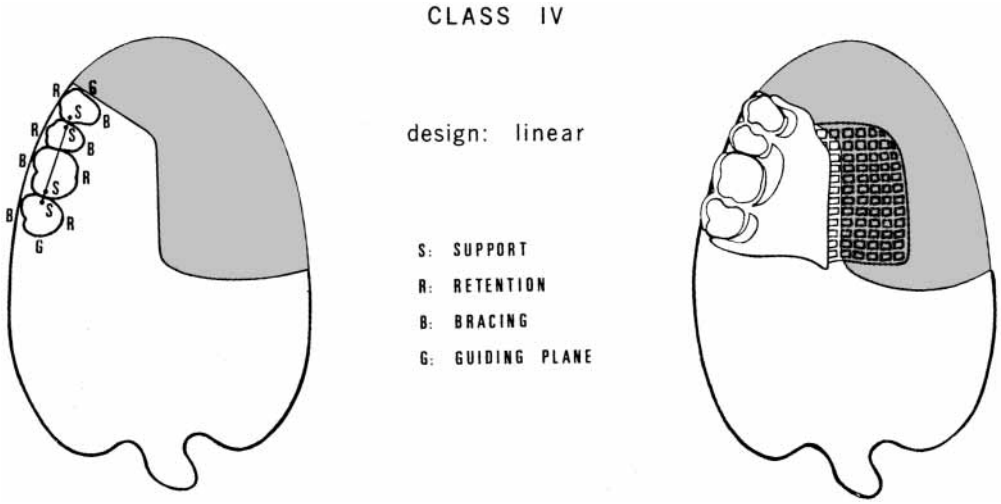

Fig. 7. A lineal design for metal frameworks for a Class III maxillectomy is indicated. Retention and bracing are diagonally opposed. Guiding planes are placed on proximal surface of the tooth next to the defect and the posterior terminal tooth.

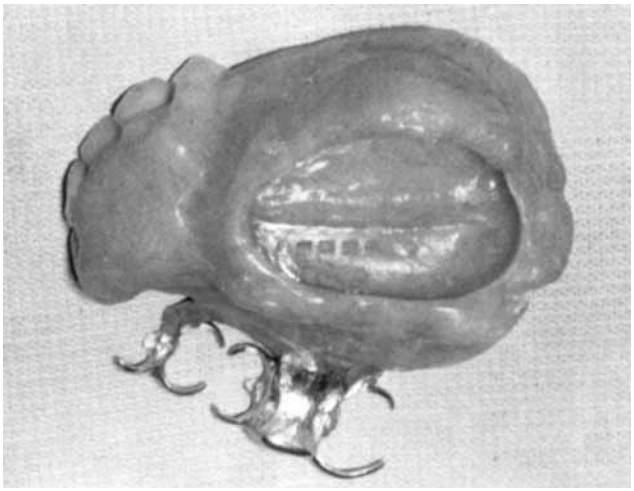

Fig. 8. The tissue surface of an obturator prosthesis constructed for a patient with a Class IV maxillary defect.

remaining teeth are in less than optimal condition, a quadrilateral configuration design is followed (Fig. 11).

SURGICAL CONSIDERATION

Efforts are directed toward converting a potential Class I maxillary defect into a Class II defect to provide a superior prosthesis both functionally and esthetically. Recommendations are directed toward:

1. Preservation of the contralateral anterior teeth, if it does not compromise tumor eradication.
2. If the palatal mucosa is not invaded by the tumor, it is preserved and reflected to cover the medial wall. This procedure provides superior tissue quality coverage for the nasal septum.
3. Preservation of the posterior hard palate on the defect side if the tumor is situated anteriorly or laterally.
4. Resection through the socket of the tooth closest to the specimen allows for maintenance of the proximal alveolar bone adjacent to the abutment tooth (Fig. 12).

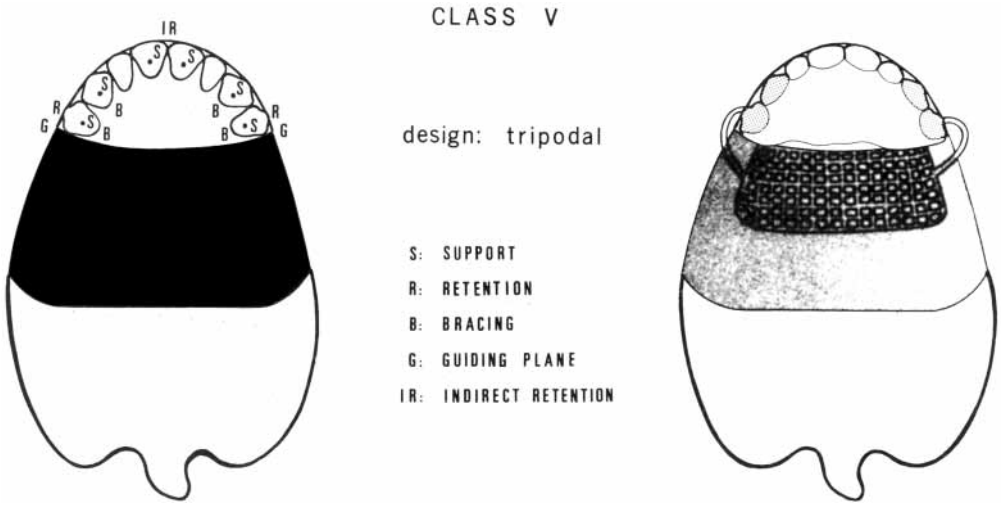

Fig. 9. The design for a Class V maxillary defect. Splinting of the anterior teeth is recommended. Tripodal design calls for buccal retention and palatal bracing. Support is derived from the splinted components, and indirect retention is located on the central incisors.

Fig. 10. A porcelain-fused-to-gold splint is used on the six anterior teeth and a hinge-gate obturator prosthesis is used to restore a Class V defect.

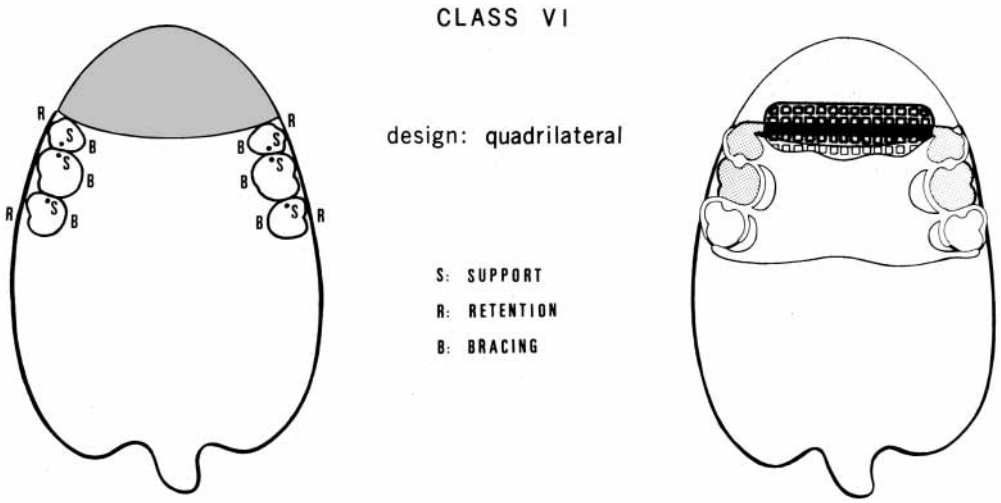

Fig. 11. In Class VI defects, the abutment teeth next to the defect are splinted in conjunction with a cross-arch bar connector. Retention, bracing, and support are derived from four separated abutments.

Fig. 12. Protection of the tooth next to the defect is attained by resection of the maxilla away from the remaining tooth. Arrows point to the alveolar ridge next to the maxillary central incisor.

SUMMARY

A classification for partially edentulous maxillectomy patients has been proposed, and a suggested design for each class is discussed. A simplified approach to the planning of resective surgery and a guide for the design of the maxillary obturator prosthesis have been presented.

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