

Complete Denture Remounting

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Summary

Correct occlusal relationships on complete dentures are part of the success in prosthetic treatment of edentulous patients. As denture base materials and fabrication procedures cannot provide dimensionally accurate complete dentures, it is necessary to check the occlusion. The relation between artificial teeth on complete dentures has a significant impact on even loading of denture foundations and optimum stabilisation of dentures during wearing. A remount procedure begins with fabrication of remount casts, determination and transfer of interarch relationships into the articulator. Deflective contacts on dentures are eliminated by selective grinding carried out in the articulator in the intercuspal position and by excursive tooth guided movements. The purpose is to represent a remount procedure as a constituent part of complete denture fabrication procedures in everyday practice. When selecting a dynamic concept of occlusion, priority is given to unbalanced dentures, i.e. to canine guided occlusion and/or to the concept of unilateral occlusal balance.

Key words: *concepts of occlusion, complete dentures, remounting, selective grinding*

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Introduction

Complete dentures are prosthetic replacements for lost natural teeth and lost soft and bony tissues, which are fabricated in order to restore impaired or lost functions and appearance. Fabrication of complete dentures comprises clinical and laboratory procedures, whose precise execution is of crucial importance for achieving success with fabricated dentures. Success is greatly influenced also by the psychosocial profile of the patient.

Denture foundations of complete dentures consist of residual ridges, palate and soft tissues that can

perform a valve effect in the marginal area of the denture base, i.e. by means of their limited movability they can enable a steady seat of the denture when in function. At the first examination, as well as at handing in of the finished dentures, beside marginal closure, the denture foundations with poor resilience (*papilla incisiva, rugae palatinae, torus palatinus, linea milohyoidea*) are checked, i.e. soft parts of the denture foundations without bone base.

Wearing of complete dentures represents an interaction between physical, biological and prosthetic factors (1). The denture base, mucosa of the denture foundation and saliva enable retention by

means of adhesion, cohesion and the effect of sticking. These are physical factors. Biological factors depend on the neuromuscular balance, content and amount of saliva. The forms of residual ridges can to a certain extent mechanically hold the denture base on the denture foundation. Movable parts of mucosa and muscles that have a favourable effect on stabilisation of complete dentures also during mastication, are included in this group. Occlusion and artificial teeth arrangement on the denture are prosthetic factors. Subsequent patient care and a remount procedure are important factors for stabilisation of complete dentures and their successful wearing.

Lower jaw movements and positions

Lower jaw movements and positions are inter-related with the anatomic structure of the temporomandibular joint, tooth occlusion, masticatory muscle activity and neuromuscular system.

Maximum intercuspatation is a static occlusion with maximum number of antagonist tooth contacts, independently of the position of the temporomandibular joint condyles. A synonym that was often used earlier is centric occlusion.

Habitual or acquired occlusion is a static occlusion established clinically on the patient, i.e. the occlusion the individual uses the most. Every occlusion is acquired, because there is no ideal and final occlusion. Abrasion, partial tooth loss and occlusal anomalies cause changes in the occlusion. In the habitual occlusion position, i.e. in maximum intercuspatation, the condyles are more ventral in relation to the position of the condyles in the centric relation position. Muscles guide closure in habitual occlusion.

The physiologic rest position is a position in which the head is held upright, the elevator and depressor muscles are in equilibrium in tonic contraction and the temporomandibular joint head is in a neutral position in the temporomandibular joint socket. Between the occlusal surfaces of the lower and upper teeth there is a functional space dependent on the type of occlusion, which is called free interocclusal space. The physiologic rest position of the lower jaw is 0.5 - 6.0 mm below the maximum

intercuspatation position, and a bit ahead, depending on the class of occlusion.

Centric relation is the most distal marginal and physiologic position of the lower jaw, and the temporomandibular joint condyles are located most cranially in the temporomandibular joint sockets. The centric relation position or retruded hinge position is the most distal unstrained marginal position of the lower jaw, which is physiologic and which is possible to register again with high precision. This is the most distal physiologic relation of the lower jaw to the upper jaw from which lateral movements can still be made. The relation between the bony parts of the temporomandibular joint determines centric relation. The condyles are situated bilaterally in the most cranial position in the temporomandibular joint socket, and they are in contact with the temporomandibular joint disk. The initial contact point of the tooth in centric relation is called retruded contact position (RCP), and tooth occlusion is called centric relation occlusion (CRO). Only in 10% of the population are the centric relation position and centric occlusion position identical, whereas in the remaining 90% of the population the lower jaw slides forwards from the retruded contact position 0.5 to 1.5 mm, without deviation. The centric relation position is used as a position of reference in application of articulators in dentistry.

There is a difference between functional and parafunctional movements performed within marginal movements of the lower jaw: maximum protrusion, retrusion, opening, closing and lateral movements (2-5).

Concepts of occlusion

In the theory of complete dentures different concepts of occlusion have been mentioned during past years, which have been changed with their application and experience. In Europe the basics of the study of the concept of bilateral occlusal balance were defined and developed by Gysi, Schröder and Gerber (6, 7). The study of bilateral balance was based on the examination of the temporomandibular joint and condylar path by Von Spee (8, 9). In the United States of America the so-called gnathologic

school developed, according to which also scientific examination of occlusion is called gnathology. A Scandinavian, Posselt, laid down the concept of the school *freedom in centric* (7, 9, 10).

The foundation of the gnathologic school is associated with McCollum (11, 12). With respect to fabrication of complete dentures the school advocated the application of balanced occlusion, whereby teeth in functional movements should be supported both on the laterotrusive and on the mediotrusive side. Bilateral occlusal balance requires tooth contacts in all positions and movements of the lower jaw. In the laterotrusive movement on the working side all teeth are in contact, and on the nonworking side at least one pair of antagonist teeth (2). This concept was preserved later as the most commonly applied concept for teeth arrangement in complete dentures. Stallard and Stuart (11, 12) changed the concept of the gnathologic school of past times: on the assumption that excursive movements are mainly masticatory movements, and that thereby teeth should not be in contact, a concept of canine protected occlusion was developed as the main characteristic of this school. D'Amico (13) compared the role of canines during evolution and concluded that it is of great importance for protection of the periodontal apparatus of a tooth. Canine guided (protected) occlusion implies even contacts of premolars and molars in maximum intercuspation, and the intercanine area to be held outside contacts. During laterotrusive movements antagonist tooth contact is present only on canines, whereas every second tooth contact, including the nonworking side, is considered as interference. Protrusion brings about contacts on incisors.

Lauritzen (14) also inclines towards the learning of the gnathologic school. He considers a canine as a proprioceptive control organ during laterotrusion and by means of which all posterior teeth are kept out of contact. Group guidance of the lower incisors and canines with the upper canines should be present during straight protrusive movement.

Posselt (15) laid the groundwork of the occlusal concept *freedom in centric*. Freedom in centric is a simple concept of occlusion to be applied in practice. It provides preconditions for physiologic relations with respect to lower jaw guidance, occlusal stability, mastication and deglutition. The original

concept of the gnathologic school is the correspondence between the maximum intercuspation and retruded contact position. The concept of freedom in centric implies possibility of movements from the centric contact in all directions in three orthogonal planes - horizontal, frontal and sagittal. On the lateral side there is no need for contact in four points, and during movements into laterotrusion and lateroprotrusion there should be no obstacles. Sliding movements should be free. In the case of tooth guidance, it is best to take into account only canine guidance.

Mann and Pankey (16) define *long centric* or *freedom in centric* by means of occlusal balance with anterior sliding movement between the terminal hinge axis position and habitual intercuspation of 1 mm. The principle of a group function (unilateral occlusal balance) on the laterotrusive side is a movement with a simultaneous guidance of canines, buccal cusps of premolars and the mesio-buccal cusp of the first molar. On the mediotrusive side there should be no contacts. During protrusion the posterior teeth are not in contact. In this concept of occlusion Schuyler (17) and other advocates (12, 18) of the group function recognised the possibility of stress compensation and achievement of normal functional relations.

Occlusal concepts should enable effective lower jaw movements and lead to occlusal stability, and they should be applicable in prosthetic treatment in general. In the approach to the problem of occlusion mainly in all areas of application in dentistry it is necessary to apply not only theoretic knowledge but also experience from practice.

Remount procedure

Errors in occlusal relationships of teeth on complete dentures are caused by various factors (19). They include changes in the condition of the temporomandibular joints, unstable trial bases for inter-arch relationship record, incorrect use of face-bow, transfer of casts into the articulator, inaccurately defined vertical and horizontal relation, irregular arrangement of the posterior teeth, use of excessive pressure during pressing of acrylic resin into the flask, inadequately closed flasks during polymerisation, as well as overheating of the finished den-

tures by final polishing (20). All the mentioned factors result from an error by the dentist or dental technician in the course of fabrication of complete dentures. Occlusal errors can also result from inevitable dimensional changes in the denture material during and after polymerisation (contractions) and from wearing of the finished dentures in the mouth (expansion of the acrylic resin due to water absorption) (21).

The purpose of this paper is to represent a remount procedure (placing the dentures back into the articulator) as an indispensable part of complete denture fabrication procedures. Polymerised and polished dentures are repositioned on the articulator. The first remounting is performed before the dentures are handed in to the patient and the second after a certain time of wearing. The first procedure corrects occlusal errors resulting from imperfect fabrication, and the second, after wearing of dentures, adjusts the denture base on the denture foundation. When reseating the dentures on the articulator, the existing casts, if preserved, can be used, or it is necessary to fabricate new casts for transfer.

Fabrication of remount casts and transfer of dentures in the articulator

The remount procedure starts with preparation of dentures for fabrication of remount casts. The dentures are dried and undercuts in the denture base and lingual area are filled with hard silicone (Figure 1). Remount casts are made from hard stone. As soon as the stone is hardened, the silicone is taken off the dentures and the dentures are placed on the casts with high precision. The transfer of the upper denture, according to the horizontal plane of reference, is performed by anatomic face-bow, which is satisfactory with respect to accuracy and practicality of application. As opposed to split casts, some articulators have a system with a magnetic disk (e.g. in the SAM 2 articulator the control system SAM Axiosplit). The remount cast with the upper denture is positioned on the mounting table and bonded with stone to the upper mounting stand of the articulator.

Determination of the horizontal interarch relationship

A habitual and physiologic occlusion is an important factor of adjusted relations in the mas-

ticatory system. By loss of all teeth the patient loses habitual occlusion (3). The horizontal and vertical interarch relationships are reconstructed at fabrication of the upper and lower complete denture. In maximum intercuspation of artificial teeth the condyles of the lower jaw must be in the centric, i.e. physiologic position within the temporomandibular joint socket.

Centric relation, i.e. horizontal interarch relationship is determined once again by a remount procedure. The functional position of the terminal hinge axis is determined by functional record by means of aluminium wax and zinc oxide paste.

Vertical interarch relationship is preserved during registration. Points are made with a permanent marker on the labial surfaces of the upper and lower central incisor, and the distance between them is recorded by sliding callipers in maximum intercuspation. Finger rests for the operator (made from compound thermoplastic impression material), which are placed in the premolar and molar area, enable recording. In this way a steady seat of the lower denture on the denture foundation is achieved (Figure 2). The dentures are dried and a 1 mm thick layer of aluminium wax is applied to the outer and inner surfaces of distal teeth in order to prevent intrusion of saliva. With the dentures prepared in this way, the patient first practices guidance of the lower jaw into centric relation until he touches the wax layer.

The lower denture with the wax layer is immersed in the water bath at 52°C for 20 seconds and placed on the denture foundation. The patient closes the mouth gently, as he has practised, and by means of antagonist tooth contact the operator checks the recorded distance between the control points, which must be the same or increased by the space between the teeth not exceeding 0.2 - 0.5 mm. The lower denture is removed from the mouth, all wax impressions chilled in water are trimmed off with a scalpel and the procedure is repeated. The patient in an upright position touches the upper dental arch slowly and simultaneously without the operator's aid. The dentures are removed from the mouth, the impressions are chilled in water, and their depth and uniformity are checked. Only canines and cusps of lateral teeth can make impressions. The procedure is repeated if uneven pressure creates impressions

of different depths. The upper teeth on the denture must perfectly slip into the respective impressions on the lower denture. Zinc oxide eugenol paste is applied into the impressions with a thin brush and a definite record of the interarch relationship is made.

The dentures connected with the record are mounted on the casts fastened by warm glue (Pattex). In the mounting table of the articulator the lower cast is attached with stone to the lower mounting stand of the articulator. A record check is repeated by elimination of impressions, and a check in the articulator is performed by means of split casts.

Elimination of deflective occlusal contacts in the articulator

Correction of occlusal relationships starts with mounting of dentures on the casts in the articulator and marking of the relation between fossae and cusps on the buccal and oral surfaces of the posterior teeth from the cusp tip to the tooth equator by a permanent marker (Figure 3).

The final correction of possible occlusal disharmony on dentures is carried out by the process of *selective grinding*. Selective grinding preserves the desired tooth form and types of occlusion (22). Occlusal contacts in the retruded contact position are marked with thin articulating paper. The process of marking and grinding is repeated until bilateral, simultaneous and uniform contacts of all lateral teeth, optionally also of canines, are obtained. A sufficient number of anteroposterior and buccolingual stabilising tooth contacts is needed. Every deflective contact is trimmed with a bur in order to preserve the tooth morphology (Figure 4). Incisors must be outside occlusion. It is important that the incisal pin always contacts the incisal table simultaneously with mutual tooth contacts.

The next step is elimination of deflective occlusal contacts at straight protrusive movement. The border occlusion of the anteriors is transferred into the articulator by means of protrusive interocclusal bite, and this position is maintained by means of a protrusive screw and contact between the incisal pin and the anterior guidance holder. Only incisors produce a simultaneous and uniform contact.

Deflective contacts are ground with a bur on the palatal side of the occlusion rim due to aesthetic reasons (Figure 5). Then the upper mounting stand of the articulator is moved gradually for 1 mm towards the retruded contact position, where also canines should make contact, and if contacts between incisors are not possible, they should be made also on the first premolars (protrusive group contacts).

Control of the right and left tooth guided lateral movement can be initiated if the articulator is programmed (e.g. setting of Bennett angle in the SAM articulator by means of setting the red SAM extension at 10° on both sides). It is started with the right lateral movement. The upper part of the articulator is moved towards left whereby the condylar ball on the working side touches the rear wall of the housing. It is necessary to produce contacts on canines by selective grinding, i.e. on premolars on the working side (Figure 6). Deflective contacts are eliminated by grinding of excursive contacts (of the part beside the cusp), and the ones nearer to the fossae are preserved, because this is the place of contacts in the retruded contact position. Each contact on the free or balancing side is eliminated (Figure 7). The same correction is carried out also on the left side.

Occlusal errors in the retruded contact position and their correction

In the retruded contact position there are three types of occlusal errors and each can be corrected by specific grinding (20):

1. Any pair of antagonist teeth can be too long and thus hold other teeth out of contact.

For correcting this error fossae on teeth are deepened by grinding so that teeth can enter each other. The cusps are not reduced!

2. The lower and upper teeth can be placed almost edge-to-edge.

For correcting this error cusp inclines are ground. Buccal inclines of the upper teeth and lingual inclines of the lower teeth are ground. Central fossae become broader, and by grinding on the palatal side the maxillary palatal cusp is made narrower, and the mandibular buccal cusp is narrowed by grinding on the buccal side. The cusps are not reduced!

3. The upper teeth can be positioned too buccally in relation to the lower teeth.

For correcting this error the maxillary lingual cusp is narrowed by broadening the central fossa, and the mandibular buccal cusp is ground buccally by broadening the central fossa. Actually, the palatal cusp is ground in the palatal direction and the mandibular buccal cusp in the buccal direction so that teeth can enter each other. The cusps have not been reduced or are not reduced!

Occlusal errors on the working side and their correction

On the working side there are six types of occlusal errors. Each causes the other tooth to be held out of contact in the working occlusion and needs selective grinding of specific cusp inclines.

1. The maxillary buccal cusp and the mandibular lingual cusp are too long.

For correcting this error the length of the cusp is reduced by grinding in order to change the incline extending from the central fossa to the cusp tip. The central fossa is not deepened, but the maxillary buccal cusps and the mandibular lingual cusps are reduced so that the other tooth is in contact in this position.

2. The buccal cusps are in contact, but the lingual are not.

For correcting this error the maxillary buccal cusps are ground from the central fossa to the cusp tip in order to reduce the cusp and to change the lingual cusp incline to become less steep.

3. The lingual cusps are in contact, whereas the buccal are not.

For correcting this error the mandibular lingual cusps are reduced by grinding their buccal incline. The maxillary palatal cusp is not reduced, and the central fossa is not deepened.

4. The maxillary buccal or palatal cusps are positioned more mesially from their intercuspal position.

This error can occur together with any of the three errors already described. For its correction the mesial inclines of the maxillary buccal cusps are ground distally as if they were narrowed, and the distal inclines of the mandibular cusps are

ground forwards. In this way the same cusp incline is obtained.

5. The maxillary buccal or lingual cusps are positioned more distally from their intercuspal position.

This error can also occur together with buccolingual errors. For its correction grinding is performed on the maxillary cusps distally and on the mandibular cusps mesially.

6. The teeth on the working side can be out of contact.

The cause of this error is an intense contact on the nonworking side.

Occlusal errors on the nonworking side and their correction

The contact on the nonworking side is so intense that teeth on the working side are out of contact. For correcting this error pathways are ground over the mandibular buccal cusp in order to reduce the incline of the part of the cusp that prevents tooth contacts on the working side. Each interfering cusp is preserved as much as possible. Grinding is not performed on the lingual cusps that can be included in this contact.

In prosthetic treatment, through application of the concept of unbalanced occlusion there are canine guidance or group contacts (concept of unilateral occlusal balance) on the working side. On the balance side each contact is considered as interference. This viewpoint excludes the concept of bilateral occlusion that was predominant for a long time (23).

Control of dentures during wearing

The success of prosthetic treatment of edentulous patients is determined by a good function with complete dentures. The pressure points should be eliminated in two to three visits and in this way sore spots on the denture foundation can be eliminated. A remount procedure also helps, which can be repeated several times in cases of very atrophied and movable residual ridges. If the process of denture base adjustment on the denture foundation is not fully completed, a remount procedure is performed again after 2-6 weeks. It is advised to perform a functional control of dentures once a year.

A remount procedure of complete dentures should be accepted as an indispensable procedure in everyday practice of complete denture fabrication (24). Gutowski (25) recommends this procedure to be performed 4-7 days after handing in the dentures and, if necessary, after 4-6 weeks.

In order to have a better review of occlusal contacts without presence of saliva, movability of dentures on the denture foundation and influence of soft tissues in the oral cavity, it is much better to analyse and grind the occlusion on the dentures in the articulator. A remount procedure comprises repositioning of the finished dentures on the articulator on the old preserved casts (26), by means of a simplified procedure with rubber materials of high consistency (27) or by fabrication of new casts.

Theoretically and practically, the occlusal concept that used to be most applied in fabrication of complete dentures is the concept of bilateral (balanced) occlusal balance (9, 10, 28). This concept implies even contacts of the anterior and posterior teeth in excursive movements (29).

Bilateral occlusal balance of natural teeth is rare, and as a concept of occlusion of complete dentures it is technically hard to perform and requires the use of fully adjustable articulators. On the basis of his own experience and other authors' studies Trapozzano (30), (Schmidt-Diemel (9, 10), Gausch (31), End (32)), Gutowski (25) does not consider the concept of balanced occlusion to be necessary in fabrication of complete dentures. Gutowski (33) prefers the concept of unbalanced occlusion. Simplified, this is the concept of canine guidance (mutually protected occlusion) and/or the concept of unilateral occlusal balance (lateral group function), which are the most frequent in the relations of natural teeth. It is pointed out that the patient primarily does not differ mastication with balanced dentures from mastication with unbalanced dentures. Unbalanced dentures are fabricated more easily, their aesthetics is better in the anterior teeth area, and occlusion with such complete dentures is more stable during a longer time and with less parafunctional movements. Unilateral occlusal balance would be the selected option for tooth arrangement on the denture. In maximum intercuspation only the posterior teeth are in uniform and simultaneous contact, whereas between the anterior teeth there is

a distance that can be increased by wearing dentures. In lateral movements each contact on the balancing side is considered as occlusal interference. The anterior teeth, including canines, contact during protrusive movements, and the posterior teeth are not in contact.

Conclusions

1. The procedure of investment into the flask and pressing of acrylic resin causes changes in the size of the denture resulting in a change in the occlusion of artificial teeth.
2. It is not good to correct occlusal errors directly in the patient's mouth. Movability of dentures on the denture foundation and inadequate willingness of patients to cooperate result in incorrect representation of occlusal relationships in maximum intercuspation and excursive mandibular tooth guided movements.
3. A remount procedure of the finished dentures is a constituent part of prosthetic patient treatment in practice of complete dentures. Correct occlusal relationships are a part of the success in prosthetic treatment of edentulous patients. By fabrication of complete dentures tooth occlusion is reconstructed in the articulator, and an attempt is made to avoid deflective occlusal contacts.
4. Occlusal disharmony is eliminated by selective grinding of denture teeth. Unilateral occlusal balance is the selected option for tooth arrangement on the denture. In maximum intercuspation only the posterior teeth are in a uniform and simultaneous contact, whereas there is a distance between the anterior teeth. In lateral movements each contact on the balancing side is considered as occlusal interference. Occlusion of such dentures is more stable for longer time and with less parafunctional movements.

Dedication: This paper is dedicated to our teachers Prof. (HR) Alexander Gutowski and Prof. Krešimir Kraljević Ph.D.