Remounting and occlusal adjustment of complete dentures

Alexander Gutowski, Dr Med Dent

Complete dentures change in their dimensions during the polymerization process. Shrinkage leads to changes in the position of the denture teeth, and thus to changes in the entire occlusion. Neither a denture material nor a polymerization procedure is yet known that makes dimensionally accurate acrylic dentures possible, despite promotional claims to the contrary. Injection processes that run under high pressure provide only slightly better results than the conventional processes. Cold polymerization processes are somewhat better than heat curing. When the occlusally unadjusted complete dentures are inserted, however, the consequences of inherent occlusal disturbances quickly appear. In function, uneven pressure of the denture bases on the mucosa-bone support leads to tipping or displacement of the denture bases on the supporting tissue. In turn, this leads to formation of pressure points; the seat of the denture is altered and food particles find their way under the bases. It may be said that dentures, the occlusion of which has not been adjusted after fabrication, are functionally inadequate or require a great — if not artistic — measure of adjustment of the patient's tissues and feelings.

In principle, occlusal disturbances may be adjusted in one of three ways. The first and most ineffective way is to attempt to grind in the occlusion while the dentures are in the patient's mouth. The mobility of the denture bases on the supporting tissue does not permit evaluation and identification of premature contacts in centric occlusion and in tooth-guided excursions of the mandible with any degree of certainty. This is true even for the intraoral central bearing device described by Marxkors for direct adjustment of the occlusion in the patient's mouth.

The second possibility is "reocclusion" of the complete dentures. In this procedure, the polymerized dentures are not removed from the original models, but are replaced on the articulator and the occlusion is adjusted there. The results are imprecise because dimensional changes in the dentures appear to their full extent only after removal from the models. This is particularly true of the maxillary denture.

The third and most effective alternative is remounting of the temporarily inserted complete dentures. Transfer models are prepared for the finished, polished prostheses for this purpose. After a new jaw relationship is recorded, the prostheses are mounted in an adjustable articulator, an occlusal analysis is performed, and the occlusion is adjusted in the articulator.

Various opinions exist about the best time for remounting. Lauritzen recommends that the patient wear the dentures for 8 to 10 days before remounting. During this period, the prostheses can adjust to the supporting tissues, and water uptake by the resin is essentially complete. A decided disadvantage lies in the fact that the patient has difficulties with the functionally inadequate prostheses during this time. Occlusion-related pressure points and sore spots form, particularly in the mandible. Adjustments to the denture base do not correct the cause of these problems, and are wrong. In my experience, it is therefore desirable to remount the prostheses during the course of the initial insertion process. After placement of the prostheses into the denture bed, the occlusion is adjusted again in the articulator after the patient has worn the dentures for about 2 weeks. This procedure is recommended as well by Nagle and Sears.
Fig 1  Block-out of the maxillary denture base with silicone putty.

Fig 2  Block-out of the mandibular denture base with silicone putty.

Fig 3  The prosthesis have been separated from the remount models.
Remount models

The tissue sides of the finished, polished prosthesis bases are carefully inspected. Sharp edges are eliminated. The incisive papilla regions, the palatal rugae, and the regions covering highly movable ridge sections are relieved. The prostheses are then inserted temporarily and the margins are adjusted as needed. When necessary, the region of the torus palatinus is relieved somewhat. Only those dentures that are seated well on their tissue bases are appropriate for remounting. We check the temporarily inserted prostheses for function at this point.

The prostheses are removed from the patient's mouth and dried carefully. Undercuts on the tissue sides of the prostheses and the tongue space of the mandibular denture are filled with silicon putty (Figs 1 and 2). We mount the prostheses thus prepared on Class II dental stone (Fig 3). When the stone has set, we separate the prostheses from the model bases, remove the putty carefully, and reposition them on the models (Figs 4 and 5). The prostheses must fit well, without the least mobility, on the models. The Quicksplit system makes fabrication of split cast bases superfluous (Figs 6 and 7).
Registration and mounting

The spatial relationship between the teeth of the maxillary prosthesis and the anatomical hinge axis points and an anterior reference point is registered with an anatomic transfer bow (Figs 8 and 9). The anterior reference point is chosen specifically so that the occlusal plane of the prosthesis runs approximately in the vertical center of the articulator. This leaves sufficient space for both models in the articulator. The third reference point is marked 50 mm from the edge of the resting upper lip on the nasal ridge. If the glabella or the orbitale is selected instead as the reference point, insufficient room remains for the model of the mandible in those patients in whom the distance between the glabella and the incisal edge of the anterior teeth is greater than 7 mm. The reference plane for registration of the slopes of the condylar paths also lies too far cranially, leading to excessively steep condylar slope angles in the articulator. When face-bows fitted with glabellar supports are used, the supports are eliminated and replaced by an anterior reference indicator.

In complete-denture patients, the kinematic localization of the terminal hinge axis is fraught with a series of difficulties and uncertainties, particularly for the inexperienced care provider. If the vertical dimension is raised only slightly in determination of the horizontal jaw relation, the anatomic transfer of the terminal hinge axis may be sufficiently exact. “Sufficient” here does not mean equal or better, however. The anatomic transfer is, rather, the minimum requirement imposed on proper mounting of the model in the articulator. The maxillary prosthesis then is mounted in the upper part of the articulator (Fig 10).

Registration of the positional relationship of the mandibular arch to the maxillary arch in centric occlusion

Controversy continues about the position of the mandible in relation to that of the maxilla in the terminal occlusion position of the complete-denture wearer.1 - 4, 7 - 10 The differences in opinion, however, are more academic than practical. It is indisputable that the patient’s habitual terminal occlusion position is lost through the loss of all the natural teeth. The vertical and horizontal maxilla-mandible relationships must be established anew during the fabrication of complete dentures. The polymerization shrinkage of the resin leads to alterations in the position of the artificial teeth, and thus also to alteration of the occlusal relationships. The horizontal relation must be established anew if a correct centric occlusion position and excursions free of interferences are to be established through correction of the occlusion.

The retruded contact position has proven to be an acceptable, reproducible and thus verifiable position when the muscle-ligament-temporomandibular joint system is healthy or has been treated successfully. In the retruded contact position, the mandible, because of muscle action, is in a terminal hinge axis position.10 The condyloid processes are in superior, anterior, laterally correct positions on the posterior slopes of the articular eminences. The interarticular disks are in correct position between the bony or cartilaginous joint components.

The horizontal jaw relation can be registered in either of two ways for remounting:

1. With a functional registration in aluminum wax and zinc oxide-eugenol paste
2. With a central-bearing device registration

Experience has shown that satisfactory results are obtained with both procedures. We prefer the functional registration for several reasons. The central-bearing device system, in contrast to the functional registration, reduces the patient’s tongue space greatly, thus inhibiting the natural muscle functions, especially during the act of swallowing. The bearing point can center only a single prosthesis, if that. The vertical dimension of the prostheses must be increased significantly, ie, 5 to 10 mm in the support pin registration; otherwise the artificial teeth collide during excursive movement of the mandible. In contrast, in the functional registration, the vertical dimension is increased only 1 to 2 mm. If the registration position differs only slightly vertically from the centric occlusion position, the precision with which the desired centric occlusion can be replicated in the articulator improves. That is particularly the case when
Fig 8  Bite fork coated with compound. The dental arch of the maxillary denture has been placed on the bite fork.

Fig 9  Transfer of the position of the dental arch of the maxillary prosthesis to a skull-oriented reference plane with a Denar anatomical transfer bow.

Fig 10  Mounting the maxillary prosthesis into the upper part of the articulator.
Fig 11  Reference points on the labial surfaces of the denture incisors.

Fig 12  Measuring the distance between the marked points in terminal relation.

Fig 13  Compound finger rests on the external surface of the mandibular prosthesis in the region of teeth 34, 35, 44 and 45.

Fig 14  Aluminum wax has flowed onto the canines and posterior teeth of the mandibular prosthesis.

Fig 15  The patient closes on the aluminum wax until the desired vertical gap is reached.

Fig 16  Drop-wise application of aluminum wax following elimination of all mandibular tooth impressions.
only an anatomic transfer of the terminal hinge axis has been undertaken. To be fair, one must recognize that errors are possible as well in the functional registration. Dogmatic disputes about various registration techniques are of little use to the patient. It is more important that the dentist is skilled at the registration technique and has developed a flair, not to be underrated, in its use. No matter which method is used, two registrations always should be recorded and checked for identity with the check-cast technique.\textsuperscript{7}

The aluminum wax/zinc oxide-eugenol paste functional registration

To raise the vertical dimension as little as possible when the horizontal jaw relation is registered, a maxillary and a mandibular denture incisor is marked with a permanent felt tip pen (Fig 11). The patient is guided into the position of terminal occlusion with the prostheses and the distance between the marked points is measured and recorded (Fig 12). The mandibular prosthesis is removed from the mouth and dried. Finger supports of compound are placed on the outer surfaces in the region of the premolars and first molars (Fig 13). This permits secure adaptation of the mandibular prosthesis to its supporting base. Simultaneously, the dentist can guide the mandible bimanually into the terminal hinge axis position. A layer of aluminum wax 2 mm thick is placed on both posterior tooth complexes and the canines and allowed to flow into the outer and inner surfaces of the artificial teeth (Fig 14). By preventing moisture from getting under the wax layer, the wax will not separate during the registration process. The maxillary prosthesis remains in place and the mandibular denture is reinserted. The dentist explains and practices the registration procedure with the patient. The dentist guides the mandible from the rest position to the terminal hinge axis position. Both of the dentist's index fingers are supported by the previously placed finger rests; both thumbs are under the mandibular rami. The patient opens and closes the mandible slowly as it rotates about the hinge axis. The patient is instructed to touch the wax layer only slightly with the maxillary teeth. After this dry run, the registration can proceed.

The wax layers are warmed for 20 seconds in a 52 °C water bath and the mandibular prosthesis is repositioned. The patient closes the mandible slowly under the guidance described above, touches the wax layer with the maxillary arch, and remains in that position while the dentist checks the distance between the marked points with a sliding caliper. The patient closes on the mandibular arch until the distance desired between the marks is reached. The dental arches, in the ideal case, are only separated by 2 mm in relation to terminal occlusion (Fig 15). The mandibular prosthesis is removed from the mouth and the aluminum wax impressions are completely eliminated with a hot wax knife. Then a thin layer of aluminum wax is flowed (Fig 16) and the registration procedure is repeated (Fig 17). While the patient touches the wax layers lightly and evenly bilaterally with the maxillary arch, he sits upright and swallows several times; the dentist does not guide or support the mandible during this process. The mandibular prosthesis is removed from the mouth and the wax layers are cooled in ice water. The impressions must be achieved through impressions of the incisal edges of the canines or the cusp tips of the posterior teeth (Fig 18).

The mandibular prosthesis is repositioned in the mouth. The patient closes the teeth without guidance from the dentist. The maxillary arch must meet the impression exactly, and the stress from the prostheses on the tissue bases must be even bilaterally and anteriorly-posteriorly. Perception of uneven pressure results from impressions of various depth, which must be improved. In such instances, the registration must be corrected.

The impressions are refined by coating with zinc oxide-eugenol paste and repetition of the registration process (Fig 19). The mandibular prosthesis is not removed from the patient's mouth for this purpose. After arrangement of both prostheses (Fig 20), the mandibular prosthesis is mounted in the articulator with the lower remount model (Figs 21 and 22) with impression plaster. If the distance between the model of the mandible and the mounting plate is more than 10 mm or is uneven, mounting in two steps is undertaken. We check the correctness of the mounting with the Quicksplit system (Figs 23 to 27). The entire registration procedure is repeated on the patient after elimination of all impressions.
Fig 17  Registration of the retruded contact position.

Fig 18  Impressions of the maxillary teeth in aluminum wax.

Fig 19  Impressions in aluminum wax refined with Temp-Bond.

Fig 20  Arrangement of the maxillary and mandibular prostheses before mounting in the articulator.

Fig 21  Keying the prosthesis before mounting.

Fig 22  Mounting the mandibular prosthesis in the lower part of the articulator.
Fig 23 - 27 Checking the correct mounting of the Quick Split system.

Fig 23

Fig 24

Fig 25

Fig 26

Fig 27
We check the identity of both registrations in the articulator with the Quick Split system. If the registrations are identical, the likelihood that the registration was performed properly is high. Lack of coincidence in the registrations is a sure sign of faulty registration.\(^1\)

Registration of excursive movements of the mandible

It is expedient to carry out positional registrations of the excursive positions of the mandible or two-dimensional registrations of the condylar paths and the course of the lateral movements during prosthesis fabrication. The values recorded can be used during remounting if the anterior reference point of the face-bow transfer is selected to be identical with the first transfer.

The occlusion concept of the complete denture

For more than a century, the dogma of a fully balanced occlusion with bilaterally equal contacts of the anterior and posterior teeth in tooth-guided excursive movements was rarely disputed. That is surprising for several reasons. For one thing, mandibular movements would have had to be registered in two, or more suitably, in three dimensions and copied in a fully adjustable articulator. For another, it is nearly impossible technically to provide a bilateral and anteriorly-posteriorly balanced occlusion in an articulator without violating esthetic requirements of the anterior tooth region. Finally, the balanced relationships achieved in the articulator do not exist in the mouth during function. Encouraged by good experiences with excursively nonbalanced prostheses, about which C.E. Stuart had reported earlier, I discarded the concept of bilaterally balanced occlusion in my own practice and in my complete-denture courses.

The following conclusions may be drawn on the basis of more than 10 years of experience:

1. The patient does not perceive any difference in chewing ability between nonbalanced and balanced prostheses.
2. Excursively nonbalanced prostheses are technically much easier to fabricate.
3. Long-term observations demonstrate that the occlusion, and particularly centric occlusion, is more stable with nonbalanced prostheses. The patient is less likely to develop parafunctions.
4. Fractures of porcelain teeth, quite ordinary in balanced prostheses because of the extensive grinding procedures that they undergo, do not arise in nonbalanced prostheses.
5. The esthetic appearance of nonbalanced prostheses is convincingly better than in balanced prostheses, particularly in the anterior tooth region.

The occlusion concept that I use for complete dentures may be summarized as follows:

1. In the position of centric occlusion, which arises in a functional terminal hinge axis position and correct vertical dimension is correct, the posterior teeth touch evenly, bilaterally, and simultaneously. The incisors do not touch in centric occlusion. The interocclusal space is at least 50 µm in the articulator but may be significantly greater depending on the horizontal object.
2. Sufficient intercuspation depth exists in the posterior tooth region.
3. Before the anterior teeth, or the canines in tooth-guided excursions, can contact, guidance occurs bilaterally in a straight protrusive movement through the premolars or, in lateral movements, through the premolars of the laterotrusion (working) side. Contacts on the mediotrusion (idling) side are avoided in the articulator.
4. As soon as the anterior teeth have contact opportunity in tooth-guided protrusive movement, guidance is provided by the central incisors in protrusion or, if anatomic conditions preclude that, guidance is bilateral via the canines; in lateral movements via the canines on the laterotrusion (working) side.

Porcelain or acrylic teeth

Largely for reasons of convenience, acrylic teeth are used almost exclusively today for complete prostheses. However, acrylic teeth are associated with significant,
uncontrollable abrasion processes which work deleteriously to alter the occlusal relations. When porcelain teeth are used, however, precise determination of the jaw relation, remounting, and appropriate follow-up care must be assured. Under those conditions, porcelain teeth are superior to acrylic teeth esthetically and functionally as well.

Occlusal adjustment of the prostheses by selective grinding of the occlusal relief

The dentures, mounted in the articulator with impression plaster, now may be analyzed occlusally and the occlusion may be adjusted. We give adjustment of a cusp-fossa analysis priority. We note the existing or the desired position of the cusps and the depressions defined by ridges in the posterior tooth complex in centric occlusion. Starting from the existing position of the buccal cusps of the maxillary posterior teeth, we mark the desired position of the buccal cusps of the mandibular posterior teeth and the lingual cusps of the maxillary posterior teeth on the external walls of the artificial teeth with a felt tip pen, extending the markings to the cusp tips (Fig 28). The purpose of this cusp-fossa analysis is to determine the functionally correct relation of the occlusal relief in centric occlusion and in tooth-guided excursive movements. Whether the desired position of the cusps can be achieved through selective grinding adjustment of the artificial teeth depends on whether the jaw relation established during the primary mounting and remounting procedures are essentially identical, and whether care was taken during the initial tooth set-up to achieve the appropriate cusp-fossa relation. Only the occlusal interferences arising as a result of polymerization shrinkage should require adjustment by selective grinding.

Occlusal adjustment in the centric occlusion

We use fine-toothed carbide burs for grinding porcelain teeth. We begin by establishing the initial interfering contact in the retruded contact position. For this purpose, we guide the incisal pin of the articulator into contact with the incisal guide plate; the initial interfering
contacts of the antagonists occur during this process. The contacts are recorded with occlusal foil (Figs 29 and 30). Guided by the cusp-fossa position, we decide whether the interference is removed in the relief of the maxillary or the mandibular tooth, or whether both should be ground. Grinding proceeds such that the desired shape of the relief is achieved. Selective grinding is continued until even and simultaneous contact occurs in all posterior teeth bilaterally, a sufficient number of contacts exists, and a sufficient number of anterior-posterior and buccal-lingual contacts is provided (Figs 31 and 32), and the relations between the anterior teeth sought in the initial set-up of the artificial anterior teeth are achieved.

Occlusal adjustment of tooth-guided protrusive movements

In the next step, the interfering contacts arising in a tooth-guided protrusive movement are eliminated. An edge-to-edge position of the anterior teeth is copied in the articulator. This position is held with the aid of the protrusion screws and contact between the incisal pin and the incisal guidance plate. Points of both central maxillary and mandibular incisors should touch evenly and simultaneously in this position, while all other teeth are out of contact. The necessary grinding adjustments are made either on the maxillary or mandibular incisors, esthetic considerations being kept in mind (Fig 33).

The protrusion screws are turned back in the direction of the retruded contact position, millimeter by millimeter. If the anterior tooth relation permits, only the central incisors should have contacts; if that is not possible, the canines. Grinding adjustments may be done only on the palatal surfaces of the maxillary anteriors or canines after the edge-to-edge position has been left. If the complete dentures have been set up with a horizontal overjet because of anatomical conditions, anterior tooth contacts are not possible in a protrusive position of 1 or 2 mm from the retruded contact position. The contacts in such cases should be established through the premolars (protrusive group contacts). Grinding of the protrusive movement is stopped 0.5 mm before the retruded contact position.
Fig 34  Placement of grinding paste.

Fig 35  Checking the occlusion in the retruded contact position with slim stock sheets.

Fig 36  Checking the occlusion in the retruded contact position with slim stock sheets.

Fig 37  Prostheses in place.

Fig 38  Checking biting ability with an apple.
Occlusal adjustment in tooth-guided lateral movements

The initial mediotrusion of the mandible in right and left lateral movements and the mediotrusion angle (Bennett angle) are adjusted in the articulator. If no two-dimensional measurement of the lateral movements is undertaken, the articulator is adjusted bilaterally to an initial mediotrusion of 1 mm and a 10° Bennett angle. We begin with a right lateral movement. The mediotrusion condylar ball (balance condylar ball) is protruded 1 mm with the protrusion screw. The upper part of the articulator is pulled to the left until the condylar ball has contact with the guidance hinge of the left condylar housing. The laterotrusion ball (working-side condylar ball) must touch the back wall of the right condylar housing. In this position, canine contacts should be sought on the working side or, failing that, group contacts of the premolars on the laterotrusion side. Contacts on the mesiotrusion side (idling contacts) are eliminated. The protrusion screw is turned back stepwise and the occlusion is adjusted at each step. Finally, a lateral movement is made from the retruded contact position. When the retruded contact position is left, contacts between the canines and the premolars on the laterotrusion (working) side should remain limited. Traces of grinding in the relief of other posterior teeth are reduced to the extent that components near the fossae (contacts in the retruded contact position) remain, and the components toward the cusps (excursion contacts) are eliminated. This avoids loss of contact of the posterior teeth in the retruded contact position. Such an occlusal adjustment is repeated in the same manner for left lateral movements.

As a final step, fine adjustments are made in centric, until each pair of posterior teeth holds slim stock sheets evenly and simultaneously (Figs 35 and 36).

Insertion of the dentures and follow-up care

The prostheses are inserted (Fig 36). Their function is checked by, among other things, chewing peanuts and biting an apple (Fig 38). The patient is recalled for the following day. Any pressure points may be corrected only on the basal side of the prostheses. In general, two or three adjustments are required until the patient has no further complaints. The occlusion is examined again after about 2 weeks. After a further registration in retruded contact position and mounting of the mandibular prosthesis in the lower portion of the articulator, occlusion is adjusted again. Annual check-ups of the complete dentures and occlusal adjustments in the articulator, if required, ensure the long-term success of complete dentures.

References


Address:

Alexander Gutowski, Dr Med Dent
Königsturstrasse 15, D-7070 Schwäbisch-Gmünd, Germany.