Occlusal relationships for removable partial dentures

Desirable Occlusal Contact Relationships for Removable Partial Denture

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The fourth phase in the treatment of patients with removable partial dentures is the establishment of a functional and harmonious occlusion. Occlusal harmony between a partial denture and the remaining natural teeth is a major factor in the preservation of the health of their surrounding structures.

In the treatment of patients with complete dentures, the inclination of the condyle path is the only factor not within the control of the dentist. All other factors may be altered to obtain occlusal balance and harmony in eccentric position, to conform with a particular concept or philosophy of occlusion.

Balanced occlusion is desirable with complete dentures because unbalanced occlusal stresses may cause ill-fitting of the denturc and, in turn, to the supporting structures. This pattern may have been altered by occlusal adjustment or restoration; however, the pattern present at the time the partial denture is made dictates the occlusion on the partial denture. The only exceptions are those in which an opposing complete denture can be made to do so.

Ever, because of the attachment of the partial denture to the abutment teeth, occlusal stresses can be transmitted directly to the abutment teeth and other supporting structures, resulting in sustained stresses that may be more damaging than those transient stresses found in complete dentures. Failure to provide and maintain adequate occlusion on the partial denture is primarily a result of (1) lack of support for the denture base, (2) the fallacy of establishing occlusion to a single static jaw relation record, and (3) an unacceptable occlusal plane.

In establishing occlusion on a partial denture the influence of the remaining natural teeth is such that the occlusal forms of the teeth on the partial denture must be made to conform to an established pattern. This pattern may have been altered by occlusal adjustment or restoration; however, the pattern present at the time the partial denture is made dictates the occlusion on the partial denture. The only exceptions are those in which an opposing complete denture can be made to do so.

See Chapter 2, under discussion on the six phases of partial denture service.
function harmoniously with the partial denture or in which only anterior teeth remain in both arches and the incisal relationship can be made so that tooth contacts do not disturb denture stability or retention. In these situations jaw relation record and the arrangement of the teeth may proceed in the same manner as with complete dentures, and the same general principles apply.

With all other types of partial dentures the remaining teeth dictate the occlusion. The dentist should strive for planned contacts in centric occlusion and no interference in lateral excursions. Smith claims that a functional relationship of the partial denture to the natural dentition may be adjusted satisfactorily in the mouth. It is doubtful that this can be done adequately.

The establishment of a satisfactory occlusion for the partial denture patient should include the following: (1) analysis of the existing occlusion; (2) the correction of existing occlusal disharmony; (3) the recording of centric relation or an adjusted centric occlusion; (4) the recording of eccentric jaw relations or functional eccentric occlusion; and (5) the correction of occlusal discrepancies created by the fit of the framework and in processing the denture.

DESIRABLE OCCLUSAL CONTACT RELATIONSHIPS FOR REMOVABLE PARTIAL DENTURES

The following occlusal arrangements are recommended to develop a harmonious occlusal relationship of partial dentures and to enhance stability of the partial dentures:

1. Simultaneous bilateral contacts of opposing posterior teeth must occur in centric occlusion.

2. Occlusion for tooth-supported partial dentures may be arranged similar to the occlusion seen in a harmonious natural dentition. Stability of the partial dentures is ensured by direct retainers at both ends of the denture base (Fig. 17-1).

3. Balanced occlusion in eccentric positions should be formulated when the partial denture is opposed by a maxillary complete denture (Fig. 17-2). This is accomplished primarily to promote the stability of the complete denture. However, simultaneous contacts in a protrusive relation do not receive priority over appearance, phonetics, and/or a favorable occlusal plane.

4. Working side contacts should be obtained for the mandibular distal extension denture.

Fig. 17-1 Opposing partially edentulous arches having prospective abutments bounding all edentulous spaces. A, Linear working contacts may be developed if group function does not take molars out of contact in working position. B, Posterior balancing and protrusive contacts would not add to stability of either restoration and should be avoided.
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(Fig. 17-3). These contacts should occur simultaneously with working side contacts of the natural teeth to distribute the stress over the greatest possible area. Masticatory function of the denture is improved by such an arrangement.

5. Simultaneous working and balancing contacts should be formulated for the maxillary bilateral distal extension partial denture whenever possible (Fig. 17-4). Such an arrangement will compensate in part for the unfavorable position the maxillary artificial teeth must occupy in relation to the residual ridge, which is usually lateral to the crest of the ridge. However, this desirable relationship must often be compromised when the patient's inferior teeth have excessive vertical overlap with little or no horizontal overlap. Even in this situation, working side contacts can be obtained without resorting to excessively steep cuspal inclinations.

6. Only working contacts need to be formulated for either the maxillary or mandibular unilateral distal extension partial denture (Fig. 17-5). Balancing side contacts would not enhance the stability of the denture because it is entirely tooth supported by the framework on the balancing side.

7. In the Class IV removable partial denture configuration, contact of opposing anterior teeth in the planned intercuspal position is desirable to prevent a continuous eruption of the opposing natural incisors (Fig. 17-6), unless they are otherwise prevented from extrusion by means of a lingual plate, auxil

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Fig. 17-2 A, Class I partially edentulous arch opposed by edentulous maxillary arch. Stability of maxillary complete denture can be promoted by developing balanced occlusion. B, Linear working contacts. C, Balancing contacts are arranged, thus minimizing tipping stresses to complete denture. D, Protrusive contact of posterior teeth will better distribute forces to entire basal seat of complete denture in contrast to contacts only by opposing anterior teeth.
Fig. 17-3 A, Bilateral distal extension mandibular arch opposed by natural dentition in maxillary arch. Matrices have been oriented in articulator in centric relation. B, Acrylic resin record base to framework to support artificial teeth that have been arranged. C, Working contacts have been developed after articulator was programmed with eccentric records. D, Balancing contacts are purposefully avoided because they would not enhance stability of restoration. Protrusive balance is also avoided in order to achieve a favorable occlusal plan.

Fig. 17-4 Casts of opposing Class I partially edentulous arches correctly oriented on programmed articulator. A, Resultant restoration has linear working side contacts of opposing posterior teeth occurring simultaneously with contact of opposing canines on working side. B, Balancing contact should be arranged to minimize tipping of maxillary removable partial denture and to broadly distribute forces accruing to its supporting structures (abutments and residual ridges).
Fig. 17-5 A, Class III (skeletal classification) mandibular arch opposed by natural dentition. Artifical teeth were arranged for maximum intercuspatation in centric occlusion with linear working contact. C, \textit{ro_tnior protru}EJive and balance contacts have been avoided because such arrangement would not enhance stability of the unilateral restoration.

Fig. 17-6 Class IV maxillary arch opposed by mandibular dentulous arch. A, Contact of prosthetically supplied teeth and opposing mandibular teeth has been developed in the planned intercuspal position to prevent continued eruption of mandibular teeth. B, Contact of anterior teeth in eccentric positions is avoided to eliminate unfavorable forces to maxillary anterior residual ridge.
Fig. 17-7 Posterior teeth should not be arranged distal to upward incline of residual ridge. Note that this beginning incline has been marked on land area of cast as reference point.

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inary bar, or by splinting. Contact of the opposing anterior teeth in eccentric positions can be developed to enhance "incisive function but should be arranged to permit balanced occlusion without excursive interferences.

8. Balanced contact of opposing posterior teeth in a straightforward protrusive relation is desirable only when an opposing complete denture or bilateral distal extension maxillary partial denture is placed (see Figs. 17-2 and 17-4).

9. Artificial posterior teeth should not be arranged farther distally than the beginning of a sharp upward incline of the mandibular residual ridge or over the retromolar pad (Fig. 17-7). To do so would have the effect of shunting the denture anteriorly.

A harmonious relationship of opposing occlusal and incisal surfaces alone is not adequate to ensure stability of distal extension removable partial dentures. In addition, the relationship of the teeth to the residual ridges must be considered. Bilateral eccentric contact of the mandibular distal extension partial denture need not be formulated to stabilize the denture. The buccal cusps, however, must be favorably placed to direct stress toward the buccal shelf, which is the primary support area in the mandibular arch. In such positions the denture is not subjected to excessive tilting forces (Fig. 17-8). On the other hand, the artificial teeth of the bilateral, distal extension, maxillary partial denture often must be placed laterally to the crest of the residual ridge (Fig. 17-9). Such an unfavorable position can cause tipping of the denture, which is restrained only by direct retainer action on the balancing side. To enhance the stability of the denture, it seems logical to provide simultaneous working and balancing contacts in these situations if possible.

METHODS FOR ESTABLISHING OCCLUSAL RELATIONSHIPS

Five methods of establishing interocclusal relations for removable partial dentures will be briefly described. Before describing any of these, it is necessary that the use of a face-bow mounting of the maxillary cast and the pertinent factors in partial denture occlusion be considered. The technique for applying the face-bow has been described briefly in Chapter 12.

Although a hinge axis mounting may be desirable for complete oral rehabilitation procedures, any of the common types of face-bow will facilitate mounting of the maxillary cast in relation to the condylar axis of the articulating instrument with reasonable accuracy and are acceptable for a removable partial denture. As suggested in Chapter 12, it is still better that the plane of occlusion be related to the axis-orbital plane. Because the dominant factor in partial denture occlusion is the remaining natural teeth and their proprioceptive influence on occlusion, a comparable radius at the oriented plane of occlusion on an acceptable instrument will allow reasonably valid mandibular movements to be reproduced. Such instruments are the Hanau models (183-2 and 96-H2-0), the Dentatus model ARH, the Whip-Mix 2200, and similar instruments.

Articulators can simulate but not duplicate jaw movement. A realization of the limitations of a specific instrument and a knowledge of the procedures that can overcome these limitations are necessary if an adequate occlusion is to be created.

The recording of occlusal relationships for the partially edentulous arch may vary from the
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Fig. 17-8 A, Artificial posterior teeth are elected that are narrower buccolingually than natural teeth they are to replace. Using smaller teeth is thought to decrease occlusal load applied to residual ridges. B, Stability of restoration is enhanced by positioning buccal cusps of posterior teeth to direct stress toward the buccal shelf. Note that this landmark has been marked on the land area of cast posterior to retromolar pad (arrow). C Posterior teeth have been arranged and occlusal surfaces have been adjusted for harmonious occlusion.

Fig. 17-9 It is often necessary to arrange posterior teeth for maxillary distal extension removable restoration lateral to crests of residual ridges to accommodate positions of posterior teeth in opposing arch. This position is unfavorable; however, stability can be improved by arranging simultaneous working and balancing contacts in occlusal scheme.
simple apposition of opposing casts by occluding sufficient remaining natural teeth to the recording of jaw relations in the same manner as for a completely edentulous patient. As long as there are natural teeth that remain in contact, however, the cuspal influence that those teeth will have on functional jaw movements dictates the placement of the artificial teeth and the occlusal scheme.

The horizontal relation (planned intercuspal position or centric relation) in which the restoration is to be fabricated should have been determined during diagnosis and treatment planning. Mouth preparations also should have been accomplished based on this determination, including occlusal adjustment of the natural dentition, if any were indicated. Therefore one of the following conditions should exist: (1) centric relation and planned intercuspal position coincide clearly defined and the decision should be made to fabricate the restoration in centric relation; (2) centric relation and the planned intercuspal position do not coincide but the planned intercuspal position is clearly defined and the decision has been made to fabricate the restoration in the planned intercuspal position; (3) centric relation and the planned intercuspal position do not coincide and the intercuspal position is not clearly defined, therefore the decision should be made to fabricate the restoration in centric relation and (4) posterior teeth are not present in one or both arches and the denture will be fabricated in centric relation.

Occlusal relationships may be established by use of the most appropriate of the following methods to fit a particular partially edentulous situation.

Direct apposition of casts

The first method is used when there are sufficient opposing teeth that remain in contact to make the occlusal relationship obvious or when only a few teeth are to be replaced on short denture bases and there is no evidence of occlusal pathology. In this method, opposing casts may be occluded by hand. The occluded casts should be held in apposition with rigid supports attached with sticky wax to the bases of the casts until they are securely mounted on the articulator.

At best, this method can only perpetuate the existing occlusal vertical dimension and any existing occlusal disharmony present between the natural dentition. Occlusal analysis and the correction of any existing occlusal disharmony should precede the accepting of such a jaw relation record. The limitations of such a method should be obvious. Yet, such a jaw relation record is better than an inaccurate interocclusal record between the remaining natural teeth unless a record is made that does not influence the closing path of the mandible because of its bulk and/or the consistency of the recording medium, direct apposition of opposing casts, at best eliminate the possibility of the patient's giving a faulty jaw relationship.

Interocclusal records with posterior teeth remaining

A second method, which is a modification of the first is used when sufficient teeth remain to support the partial denture (Kennedy Class III or Class IV, TV), but the relation of opposing teeth does not permit the occluding of casts by hand. In such situations, jaw relations must be established CIB for fixed restorations that use some type of interocclusal medium.

The interocclusal wax record. The successful recording of centric relation with an interocclusal wax record will be influenced by the bulk and the consistency of the wax and the accuracy of the wax after chilling. Excess wax that contacts mucobdul surfaces may distort soft tissues, thereby preventing accurate seating of the wax record onto the stone casts. Distortion of wax during or after removal from the mouth may also interfere with accurate seating. Therefore a definite procedure for making interocclusal wax records is given as follows:

A uniformly hardened, metal-reinforced "Wafer of baseplate or cast-up wax is placed between the teeth, and the patient is guided to close in centric relation (Fig. 17-10). Correct closure should have been rehearsed before placement of the wax so that the patient will not hesitate or deviate in closing. The wax is then
removed and immediately chilled thoroughly in room-temperature water. It should be replaced a second time to correct the distortion that results from chilling and then again chilled after removal.

All excess wax should now be removed with a sharp knife. It is most important at this time that all wax that contacts mucosal surfaces be trimmed free of contact. The chilled wax record again should be replaced to make sure that no contact with soft tissue exists.

A wax record should be further corrected with a bite registration paste, which is used as the final recording medium. In making such a corrected wax record, the opposing teeth (and also the patient's lips and the dentist's gloves) should first be lightly coated with petroleum jelly or a silicone preparation. The bite registration paste is then mixed and applied to both sides of the metal reinforced wax record. It is quickly placed, and the patient is assisted with closing in the rehearsed path, which will this time be guided by the previous wax record. After the paste has set, the corrected wax record is removed and inspected for accuracy. Any excess projecting beyond the wax matrix should be removed with a sharp knife until only the registration of the cusp tips remains.

Such a record should seat on accurate casts without discrepancy or interference and will provide an accurate interocclusal record. When an intact opposing arch is present, use of an opposing cast may not be necessary. Instead, a hard stone may be poured directly into the impression paste record to serve as an opposing cast. However, although this may be an acceptable procedure in the fabrication of a unilateral fixed partial denture, the advantages of having casts properly oriented on a suitable articulator contraindicates the practice. The only exception to this is if the maxillary cast on which the partial denture is to be fabricated has been mounted previously with the aid of a face-bow.

In such an instance an intact lower arch may be reproduced in stone by pouring a cast directly into the interocclusal record.

An interocclusal record also may be made with an adjustable frame. Reference to this method was made in Chapter 12 (see Fig. 12-15). The adjustable frame was devised for use with materials that offer no resistance to closure, such as zinc oxide and eugenol impression pastes.

Some of the advantages of using a metallic oxide paste over wax as a recording medium for occlusal records follow: (1) uniformity of consistency; (2) ease of displacement on closure; (3) accuracy of occlusal surface reproduction; (4) dimensional stability; (5) the possibility of some modification in occlusal relationship after closure, if it is made before the material sets; and (6) less likelihood of distortion during mounting procedures.

Three important details to be observed when one uses such a material are as follows:

1. Make sure that the occlusion is satisfactory before making the interocclusal record.
2. Be sure that the casts are accurate reproductions of the teeth being recorded.
3. Trim the record with a sharp knife wherever it engages undercuts, soft tissues, or deep grooves.
Establishing occlusion by the recording of occlusal pathways

The fifth method of establishing occlusion on the partial denture is the registration of occlusal pathways and the use of an occluding template rather than a cast of the opposing arch. When a static jaw relation record is used, with or without eccentric articulatory movements, the prosthetically supplied teeth are arranged to o_d"de a__ording to a specific concept of occlusion. On the other hand, when a functional occlusal record is used, the teeth are ft\l'Idifi_d t\l' accl:ry rl>d cl:ntric jaW' movement.

These movements are made more complicated by the influence of the remaining natural teeth. Occlusal harmony on complete dentures and in complete mouth rehabilitation may be obtained by the \Wi:\ of si\:v:\ral d\ifferent instruments and techniques. Schuyler has emphasized the importance of establishing first the anterior tooth relation and incisal guidance before proceeding with any complete oral rehabilitation. Others have shown the advantages of establishing canine guidance as a key to functional occlusion before proceeding with any functional registration again. The opposing \Qi\oth COIDQ into functional contact, it ak-a has bQQn pointed out that the canine teeth transmit periodontal proprioceptive impulses to the muscles of mastication and thus have an influence on mandibular movement even without actual contact guidance. However, a:; long a:; the occlusal surfaces of the m\restorer) n;\r;J teeth rem;\Jin in conflict, d\b in m\n\d p\rd\dlly dentoulou15 mouth, these teeth will always be the primary influence on mandibular movement. The degree of occlusal harmony that can be obtained on a fixed or removable restoration will depend on the occlusal harmony that exists between these teeth.

Regarding occlusion, Thompson has written: "Observing the occlusion with the teeth in static relations and then moving the mandible into various eccentric positions is not sufficient. A dynamic concept is necessary in order to produce an occlusion that is in functional harmony with the facial skeleton, the musculature, and the temporomandibular joints." By adding "and with the remaining natural teeth," the requirements for partial denture occlusion will be more completely defined.

Some of the methods described previously may be applied to the construction of partial dentures in both arches simultaneously, whereas the registration of occlusal pathways requires that an opposing arch be intact or restored to the extent of planned treatment. A diagnostic wax up of both maxillary and mandibular arches will facilitate visualization of the proposed mouth, preparation and restorative procedures required to accommodate the planned occlusal scheme, and the orientation of the occlusal plane, correct arch form, and complete tooth modifications. To accommodate this partial denture design, all at the Qired vertical dimension of occlusion. If partial dentures are planned for both arches, a decision is necessary as to which denture is to be made first and which is to bear a functional occlusal relation to the opposing arch. Generally the mandibular arch is restored first and the maxillary partial denture occluded to that restored arch. If the maxillary arch is to be restored with a complete denture or a fixed partial denture or crown, a full diagnostic wax-up must be done before establishing the occlusion on the opposing partial denture. If opposing fixed partial dentures or opposing occluding crowns are to be fabricated, it may be advantageous to develop the occlusion and fabricate them simultaneously to ensure optimal positioning, occlusal relationship, and functional integrity. Regardless of the method used for recording jaw relations, when one arch is completely restored and the arch is treated as an intact arch even though it is wholly or partially restored by prosthetic means. The dentist must consider at the time of treatment planning the possible advantages of establishing the final occlusion to an intact arch.

A step-by-step procedure for registering occlusal pathways:

1. Support the wax occlusion rim by a denture base having the same degree of accuracy and flexibility. The rim is applied to the mouth, and thin coating of model release agent is applied to the surface of the cast. This base is then used to establish occlusal relation by which the opposing tooth is well defined. Completed registration must be placed back onto the cast without interfering debris or discrepancy and secured there with sticky wax so that accuracy of occlusal registration will be maintained.

2. In any distal extension partial denture, make the base on a cast that has been corrected to the functional or supporting form of the edentulous ridge (Fig. 17-13). Place a film of hard sticky wax on the base before the wax occlusion rim is secured to it. The wax used for the occlusion rim should be hard enough to support biting stress and should be tough enough to resist fracture. Peck’s purple inlay wax has proved to be suitable for the majority of patients. However, some individual with weak musculature or hindered mouths may have difficulty in reducing this wax. In such situations use a slightly less hard wax. Make the occlusion rim wide enough to record all extremes of mandibular movement.

Fig. 17-14 Example of completed occlusal registration in hard inlay wax supported by accurate record bases. Note that width of each cusp in all extremes of mandibular movement is recorded as a continuous surface. Yet, anatomy of each opposing tooth is well defined. Completed registration must be placed back onto the cast without interfering debris or discrepancy and secured there with sticky wax so that accuracy of occlusal registration will be maintained.
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rim must maintain positive contact with the opposing dentition in all excursions and must be left high enough to ensure that a record of the functional path of each cusp will be carved in wax. This record should include not only voluntary excursive movements but also involuntary movements; and changes in jaw movement caused by changes in posture. Extreme jaw positions and habitual movements during sleep should also be recorded.

The occlusal paths, thus recorded, will represent each tooth in its three-dimensional aspect. Although the cast poured against this will resemble the opposing teeth, it will be wider than the teeth that carved it because it represents those teeth in all extremes of movement. The recording of occlusal paths in this manner eliminates entirely the need to reproduce mandibular movement on an instrument.

Instruct the patient in the removal and placement of the partial denture that supports the occlusion rim and explain that by chewing in all directions, the wax will be carved by the opposing teeth. The opposing teeth must be cleaned occasionally of accumulated wax particles, it is necessary that the patient comprehend what is to be accomplished and understand that both voluntary and involuntary movements must be recorded.

Before dismissing the patient, add or remove wax where indicated to provide continuous contact throughout the chewing range. To accomplish this, repeatedly warm the wax with a hot spatula and have the patient chew it with the opposing dentition, each time adding to any areas that are deficient. Any area left unsupported by the flow of the wax under occlusal forces must be reinforced with additional wax. It is important that the wax rim be absolutely dry and free of saliva before additional wax is applied. Each addition of wax must be made homogeneous with the larger mass to avoid separation or fracture of the occlusion rim during the time it is being worn. Leave the wax occlusion rim from 1 to 3 mm high, depending on whether vertical dimension is to be increased.

3. After 24 hours, the occlusal surface of the wax rim should show a continuous gloss, which indicates functional contact with the opposing teeth in all extremes of movement (see Fig. 17-14). Any areas deficient in contact should be added to at this time. The reasons for maintaining positive occlusal contact throughout the time the occlusion rim is being worn are that (a) all opposing teeth may be placed in function; (b) an opposing denture, if present, will become fully seated; and (c) vertical dimension of occlusion in the molar region will be increased, thus the head of the mandibular condyle will be repositioned and temporomandibular tissues can return to a normal relationship.

If during this period the wax occlusion rim has not been reduced to natural tooth contact, warm it by directing air from the air syringe through a flame onto the surface of the wax. By holding the wax rim with the fingers while warming it, a gradual softening process will result, rather than a melting of the surfaces already established. Repeatedly warm the occlusion rim and replace it in the mouth until the occlusal height has been reduced and lateral excursions have been recorded. At this time, use additional way to support those areas left unsupported by the flow of the wax to the buccal or lingual surfaces. Trim the areas obviously not involved, thus narrowing the occlusion rim as much as possible. Remove those areas projecting above the occlusal surface, which by their presence might limit functional movement.

Having accomplished seating of the denture and changes in mandibular position by the previous period of wear, it is possible to complete the occlusal registration in an operatory. However, if all involuntary movements and those caused by changes in posture are to be recorded, the patient should again wear the occlusion rim for a period of time.

4. After a second 24- to 48-hour period of wear, the registration should be complete and acceptable. The remaining teeth that serve as vertical stops should be in contact, and the occlusion rim should show an intact glossy
surface representing each cusp in all extremes of movement.

Natural teeth formerly in contact will not necessarily be in contact on completion of the occlusal registration. Those teeth that have been depressed over a period of years and those that have been moved to accommodate overclosure or mandibular rotation may not be in contact when mandibular equilibrium has been reestablished. Such teeth may possibly return to occlusal contact in the future or may have to be restored to occlusal contact after initial placement of the denture. Because the mandibular position may have been changed during the process of occlusal registration, the cuspal relation of some of the natural teeth may be different than before. This fact must be recognized in determining the correct restored vertical dimension of occlusion.

Occlusion thus established on the partial denture will have more complete harmony with the opposing natural or artificial teeth than can be obtained by adjustments in the mouth alone, because occlusal adjustment to accommodate voluntary movement does not necessarily prevent occlusal disharmony in all postural positions or during periods of stress. Furthermore, occlusal adjustment in the mouth without occlusal analysis is limited by the dentist’s ability to correctly interpret markings made intraorally, whether by articulating ribbon or by other means.

The registration of occlusal pathways has additional advantages. It makes obtaining jaw relation possible under actual working conditions, with the denture framework in its terminal position of the opposing teeth in function, and an opposing denture, if present, fully seated. In some instances it also makes possible the recovery of occlusal vertical dimension of occlusion, either unilaterally or bilaterally, when overclosure or mandibular rotation has occurred.

The completed registration is now ready for conversion to an occluding template. This is usually done by boxing the occlusal registration with modeling clay after it has been reseated and secured onto the master or processing cast (Figs. 17-15 through 17-17). Only the wax registration and areas for vertical stops are left exposed. It is then filled with a hard die stone to form an occluding template (see Chapter 18).

It is necessary that stone stops be used to maintain the vertical relation rather than relying on some adjustable part of the articulating instrument, which might be changed accidentally (Fig. 17-18). Also, by using stone stops and by mounting both the denture cast and the template before separating them, a gimbled hinge instrument may be used.

MATERIALS FOR ARTIFICIAL POSTERIOR TEETH

The improved acrylic resin teeth are generally preferred to porcelain teeth because they are more readily modified and thought to more nearly resemble enamel in their abrasion potential against opposing teeth. Improved acrylic resin teeth with gold occlusal surfaces are preferably used in opposition to natural teeth, restored with gold occlusal surfaces, whereas porcelain teeth are generally used in opposition to other porcelain teeth.

Acrylic resin tooth surfaces, however, may in time become impregnated with abrasive particles, thus becoming an abrasive themselves. This may explain why acrylic resin teeth are sometimes capable of wearing opposing gold surfaces. An evaluation of occlusal contact or lack of contact, however, should be meticulously accomplished at each 6-month recall appointment regardless of the choice of material for posterior tooth forms.

Although some controversy may still exist in regard to the use of porcelain or acrylic resin artificial teeth, there is broad agreement that narrow (reduced B-L) occlusal surfaces are desirable. Posterior teeth that will satisfy this requirement should be selected, and the use of tooth forms having excessive buccolingual dimension should be avoided.

Acrylic resin teeth are easily modified and readily lend themselves to construction of cast gold surfaces on their occlusal portions. A simple procedure for fabricating gold occlusal surfaces and attaching them to acrylic resin teeth is described in Chapter 18 under posterior tooth forms.
Arranging teeth to an occluding template

The occlusal surface of the artificial teeth, porcelain or resin, must be modified to occlude with the template. In this method, they are actually only raw materials from which an occlusal surface is developed that is in harmony with an existing occlusal pattern. Therefore the teeth must be occluded too high and then modified to fit the template at the established vertical dimension of occlusion.

Teeth arranged to an occluding template ordinarily should be placed in the center of the functional range. Whenever possible, the teeth should be arranged buccally in the center of the template. When natural teeth have registered the functional occlusion, this may be considered the normal physiologic position of the artificial dentition regardless of its relation to the residual ridge. On the other hand, if some artificial occlusion in the opposing arch has been recorded, such as that of an opposing denture, the teeth should be arranged in a favorable relation to their foundation, even if this means arranging them slightly buccally or lingually from the center of the template.
The teeth are usually arranged to intercuspitate with the opposing teeth in a normal cuspal relationship. Whenever possible, the mesiobuccal cusp of the maxillary first molar should be located in relation to the buccal groove of the mandibular first molar and all other teeth arranged accordingly. With a functionally generated occlusion, however, it is not absolutely necessary that a normal opposing tooth relationship be reestablished (Fig. 17-11). In the first place, the opposing teeth in a dental arch that is not contiguous may not be in normal alignment, and intercuspatation may be difficult to accomplish. In the second place, the occlusal surfaces will need to be modified so that they will function favorably regardless of
their anteroposterior position (Figs 17-17, 18). Because cusps modified to fit an occlusal template will be in harmony with the opposing dentition, it is not necessary that the teeth themselves be arranged to conform to the usual concept of what constitutes a normal anteroposterior relationship.

Fig 17-17 Rather than use clay to span the arch from one side to another, same may be done with wax with less time and material. Wax should form an acute angle with occlusal wax registration and exposed occlusal surfaces.

ESTABLISHING JAW RELATIONS "OR A MANDIBULAR REMOVABLE PARTIAL DENTURE OPPOSING A MAXILLARY COMPLETE DENTURE

It is common for a mandibular removable partial denture to be made to occlude with an opposing maxillary complete denture. The maxillary denture may already be present or it may be made concurrently with the opposing partial denture. In any event, the establishment of jaw relations...
in this situation m1Y hQ :;:omplid:;Qd by onQ of several methOds previOusly outlined.

If an existing maxillary complete denture is gatighdory :;nd the occlusal phne is oriQnted to an acceptable anatomic, functional, and esthetic position (which rarely occurs), then the complete denture need not be replaced and the opposing arch is treated as an intact arch as though natural teeth were present. A face-bow transfer is made of that arch, and the cast is mounted on the articulator. To accomplish this, a face-bow record is made with the complete denture in place. After the face-bow apparatus is removed from the patient, the complete denture is removed from the patient and an irreversible hydrocolloid impression of the denture is made. When the impression material has set, the denture is removed, cleaned, and returned to the patient. A cast is formed in the impression and then mounted on the articulator with the face-bow record. Maxillomandibular relations may be recorded on accurate record bases attached to the mandibular partial denture framework by use of a suitable recording medium. Centric relation is recorded and transferred to the articulator. Eccentric records can then be made to program the articulator.

In rare instances, when the mandibular partial denture replaces all posterior teeth and the anterior teeth are noninterfering, a central bearing point tracer may be mounted in the palate of the maxillary denture and centric relation recorded by means of an intraoral stylus tracing against a stable mandibular base. If a stylus jaw relation recording method is used, the stylus must be carefully removed from the denture and attached to the same palatal location of the stone cast that was transferred to the articulator via the face-bow. The mandibular cast can then be oriented by way of the horizontal position and attached to the articulator.

When an existing complete denture is opposing the arch on which a removable partial denture is fabricated, a cast of the complete denture may be used during the fabrication procedures. However, when the occlusion is corrected after processing and the removable partial denture is finalized during initial placement, the complete denture should be retrieved and mounted on the articulator with a centric relation record at the desired vertical dimension of occlusion. This will ensure a more accurate cuspal relationship and will avoid abrasion of the cusps that would occur by using a stone cast of the denture. This procedure is completed when the patient is in the office so as not to deprive the patient of use of the existing complete denture.

If the relationship of the posterior teeth on the maxillary denture to the mandibular ridge is favorable and the complete denture is stable,
Jaw relations may be established by recording occlusal pathways in the mandibular arch just as for any opposing intact arch. The success of this method depends on the stability of the denture bases, the quality of tissue support, the relation of the opposing teeth to the mandibular ridge, and the interrelation of existing artificial and natural teeth.

More often than not, the existing maxillary complete denture will not be acceptable to the patient because of poor tooth position. The denture will have been made to occlude with malpositioned mandibular teeth, which have since been lost, or the teeth will have been arranged without consideration for the future occlusal relation with a mandibular partial denture. Too often one sees a maxillary denture with posterior teeth arranged close to the residual ridge without regard for interarch relationship and with an occlusal plane that is too low. Usually, however, a new maxillary denture must be made concurrently with the mandibular partial denture, and jaw relations may be established in one of two ways.

If the mandibular partial denture will be tooth supported (a Kennedy Class III arch accommodating a bilateral removable prosthesis), the mandibular arch is restored first. The same applies to a mandibular arch being restored with fixed partial dentures. In either situation the mandibular arch is completely restored first, and jaw relations are established as they would be to a full complement of opposing teeth. Thus the maxillary complete denture is made to occlude with an intact arch.

On the other hand, as is more often the situation, the mandibular partial denture may have one or more distal extension bases. The situation then requires that the occlusion be established on both dentures simultaneously.

All mouth preparations and restorative procedures required to correctly orient the occlusal plane, correct the arch form, accommodate the desired occlusal vertical relation with the remaining lower teeth is established, and a face-bow transfer of the maxillary arch is made. The maxillomandibular relations may be recorded by anyone of the several methods previously outlined, and the articulator mounting completed. Occlusion may be established as for complete denture5, taking care to establish a favorable tooth-to-ridge relationship in both arches, an optimum occlusal plane, and cuspal harmony between all occluding teeth.

After try-in, several methods may be used to complete the restoration!- Both dentures may be processed concurrently and remounted for occlusal correction, or the partial denture may be processed first, and after it is completed and remounted, the teeth, still in wax on the complete denture, are adjusted to any discrepancies occurring.

Correction of occlusal discrepancies created during processing must be accomplished before the patient is permitted to use the denture(s). Methods by which these discrepancies may be corrected are discussed in Chapter 18.

**SELF-Assessment AIDS**

1. True or false: Occlusal harmony exists when the masticating mechanism can carry out its physiologic functions while the factors of occlusion remain in a healthy state, the factors of occlusion being the temporomandibular joint, the neuromuscular mechanism, and the teeth and their supporting structures.

2. Occlusal harmony between a removable partial denture and the remaining natural teeth is a major factor in preserving the health of the supporting structures of the natural teeth. True or false?

3. The establishment of a satisfactory occlusion for a partial denture should include five considerations or procedures by the dentist. List the five musts.

4. Define centric relation in your own words. 5. What is maximum planned intercuspaton and how does it relate to centric occlusion?
6. What is meant by eccentric occlusion? Describe a balanced occlusion.

7. Two methods are commonly used to develop an acceptable occlusion for a removable partial denture patient. Give a brief description of these two methods.

8. What records are necessary to correctly orient casts to an arc on-type articulator and to program the articulator?

9. A harmonious relationship of opposing occlusal surfaces, in itself, is not adequate to ensure stability of distal extension removable partial dentures. What other factor must be recognized and dealt with to minimize unwanted leverages?

10. What are the differences among dentition in developing contacts of opposing teeth in centric and eccentric positions for partially edentulous patients. Answer the following queries correctly and try to rationalize the recommendations contained in this text:

   a. Simultaneous contact of opposing posterior teeth must occur in the intercuspal position. True or false?

   b. Occlusion for tooth-supported removable partial dentures may be arranged to duplicate the occlusion seen in a harmonious natural dentition. True or false?

   c. Under what circumstances is a balanced occlusion desirable for the partially edentulous patient?

   d. Should working side contacts be developed when a mandibular distal extension denture is opposed by natural teeth (assuming all mandibular posterior teeth are missing)?

   e. A patient with a Kennedy Class I maxillary arch is being treated with a removable partial denture. Is it beneficial to develop balancing and working contacts? Explain. What about protractive contacts?

   f. Are balancing side contacts for a Kennedy Class II maxillary arch desirable? Why or why not?

   g. What are the desirable contact relationships of artificial-natural teeth when one arch is a Kennedy Class IV arch?

   h. What is the most distal extent that an artificial tooth should be arranged in a Kennedy Class I or II mandibular arch?

12. A patient requires a tooth-supported mandibular removable partial denture. The remaining teeth are maximally intercusing; however, this position does not coincide with centric relation. There is no temporomandibular joint pathologic process, no neuromuscular disorder, and no periodontal condition aggravated by occlusion. Would one insist that the patient be restored to have maximum intercuspsion coincide with centric relation? Why or why not?

13. Under what circumstances would one develop an occlusion for a partially edentulous patient so that maximum intercuspsion coincided with centric relation?

14. When must the dentist determine the horizontal jaw relation in which to develop the occlusion for the partially edentulous patient? Why?

15. After the horizontal relationship of the jaws to which the occlusion will be developed has been determined, occlusal relationships may be established by five methods. The choice of method will be determined by the existing partially edentulous situation of the patient location of remaining teeth in each arch, and the prior correction of any existing occlusal discrepancies. These five methods are (a) direct opposition of casts, (b) interocclusal records with posterior teeth remaining, (c) occlusal relations using occlusal rims, (d) jaw relation records made entirely on occlusion rims, and (e) recording functionally generated paths. Justify and briefly discuss the use of each of the five methods.

16. What are the disadvantages of using only wax for making interocclusal records?

17. What are the disadvantages in developing an occlusion to a stone template or stone teeth on a cast?
18. Materials of which the occlusal surfaces of artificial posterior teeth are made deserve serious consideration by the dentist. These considerations should be based on minimizing attrition of occlusal surfaces, maintaining the established vertical dimension of occlusion, and maintaining positive planar contact of posterior teeth. To best accomplish the preceding, please give the material of choice for occlusal surfaces that oppose (a) porcelain, (b) enamel, (c) restored natural teeth, and (d) fixed partial denture parts with gold occlusal surfaces.

19. Acrylic resin posterior teeth lend themselves to easier modification than do porcelain teeth when the interresidual ridge distance is small or when an edentulous space to be restored with the denture is grossly restricted. However, acrylic resin teeth have one big drawback when occluded against any other occlusal surface, including acrylic resin. What is this drawback?

20. The occlusal surfaces of acrylic resin teeth attached to a denture may be duplicated in gold and attached to the same teeth. Describe this technique.

21. Occlusal discrepancies created during processing procedures must be corrected before the patient is given possession of the dentures. When should this be accomplished? Why is it necessary?