Factors Influencing Effectiveness of Indirect Retainers

Auxiliary Functions of Indirect Retainers

- Auxiliary occlusal rest
- Canine extensions from occlusal rests

Canine rests
- Cingulum bars (continuous bars)
- Lingualplates

Modification areas
- Rugae support

For the sake of clarity in discussing the location and functions of indirect retainers, fulcrum lines should be considered the axis about which the denture will rotate when the bases move away from the residual ridge.

An indirect retainer consists of one or more rests and the supporting minor connectors (Figs. 8-4 and 8-5). The proximal plates, adjacent to the edentulous areas, also provide indirect retention. Although it is customary to identify the entire assembly as the indirect retainer, it should be remembered that the rest is actually the indirect retainer united to the major connector by a minor connector. This is noted to avoid interpreting any contact with tooth inclines as being part of the indirect retainer.

An indirect retainer should be placed as far from the distal extension base as possible in a prepared rest seat on a tooth capable of supporting its function.

Although the most effective location of an indirect retainer is commonly in the vicinity of an incisor tooth, that tooth may not be strong enough to support an indirect retainer and may have steep inclines that cannot be favorably

s described in Chapter 4, partial denture movement can exist in three planes. Although tooth-supported partial dentures effectively use tooth support to control movement in two of these planes, tooth-tissue supported partial dentures do not have this capability. Attention to the details of design and location of partial denture component parts to control functional movement is the strategy used in partial denture design.

When the distal extension denture base is dislodged from its basal seat, it tends to rotate around one of the fulcrum lines. This movement away from the tissues is resisted by the activation of the retentive element of the direct retainer assembly, the stabilizing components of the clasp assembly, and the rigid units of the partial denture framework that are located on definite rests on the opposite side of the fulcrum line away from the distal extension base (Figs. 8-1 and 8-2). The indirect retainer components should be placed as far as possible from the distal extension base, affording the best leverage advantage against dislodgement of the distal extension base (Fig. 8-3).
Fig. 8-1 For legend see opposite page.
Fig. 8–1, cont’d Possible rotational movement of distal extension partial denture in function. A, On application of cervically directed force, rotation can occur around an imaginary line passing through occlusal rests or any other rigid component located occlusally to the height of contour of the primary abutments. B, When cervically directed force is applied to one side only, rotation can occur around longitudinal axis formed by crest of residual ridge. C, Application of horizontal or off-vertical force results in rotation around an imaginary vertical axis. Vertical axes of rotation shift positions as direction and location of force applications change.

rotation about an axis will occur, which activates the indirect retainers. If total displacement of the rests occurs, there would be no rotation about the fulcrum, and the indirect retainers would not be activated.

2. Distance from the fulcrum line. The following three areas must be considered:
   a. Length of the distal extension base
   b. Location of the fulcrum line
   c. How far beyond the fulcrum line the indirect retainer is placed

3. Rigidity of the connectors supporting the indirect retainer. All connectors must be rigid if the indirect retainer is to function as intended.

4. Effectiveness of the supporting tooth surface. The indirect retainer must be placed on a definite rest seat on which slippage or tooth movement will not occur. Tooth inclines and weak teeth should never be used to support indirect retainers.

FACTORS INFLUENCING EFFECTIVENESS OF INDIRECT RETAINERS

The following factors influence the effectiveness of an indirect retainer:

1. The principal occlusal rests on the primary abutment teeth must be reasonably held in their seats by the retentive arms of the direct retainers. If rests are held in their seats,
Fig. 8-2 Fulcrum lines found in various types of partially edentulous arches, around which denture may rotate when bases are subjected to forces directed toward or away from residual ridge. Arrows indicate most advantageous position of indirect retainer(s). A and B, In Class I arch, fulcrum line passes through the most posterior abutments, provided some rigid component of framework is occlusal to abutment's heights of contour. C, In Class II arch, fulcrum line is diagonal, passing through abutment on distal extension side and the most posterior abutment on opposite side. D, If abutment tooth anterior to modification space lies far enough removed from fulcrum line, it may be used effectively for support of indirect retainer. E and F, In Class IV arch, fulcrum line passes through two abutments adjacent to single edentulous space. G, In Class III arch with posterior tooth on right side, which has a poor prognosis and will eventually be lost, fulcrum line is considered the same as though posterior tooth were not present. Thus its future loss may not necessitate altering original design of the partial denture framework. H, In Class III arch with nonsupporting anterior teeth, adjacent edentulous area is considered to be tissue-supported end, with diagonal fulcrum line passing through two principal abutments as in Class II arch.
AUXILIARY FUNCTIONS OF INDIRECT RETAINERS

In addition to effectively activating the direct retainer to prevent movement of a distal extension base away from the tissues, an indirect retainer may serve the following auxiliary functions:

1. It tends to reduce anteroposterior tilting leverages on the principal abutments. This is particularly important when an isolated tooth is being used as an abutment, a situation that should be avoided whenever possible. Ordinarily, proximal contact with the adjacent tooth prevents such tilting of an abutment as the base lifts away from the tissues.

2. Contact of its minor connector with axial tooth surfaces aids in stabilization against horizontal movement of the denture. Such tooth surfaces, when made parallel to the path of placement, may also act as auxiliary guiding planes.

3. Anterior teeth supporting indirect retainers are stabilized against lingual movement.

4. It may act as an auxiliary rest to support a portion of the major connector. For example, a lingual bar may be supported against settling into the tissues by the indirect retainer acting as an auxiliary rest. One must be able to differentiate between an auxiliary rest placed for support for a major connector, one placed for indirect retention, and one...
FORMS OF INDIRECT RETAINERS

Fig. 6-4 Planning location for indirect retainers for Class I partial denture. The greatest distance from axis of rotation (fulcrum line) would fall on incisor teeth, which are not well suited to provide adequate support without possible tooth movement or slippage of retainer or both. Proximal plates and dual occlusal rests on prepared rest seats at mesial marginal ridge of first premolars provide effective indirect retention with optimum tooth support.

Fig. 8-5 Example of indirect retention used in conjunction with palatal plate-type major connector. Indirect retainers are proximal plates on second premolars and occlusal rests located on first premolars. A secondary function of auxiliary occlusal rest assemblies is to prevent settling of anterior portion of major connector and to provide stabilization against horizontal rotation.

The indirect retainer may take anyone of several forms. All are effective in proportion to their support and the distance from the fulcrum line.

Auxiliary occlusal rest

The most commonly used indirect retainer is an auxiliary occlusal rest located on an occlusal surface and as far away from the distal extension base as possible. In a mandibular Class I arch, this location is usually on the mesial marginal ridge of the first premolar on each side of the arch (see Fig. 8-4). The ideal position for the indirect retainer perpendicular to the fulcrum line would be in the vicinity of the central incisors, which are too weak and have lingual surfaces that are too perpendicular to support a rest. Bilateral rests on the first premolars are quite effective, even though they are located closer to the axis of rotation.

The same principle applies to any maxillary Class I partial denture when indirect retainers are used. Bilateral rests on the mesial marginal ridge of the first premolars are generally used in preference to rests on incisor teeth (see Fig. 8-5). Not only are they effective without jeopardizing the weaker single-rooted teeth, but also interference with the tongue is far less when the minor connector can be placed in the embrasure between canine and premolar rather than anterior to the canine teeth.

Indirect retainers for Class II partial dentures are usually placed on the marginal ridge of the first premolar tooth on the opposite side of the arch from the distal extension base (Fig. 8-6).

Serving a dual purpose, some auxiliary rests are added solely to provide retention to a segment of the denture and should not be confused with indirect retention.

5. It may provide the first visual indications for the need to refine an extension base partial denture. Deficiencies in basal seat support are manifested by the dislodgement of indirect retainers from their prepared rest seats when the denture base is depressed and rotation occurs around the fulcrum.
Fig. 8-6 Mandibular Class II design using embrasure clasp on right side of arch. Indirect retainer on distal marginal ridge of rotated first premolar is favorably located in relation to fulcrum line. Note use of wrought-wire retentive clasp arm on buccal surface of left first premolar. Bar-type retainer could not be used because of presence of large tissue undercut (buccal) below first premolar and absence of usable undercut on its distobuccal surface.

Bilateral rests are seldom indicated except when an auxiliary occlusal rest is needed for support of the major connector or when the prognosis of the distal abutment is poor and provision is being considered for later conversion to a Class I partial denture.

Canine extensions from occlusal rests

Occasionally, a finger extension from a premolar rest is placed on the prepared lingual slope of the adjacent canine tooth (Fig. 8-7). Such an extension is used to effect indirect retention by increasing the distance of a resisting element from the fulcrum line. This method is particularly applicable when a first premolar must serve as a primary abutment. The distance anterior to the fulcrum line is only the distance between the mesio-occlusal rest and the anterior terminal of the finger extension. In this instance, although the extension rests on a prepared surface, it is used in conjunction with a terminal rest on the mesial marginal ridge of the premolar.

Canine rests

When the mesial marginal ridge of the first premolar is too close to the fulcrum line or when the teeth are overlapped so that the fulcrum line is not accessible, a rest on the adjacent canine tooth may be used. Such a rest may be made more effective by placing the minor connector in the embrasure anterior to the canine, either curving back onto a prepared lingual rest seat or extending to a mesioincisal rest. The same types of canine rests as those previously outlined, which are the lingual or incisal rests, may be used (see Chapter 6).

Cingulum bars (continuous bars) and linguoplates

Technically, cingulum bars (continuous bars) and linguoplates are not indirect retainers because they rest on unprepared lingual inclines of anterior teeth. The indirect retainers are actually...
the terminal rests at either end in the form of auxiliary occlusal rests or canine rests (see Chapter 5).

In Class I and Class II partial dentures a cingulum bar or linguoprosthesis may extend the effectiveness of the indirect retainer if it is used with a terminal rest at each end. In tooth-supported partial dentures a cingulum bar or linguoprosthesis is placed for other reasons but always with terminal rests (see Chapter 5).

In Class I and Class II partial dentures especially, a continuous bar retainer or the superior border of the linguoprosthesis should never be placed above the middle third of the teeth so that orthodontic movement during the rotation of a distal extension denture is avoided. This guideline is not so important when the six anterior teeth are in nearly a straight line, but when the arch is narrow and tapering, a cingulum bar or linguoprosthesis on anterior teeth extends well beyond the terminal rests, and orthodontic movement of those teeth is more likely. Although these are intended primarily to stabilize weak anterior teeth, they may have the opposite effect if not used with discretion.

Modification areas

Occasionally the occlusal rest on a secondary abutment in a Class II partial denture may serve as an indirect retainer. This use will depend on how far from the fulcrum line the secondary abutment is located.

The primary abutments in a Class II, modification 1, partial denture are the abutment adjacent to the distal extension base and the most distal abutment on the tooth-supported side. The fulcrum line is a diagonal axis between the two terminal abutments (Fig. 8-8).

The anterior abutment on the tooth-supported side is a secondary abutment, serving to support and retain one end of the tooth-supported segment, as well as adding horizontal stabilization to the denture. If the modification space were not present, as in an unmodified Class II arch, auxiliary occlusal rests and stabilizing components in the same position would still be essential to the design of the denture (Fig. 8-9). However, the presence of a modification space conveniently provides an abutment tooth for support, stabilization, and retention.

Fig. 8-8 Class II, modification L removable partial denture framework. Fulcrum line, when denture base is displaced toward residual ridge, runs from left second premolar to right second molar. When forces tend to displace denture away from its basal seat, supportive element (distal occlusal rest) of direct retainer assembly on right first premolar serves as indirect retainer.

If the occlusal rest on the secondary abutment lies far enough from the fulcrum line, it may serve adequately as an indirect retainer. Its dual function then is tooth support for one end of the modification area and support for an indirect retainer. The most typical example is a distal occlusal rest on a first premolar when a second premolar and first molar are missing and the second molar serves as one of the primary abutments. The longest perpendicular to the fulcrum line falls in the vicinity of the first premolar, making the location of the indirect retainer nearly ideal.

On the other hand, if only one tooth, such as a first molar, is missing on the modification side, the occlusal rest on the second premolar abutment is too close to the fulcrum line to be effective. In such a situation, an auxiliary occlusal rest on the mesial marginal ridge of the first premolar is needed, both for indirect retention and for support for an otherwise unsupported major connector.
Fig. 8.9 Clagg II maxillary removable partial denture framework design. Fulcrum line runs from patient’s right canine to left second molar. Forces that tend to unseat denture from its basal seat will be resisted by activation of retentive elements in canine and molar, using supportive elements on left first premolar as indirect retainer.

Support for a modification area extending anteriorly to a canine abutment is obtained by anyone of the accepted canine rest forms, as previously outlined in Chapter 0. In this situation the canine tooth provides nearly ideal indirect retention and support for the major connector as well.

**Rugae support**

Some clinicians consider coverage of the rugae area of the maxillary arch as a means of indirect retention because the rugae area is firm and usually well situated to provide indirect retention for a Class I removable partial denture. Although it is true that broad coverage over the rugae area can conceivably provide some support, the facts remain that tissue support is less effective than positive tooth support and that rugae coverage is undesirable if it can be avoided.

The use of rugae support for indirect retention is usually part of a palatal horseshoe design. Because posterior retention is usually inadequate in this situation, the requirements for indirect retention are probably greater than can be satisfied by this type of tissue support alone.

In the mandibular arch, retention from the distal extension base alone is usually inadequate to prevent lifting of the base away from the tissues. In the maxillary arch, where only anterior teeth remain, full palatal coverage is usually necessary. In fact, with any Class I maxillary partial denture extending distally from the first premolar teeth, except when a maxillary torus prevents its use, palatal coverage may be used to advantage. Although complete coverage may be in the form of a resin base, the added retention and reduced bulk of a cast metal palate makes the latter preferable (see Chapter 5). However, in the absence of full palatal coverage, an indirect retainer should be used with other designs of major palatal connectors for the Class I removable partial denture.

**SELF-Assessment AIDS**

1. What elements prevent movement of the base(s) of a tooth-supported denture toward the basal seats?
2. Support of a distal extension removable partial denture is shared by abutment teeth and residual ridges. The quality of support furnished by the residual ridges is proportionate to at least three factors. Please name them.
3. Movement of a distal extension base away from basal seats will occur as a rotational movement or as...
4. What is the difference between fulcrum line and axis of rotation?
5. Identify the fulcrum line on a Class I arch; a Class II, modification 1; and a Class IV. 6. Define the term *indirect retainer*. 7. What components of a removable partial denture framework usually make an indirect retainer?
8. From the standpoint of leverage advantage, where should an indirect retainer be located?
9. An indirect retainer performs one major function and four auxiliary functions. State these five functions.
10. The effectiveness of an indirect retainer is influenced by four factors. What are they?
11. What are the probable sequelae of trying to use a continuous bar retainer or linguoplate to serve the purpose of an indirect retainer?
12. In a Class II, modification 1 arch, especially if the modification is a long edentulous space, what component may act as an indirect retainer?
13. Discuss the inadequacy of the use of coverage of rugae to act as support for indirect retention.
14. Each design of the extension base-type removable partial denture should include an indirect retainer or some component that will act as an indirect retainer. True or false?
15. Bilaterally placed indirect retainers contribute to stability of the Class T restoration to a greater extent than does a single indirect retainer. True or false?