The Necessity For Postorthodontic Precision Grinding For Balanced Occlusion

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INTRODUCTION

When teeth are moved into what is considered to be a correct and finished orthodontic position, this final positioning is often correct only in centric occlusion. It is rarely correct in centric relation, or in various eccentric positions of nonfunctional and functional relationships.

For the purpose of this paper, centric relation is that relation of mandible to maxilla determined by the unstrained muscular positioning of the condyles in the fossae in which there exists a primary point, or points, of contact between upper and lower teeth. Centric occlusion is that position of full closure under muscular pressure where as many points of contact as possible are present. This may vary from centric relation by involving strained positioning of a condyle or condyles. The cause of this is a "skid" along inclined cuspal planes from the primary point, or points, of contact of this centric relation into functional occlusion.

Despite exacting orthodontic mechanotherapy, the proper amount of overtreatment, and the use of positioners for final settling, a proper registration of centric relation after correction often reveals primary points of initial contact, as well as cuspal interferences in lateral movement. These require further correction. Orthodontic appliances themselves cannot produce the necessary final balance. This may now be accomplished by proper selective grinding for occlusal harmony.

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REVIEW OF THE LITERATURE

A review of the literature indicates, as long ago as 1930, that ideal occlusion could not be achieved purely by orthodontic means. Ottolengui[1] indicated that only one perfect position and direction existed for each tooth to achieve the highest efficiency for functional occlusion, and no possible effort of the orthodontist could attain this result in most cases. He also stated that any slight variances from this ideal positioning of the teeth would interfere with proper function. Even before this, Milo Hellman[2] made the statement that perfect occlusion as conceived by the orthodontist is mythical.

In 1935 Schuyler[3] noted the importance of correcting occlusal disharmony, both in natural and artificial teeth. "When the position of a tooth is changed, it presents an unworn or improperly worn surface which would seldom immediately function in harmony with approximating teeth without corrective grinding. As teeth are brought into desirable position, a coordination of its contact with the opposing tooth could well be a common practice rather than the exception." In a later article Schuyler[4] cautioned us about the importance of occlusal harmony for proper orthodontic results. "Orthodontists should be equipped with the knowledge of the importance of the proper interdigitation of teeth, oc-

clusal balance, static centric occlusion, and maxillo-mandibular relations in both centric and eccentric mouths." The suggestion was made to set up the finished orthodontic models on an articulator in proper centric relation to help correct possible disharmonies in occlusion, and avoid traumatic injuries, relapses or failures.

Maxwell[5] delivered a paper in which he said that evolutionary intent was to produce shapes and arrangements of all teeth so that functionally they make continuous bilateral occluding contact with one another during all the movements of mastication.

Strange[6] had this to say as a comment on his paper, "I would prefer to enumerate or understand them (Maxwell's postulates) as practical ideals that demand careful and thorough study. The teeth are held in place by a group of factors, some static and some dynamic, and only so long as these forces stay in balance will the teeth stay in normal occlusion."

Radusch[7] commented about methods of relieving occlusal trauma. She explained that even unworn cusps may cause traumatic changes due to excessive forces or sharp cusps or too long a lever arm. Teeth in normal occlusion are least likely to transmit injurious stress.

More recently, a number of articles have appeared in the orthodontic literature relating to equilibration of occlusion.

Coleman[8] has offered a well-rounded article indicating the use of selective spot grinding in orthodontics to eliminate premature contacts and secure simultaneous contact of as many teeth as possible. A detailed method of balancing an occlusion was presented and the importance of equilibration to prevent relapse was noted.

Shore[9] said that the correct placement of the dentition in the skull is the static phase, and correct maintenance of the cuspal inclines of the teeth as they function is the dynamic phase of occlusion. Occlusal equilibration aims toward harmonious relations in function between inclined planes of the teeth, neuromusculature, and temporomandibular joints.

Kuljaca[10] wrote about proper selective grinding procedures after orthodontic treatment. He said that an adjustable articulator was necessary only for complicated cases and suggested the casts be mounted with the aid of a face bow.

Wylie[11] qualifies the use of an articulator for occlusal equilibration after orthodontic treatment until the case settles to some extent. This would avoid, to some degree, the necessity of immediate mounting of the final casts and possibly some of the equilibration. Articulators should be used with properly mounted models for selective grinding only after the case is stable. Occlusal equilibration is no substitute for good orthodontic treatment.

Rothner[12] wrote about the necessity for occlusal equilibration after orthodontic treatment and outlined a method similar to Schuyler's to accomplish this.

Thompson and Craddock[13] and Blume,[14] more recently, have reported about orthodontic cases in which they studied occlusion in centric and in lateral excursion and the importance of avoiding interferences.

The importance of a balanced occlusion after orthodontic treatment has not escaped previous notice in the literature. We find only one article, written by Heimlich[15] which pinpoints the need for balanced lateral excursions as well as balanced occlusion. We find no record of a series of completed cases, chosen at random, in which points of interference during both functional lateral movements, as well as centric

relation into centric occlusion are studied in detail.

Materials and Methods

This paper is a study of ten orthodontic cases, selected at random from the files of one of the authors after treatment was terminated. These patients were recalled, upper and lower impressions were taken, and stone models poured. A method of relaxing the masticatory muscles by tiring for a twenty-minute period was utilized. A wax bite was then taken as the condyles were placed in an unstrained position in the temporomandibular fossae. Six consecutive bites were taken of each patient. If four or more of the six bites indicated the same point or points of initial contact, the models were mounted in that relationship on a simple articulator indicated on the photos to be shown. Each case was studied in centric relation and occlusion, as well as in eccentric excursions.

Description of the Data

The ten cases were studied before and after orthodontic correction by careful examination of the occlusion as seen by conventional, polished orthodontic models, and later by the centric relation of the plaster casts mounted on a Johnson-Oglesby articulator.

The examples utilized ranged from Class one (Angle) malocclusions to Class two, Division one and Division two. Extractions were performed in some instances and the full dentition retained in others. Some of the posterior malocclusions were unilateral, others bilateral. Elastic traction was used in some cases and cervical traction with headgears in others. None of the cases studied were in Class three malocclusion at the inception.

Scrutiny of the posttreatment models properly mounted in centric relation indicated some interesting observations.

In every case the centric relation and centric occlusion were not identical. Forcing the bite into centric occlusion usually resulted in a normal, Class one, posterior and anterior interdigitation. But this was created by a "skid" of the mandible, mostly forward, sometimes unilaterally, governed by the inclined planes from the points of initial occlusal contact in centric relation. In a few instances the difference between centric relation and centric occlusion was slight. More often there was considerable variance compensated by a skid into forced occlusion.

The last of the ten cases studied was originally a Class two, Division one, subdivision malocclusion. The left posterior segment was in poor relationship. Some crowding of the lower arch was present. It will be described in greater detail since it mirrors the other cases in this paper.

Analysis of the Illustrations

The last case, number 10, is worthy of more detailed analysis as being typical of the others studied and described in this paper. It should be noted that the method of taking these photographs by means of propping mirrors at either side of the model, at about 50°to the camera, results in a slightly distorted image since the view is somewhat from the posterior rather than a direct lateral sight. This exaggerates somewhat in a Class II direction.

This original malocclusion, appearing as a Class II, Division 1, unilateral left side, with crowded lower anteriors, may well have been a bilateral cusp-to-cusp bite before the onset of treatment. An earlier, more careful analysis of centric relation may well have been more exacting in this regard but must now remain speculative. A pretreatment centric relation with a bilateral cusp-to-cusp initial point of contact easily skews into a unilateral Class II occlusion by simple rotational sliding

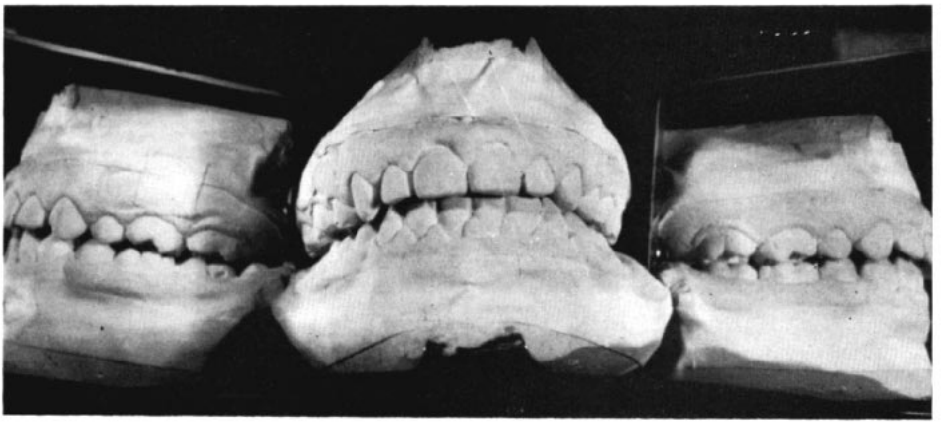

Figure 1 Centric relation.

of the mandible.

Treatment consisted of the removal of the four first bicuspids, moving the cuspids on the right side distally in parallel fashion, and moving the upper cuspid on the left side more distally than the lower cuspid to achieve proper cuspid rotation. Thereafter, remaining spaces were closed and the midline corrected with the aid of elastic traction, primarily on the left side. The crowdings and rotations were also corrected.

Figure 1 illustrates the centric relation after treatment. The point or points of initial contact indicate that unstrained positioning of the mandible results in a bilateral cusp-to-cusp posterior occlusion. The premature points of contact are the mesial marginal ridges of the upper second bicuspids and the mesiolingual cusps of the upper molars with the lower arch.

Figure 2 demonstrates forced closure under pressure. Note that the occlusion is now a solid Class I and the posterior interdigitation is normal in appearance. This is accomplished by the mandible sliding forward into this position, carrying the condyles ahead of their usual accepted positions in the glenoid fossae in so doing. The degree of path-

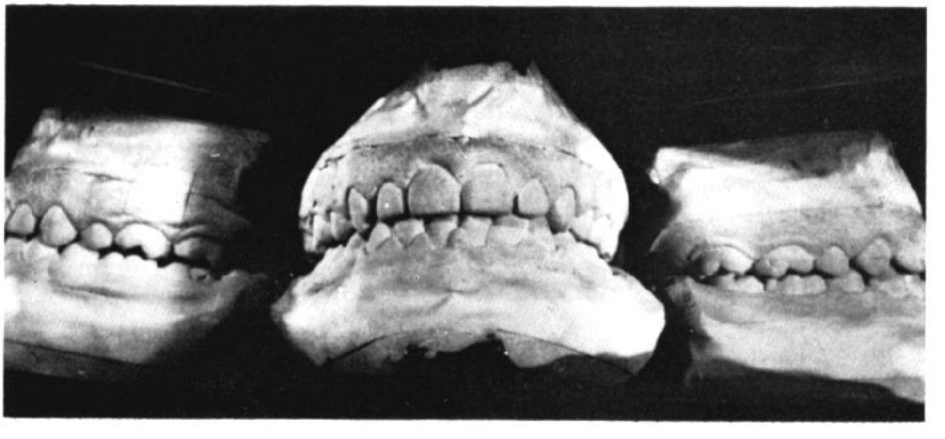

Figure 2 Forced Occlusion.

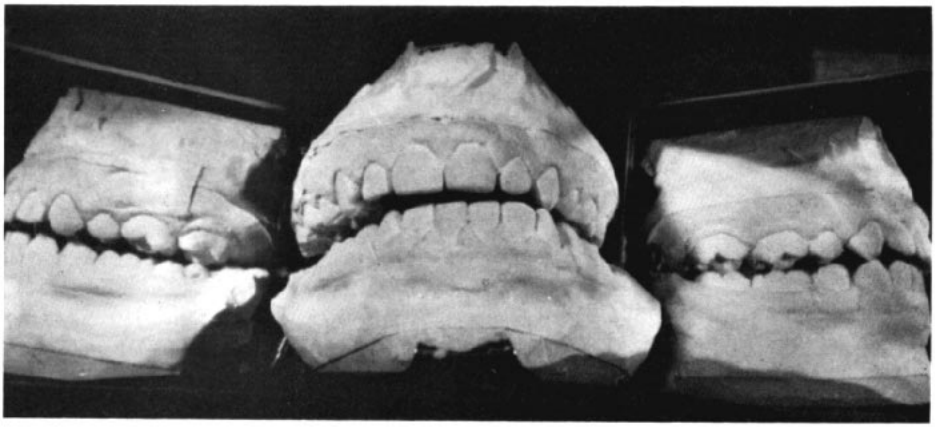

Figure 3 Left Lateral Excursion.

ology that ensues as a direct result of this will depend on the accommodative tissue tolerance of the individual involved.

Figure 3 shows left lateral excursion. Note that the two points of initial contact on the left side are the incisal edges of the cuspids and the mesiolingual cusp of the upper second molar with the lingual-inclined plane of the mesiobuccal cusp of the lower second molar. The balancing side of this aspect shows one obvious premature contact of the mesiolingual cusp of the upper second molar with the lingual-inclined plane of the distobuccal cusp of the lower second molar.

Figure 4 illustrates the right lateral excursion. In this position the right or working side has one point of contact, at the cuspids. The balancing aspect is represented solely by the mesiolingual cusp of the upper second molar prematurely occluding with the lingual-inclined plane of the distobuccal cusp of the lower second molar.

In both lateral excursions we find the mandible teetering on a few points of contact and a complete lack of contact and function of the remaining teeth. One may well speculate what the health of this dentition and its investing and

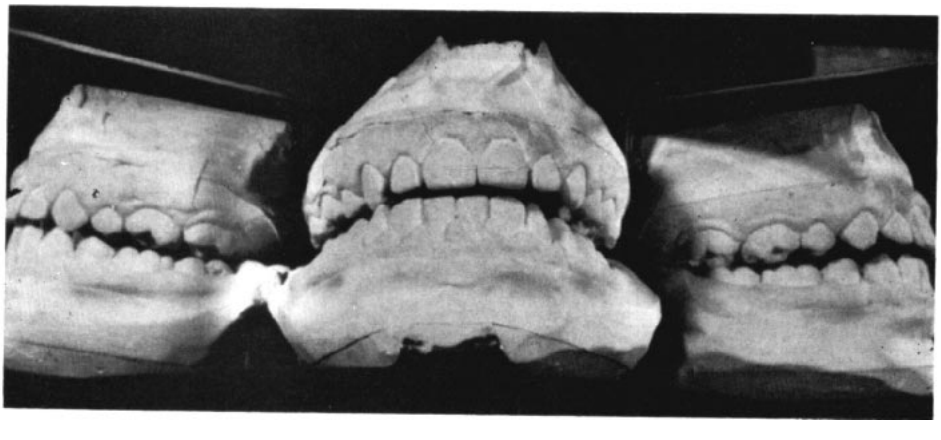

Figure 4 Right Lateral Excursion.

supporting structures would be on long-range examination.

Discussion

At the present time the use of selective equilibration after orthodontic therapy is not commonplace in private practice and, in fact, is rarely taught in graduate and postgraduate courses. Yet the very stability of the end result depends often on the equating positions of centric relation and centric occlusion, and on balanced functional mandibular movements. The proper balanced equilibration of the dentition after active treatment is just as important as the proper mechanical approach and appliance manipulation to any given orthodontic problem. It is evident from the random sampling presented in this paper that points of primary contact (prematurities) are present in every case. Functional interferences are invariably demonstrable to some degree; balancing inequities nearly always. These imbalances, if allowed to persist, may result in damage to teeth, periodontal membrane and bone. Prolonged inequities of this type sometimes culminate in temporomandibular joint problems. Some of the relapse we encounter after treatment is due to lack of balanced occlusion in the treated case. Routine balancing, after a period of functional adjustment in the retention phase, would result in increased final stability.

We are convinced that the proper relation of the condyles to their fossae is at that place when, after muscular fatigue, the mandible is in an unstrained position with some point, or points, of unforced tooth contact. This position is termed "centric relation." We are aware that differences of opinion exist on this score, but our entire treatment is based on the validity of this assumption and its correlating and following principles.

The main purpose of orthodontic correction is to provide proper function and balanced distribution of stress. Any other object is definitely secondary. Yet some of the orthodontics which has been done under the guise of achieving the aforementioned results has, in effect, wrought severe damage instead. Correct office procedure in every orthodontic case must include selective equilibration after active treatment is completed. We must caution, however, that equilibration is an essential aid to, but never a substitute for, proper orthodontic procedures.

The question arises whether the relationship of the unmounted, polished models conventionally used for case analysis and treatment plan have *any* validity. To achieve proper relationship of the teeth with regard to correct temporomandibular position the models should be mounted on an articulator, utilizing the correct bite registration. This may be done as previously described, or by other acceptable methods such as Nathan Allan Shore's aluwax procedure, or Schuyler's check-bite method. Proper diagnosis may be made only in this manner.

It is interesting to study the Class II, Division 1, bilateral malocclusions discussed here, which were treated by mandibular anchorage and intermaxillary elastics. During the retention period a relaxed bite was taken and the models correctly mounted. The Class I, normal occlusion apparently achieved is still in effect a Class II relationship. The resultant occlusion is an habitual relationship, or so-called "Sunday bite." If the models, mounted in correct centric relation, are forced into tighter occlusion, the mandible skids forward and terminates in what appears to be a normal relationship, but actually is not. Here, complete retreatment, rather than selective equilibration, is indicated. In effect, maxillary protrusion is still pres-

ent and will remain so if further treatment by means of intermaxillary elastics is utilized. The elastics serve to drag the mandible and the condyles forward, out of their proper positions in the temporomandibular fossae. Correct treatment here would involve moving the maxillary dentition posteriorly rather than forcing the mandible and its contained dentition forward.

In many of the Class II malocclusions studied, examination of the models in centric relation gave evidence that the assumption of orthodontic success in posterior bite-correction was erroneous, and the cases showed a tendency toward still being a Class II. This was true on the affected side or sides, whether the malocclusion was unilateral or bilateral. We speculate that the use of intermaxillary elastics was permanently effective where the elastic tension succeeded in sliding the mandibular posterior teeth forward within alveolar bone, similarly moving the maxillary posterior teeth distally within their alveolar housing. However, that portion of the elastic tension which moved the entire mandible forward, and the condyles out of their fossae, created an illusionary occlusion. The forced bite, sliding along planes initiated by points of primary contact, skewed the mandible forward into a pseudonormal occlusion. We must conclude that elastic tensions should be used judiciously with careful analysis of their resultants of force.

It is unfortunate that one of the authors, the orthodontist, was not familiar with the technique for proper bite registration at the time the cases illustrated in this paper were started. More adequate material for analysis and study would have been provided if each set of models had been originally related in relaxed bite position, on an articulator, as well as by the conventional method.

Many orthodontic relapses are due to unsatisfied occlusal adjustments. It is impossible to orthodontically control the movement of one inclined plane of one cusp of a tooth without making unwanted changes in the other inclined planes of that tooth. Multiply this by the number of planes on the number of cusps of all the teeth, and the task is insurmountable. Many relapses of upper and lower incisors, including some diastemas, are due to pressures exerted in functional movements. Some of these may be avoided by correct selective grinding.

A note of caution should be mentioned about the use of cephalometric head x-rays as a diagnostic tool. Lateral and frontal headplates must be taken with the patient biting in centric relation for proper registration and analysis of component parts. Tracings taken of headplates where the subject has a centric relation and a centric occlusion which do not coincide may yield a series of false measurements if the patient was in forced occlusion at the moment of radiography.

To minimize the precision balancing necessary after correction, it is proper procedure to check on centric relationship just prior to removal of the tooth-moving appliances. Adjustments can be made at that time by finishing appliance manipulations, utilizing judicious overcorrection, and the use of tooth positioners to aid in functional adjustment and settling. Good orthodontic therapy is always possible and essential. Selective equilibration should be an essential part of every orthodontist's armamentarium.

Conclusions

1. Primary points of contact in centric relation existed in every case studied.
2. Lateral mandibular movements evidenced lack of proper distribution of functional stress in working positions due to cuspal interferences in either

working or balancing sides, or both.
3. Equilibration cannot be a substitute for proper orthodontic correction but must be utilized as a necessary adjunct.

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