Selective Grinding as an Aid to Orthodontic Therapy[1]

ALBERT C. HEIMLICH, D.D.S.
Santa Barbara, California

We, as orthodontists, are interested in any technique that will help us to achieve a more nearly perfect result in treatment. We have focused much of our attention to date on the techniques necessary to bring teeth into proper alignment. In doing so it is possible to lose sight of the importance of keeping the teeth stabilized and healthy in their new positions. Routinely we take complete records, thoroughly analyze our case, carefully place each band, make full use of the advantages of our appliance and latest techniques during active treatment, and finally place our retainers. *Then,* however, we trust the benign forces of Nature to settle the teeth into a balanced occlusion during the retention period. All too often we find such forces uncooperative. It is during this retention period that some of us fail to take advantage of a most important aid in preventing traumatic occlusion and in preserving the results of treatment. I refer to selective occlusal spot grinding, accomplished for the most part, during the first few months of retention.

Selective occlusal spot grinding is concerned with the recontouring of that portion of each tooth which interferes with normal, balanced occlusion. It is extremely important that the greatest of care be exercised in choosing the areas to be ground and in judging the amount of tooth structure to be sacrificed.

This paper will be limited to include only those cases which have been well treated, where condylar and occlusal centric are the same, and where the teeth bear a good relationship to each other and to their supporting tissues. It may well be that cases which, for one reason or another, have not turned out right, need occlusal equilibration, but the problems encountered here are more complex. They require further and more comprehensive study and such cases are outside the scope of this paper.

I should like to point out:

First: Why it is necessary to adjust the occlusal surfaces in a mouth that has been treated orthodontically.

Second: What happens to the teeth and their related structures when there is occlusal interference.

And then I would like to present a method to relieve these interfering tooth surfaces, with the end in view of distributing the masticatory forces over the greatest number of teeth possible and thus reduce trauma, improve function, and supplement retention.

It would seem that we should have to do no occlusal grinding in a well-treated case, particularly when we have the advantage of being able to place each tooth separately with our appliances and when we have the additional help offered to us by positioners, if we wish to use them. There are, however, factors over which the appliances and its aids have no control, such as a dis-

[1]Presented before a joint meeting of the Pacific Northwest, Northern California and Southern California Components of the Edward H. Angle Society of Orthodontists, Pebble Beach, California, November 9, 1950, and at the Charles H. Tweed Foundation for Orthodontic Research, Tucson, Arizona, April 2, 1951.

crepancy in tooth size and shape, lack of wear on non-functional or impacted teeth, poorly contoured fillings, and so forth. These conditions all result in occlusal interference. Positioners themselves sometimes lock teeth with steeply inclined planes together — so tightly that eccentric movements are inhibited. Furthermore, teeth in malocclusion have developed facets of wear to allow for acceptable balance and function. When these teeth are moved to new positions, the old facets are no longer in use. There is no way for nature to carve new facets overnight and, as a result, we find a few teeth assuming the load intended for many.

When one or two teeth are forced to assume the same load that was meant for several, or when there is occlusal interference, a traumatic condition ensues. Few mouths have sufficient resistance to withstand indefinitely continued traumatic occlusion. Therefore, unless this condition is relieved there will occur, sooner or later, a definite breaking down of the tissues. This is readily understood when you realize that the crushing strength in the molar region is between 100 and 200 pounds, and that sometimes only two or three teeth are taking the entire load. Such symptoms as erosion, hyperemia, and pulpstones in the teeth, pain in the condylar region, and gingivitis followed by periodontoclasia in the gingival and alveolar structures have frequently been traced directly to traumatic occlusion.

When we have occlusal interference, Nature tries to move the teeth to protect them. When one or two teeth are made to assume the burden intended for many, they are subjected to force that is capable of moving them just as surely as an appliance. Many times the relapse of the lower anteriors has been blamed on pressure directed through the contact points from erupting third molars, when in reality the crowding was caused by Nature's effort to avoid trauma by repositioning teeth that were interfering with normal occlusion. For example, an over-occlusion of the mesial slope of the upper cuspid on the distal slope of the lower cuspid can easily move the latter tooth mesially with a resultant crowding of the lower anteriors. When an interfering tooth is not readily moveable, such as mesially inclined second or third molars, condylar displacement follows with the usual untoward symptoms in that region.

It is folly to take refuge in the hope that all defects in occlusal balance are self-rectifying. If, by selective grinding, we remove the *major* obstacles in her path, Nature will accomplish the final milling in for us over a period of time.

The teeth should not be equilibrated at one sitting, but more ideally at several. This should be accomplished for the most part during the first months of retention. When the bands are removed and retainers are placed, a minimum of grinding is done. Only major obstacles, particularly severely interfering cuspids, are relieved. The reason for this is obvious: The teeth will settle even with retainers in place and some of the interference will be, at least in part, self-adjusted. In the course of the next few weeks the teeth again should be relieved to a minor degree. In from four to six months the teeth will have settled to a fairly stable relationship. It is *now* that we should finish our equilibration with the end in view of distributing the masticatory forces over the greatest number of teeth in all positions and excursions.

At this time it would be most desirable to introduce masticatory exercises designed to teach the patient how to chew in eccentric excursions, particularly if he has not been able to do so before. The benefits are three-fold: First, chewing efficiency is increased; second, investing tissues are properly

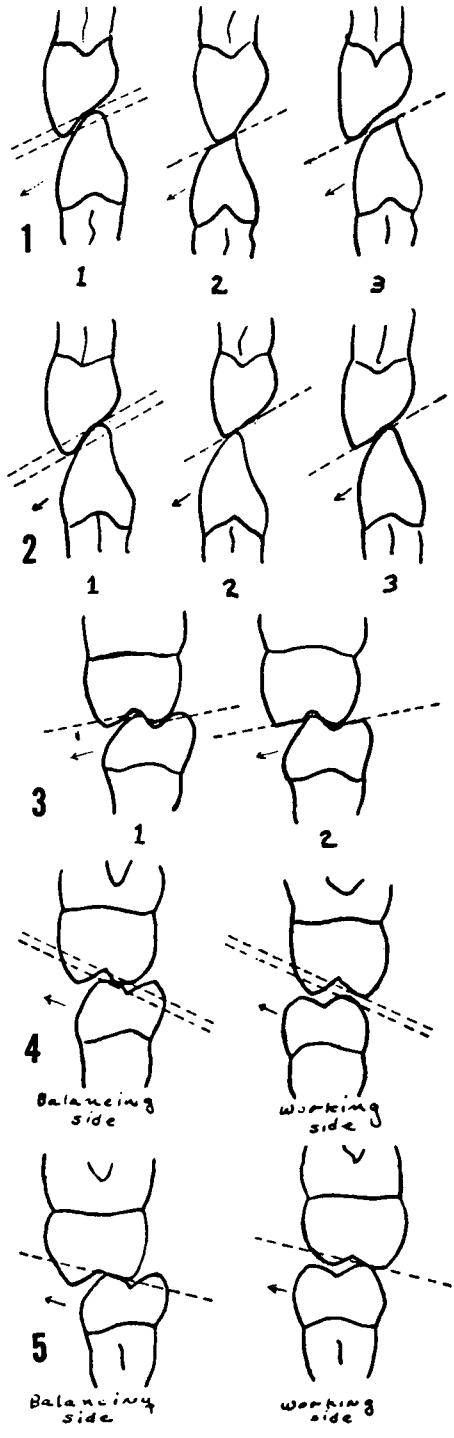
stimulated; third, retention is supplemented.

We must bear in mind throughout the entire period of adjustment that we are merely helping Nature to work into a free, unobstructed, balanced occlusion. It is important that a *minimum* amount of tooth structure be removed and that such removal shall be done in a systematic manner. Any anatomical markings that are lost during equilibration should be restored, so that the cutting efficiency is not diminished. Each time the patient presents for occlusal adjustment we should observe and correct centric position, protrusive position, protrusive excursion, right and left lateral excursions. This must be done in sequence.

To insure success in correcting occlusions it is imperative that we learn and remember certain fundamental mechanical principles or rules. I shall enumerate several of these principles which are considered important and illustrate them with examples.

In the following drawings (Figs. 1 - 5) it was found necessary to *exaggerate* the amount of tooth structure to be removed for the purpose of clear demonstration.

The first rule to be considered is the following: In correcting the contacts of one jaw relationship, we should not mutilate those of another. For example, let us assume that the cuspids are interfering in lateral excursion and must be relieved (Fig. 1, diagram 1). The dotted lines represent the correct path of occlusion. The portion of either tooth in Figure 1, diagram 1 that lies between the dotted lines might be removed to allow for acceptable function in lateral excursion. If we elect to relieve the *lower* cuspid, as shown in Figure 1, diagram 2, we will have contact in lateral excursion, but, as we see in Figure 1, diagram 3, we have lost contact in centric position. Our alternative is to remove the portion of the



Legend: Figs. 1-5; see text for detailed analysis.

upper cuspid, that is between the dotted lines (Fig. 2). Then we have contact not only in lateral excursion as seen in Figure 2, diagram 2 but also in centric position as seen in Figure 2, diagram 3. This same reasoning applies to all of the anterior teeth. In the event we should have an elongated lower incisor, however, this tooth of course would be relieved.

Rule No. 2. (Fig. 3) In the posterior region on the working side we usually relieve only the *buccal* cusps of the upper teeth and *lingual* cusps of the lower teeth as indicated by the slide. You will notice in Figure 3, diagram 2 that the untouched upper *lingual* and lower *buccal* cusps maintain the maxillo-mandibular opening. Again, the dotted line indicates the path of occlusion.

Rule No. 3. (Fig. 4) When premature contact exists on the *balancing* side, it is usually because the grinding inclines are too steep as related to the working inclines on the opposite side. The first diagram of Fig. 4 shows the steep inclines of the balancing side in contact between the dotted lines, which represent the path of occlusion. The second diagram shows the working side out of contact. Correction is made by reducing the steepness of the inclined planes on both the upper and lower molars on the balancing side, which, in the diagram, would mean removing the tooth structure *in contact* between the dotted lines, since this is the amount of tooth substance that is causing the opening on the working side.

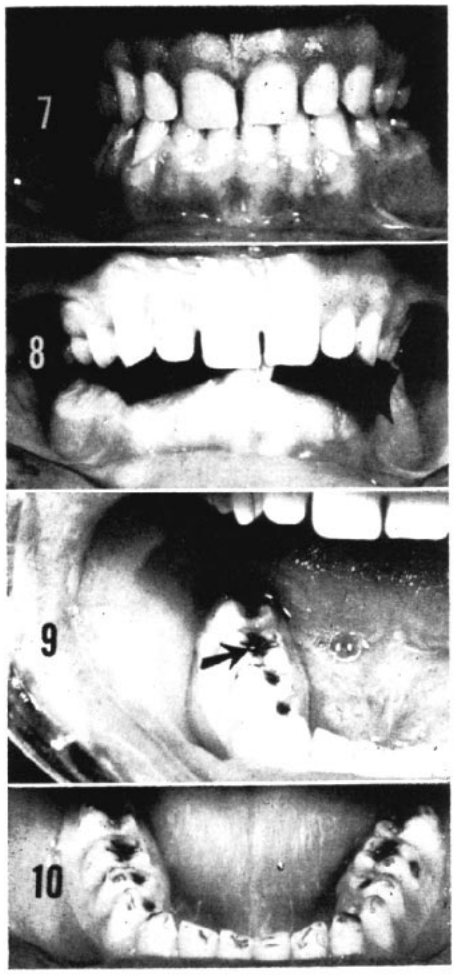
(Fig. 5) The steepness of the balancing inclines has been reduced enough to allow contact on the working side. One must be careful to grind only on the inclines and not on the *tips* of the cusps. If it becomes necessary to grind a balancing cusp tip in order to gain contact on the working side, then grind whichever cusp that is least needed for function in other positions and excursions.

Fig. 6—Auxiliaries used for occlusal equilibration: knife-edge and cylindrical stones, polishing disk and articulating paper.

With these basic principles in mind, we are ready to do a case, which has been picked especially because it involves most of the problems routinely encountered in occlusal adjustment subsequent to treatment. It is important to take each step in order to insure the best results.

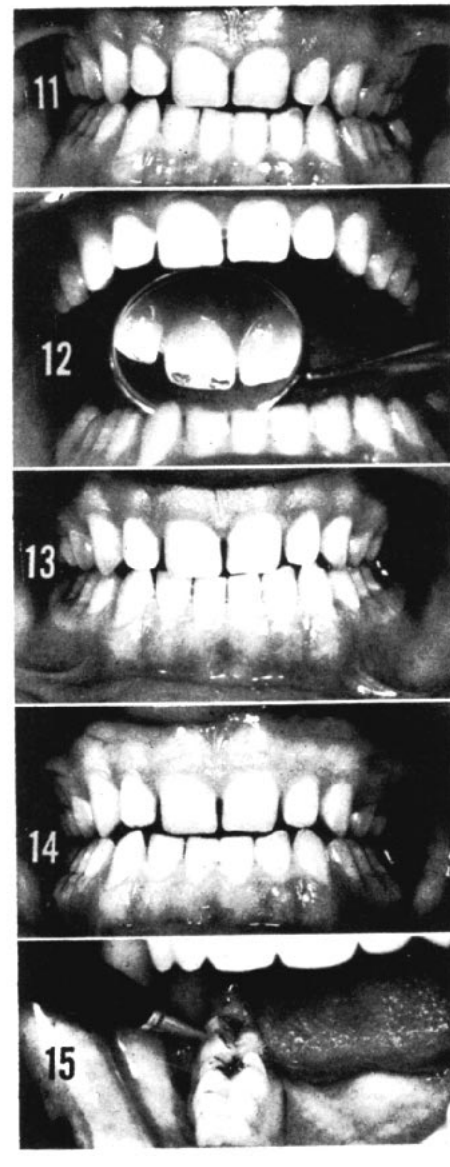
The only auxiliaries that we will need are a knife-edge stone, a cylindrical stone, a polishing disk and some articulating paper. (Fig. 6).

The patient is presenting six months after the bands have been removed for his final equilibration. (Fig. 7). He has been taught how to bite in all positions and to move in all excursions so that accurate marks with carbon paper can be made. *Centric position* must be established first. (Fig. 8). Carbon paper is placed in each side of the mouth and centric relationship is registered. We look for overloading on high fillings, oversized and interfering ridges and cusps. A high filling is revealed. (Fig. 9). Notice the light area in the center part of the carbon mark on the lower right first molar indicating over-occlusion. This spot is relieved together with two or three other over-occluding areas. Now the blue marks show an even distribution of contact points in centric position (Fig. 10).



Figs. 7-10—See text for discussion of this case as it appears in these and subsequent figures.

After centric position is established, grinding of the teeth in other positions and excursions must be accomplished in such a manner that centric is not disturbed. Our patient is instructed to bite into protrusive position. (Fig. 11). The objective here is to secure a maximum of contact with as little grinding as possible. Since we eat most of our food with utensils, it is not mandatory to have all anterior and posterior teeth contacting simultaneously in the protrusive position or excursion. At this time any irregular surfaces due to malformation or chipped edges are leveled off and made more esthetic. Our rules remind us to confine grinding to the lingual incisal surfaces of the upper teeth. Articulating paper points out areas of interference on the lingual incisal surfaces of the upper right central. (Fig. 12). These areas are relieved and our grinding is completed for protrusive position. You will notice



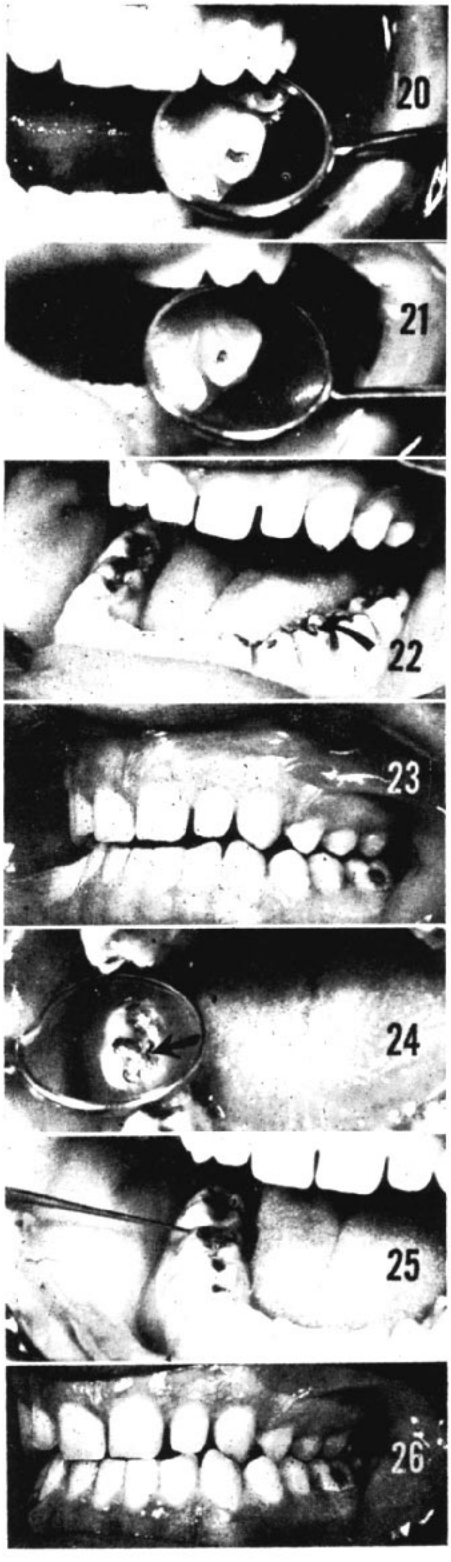
that the lower left lateral projects incisally on the distal. (Fig. 13). This point was left because the esthetics are not objectionable and it is in function in lateral excursion, as I shall point out later.

We now ask the patient to slide forward in protrusive excursion. (Fig. 14). The anterior teeth open slightly as the jaw slides forward. There seems to be some *posterior* interference. Carbon paper bears this out. (Fig. 15). Directly ahead of the pointer we see a blue mark denoting that a lower buccal cusp is contacting an upper buccal cusp. (Fig. 16). Bearing in mind our principles, we grind upper buccal cusps and not lower buccal cusps. The correction is made and now the excursion from centric to protrusive can be accomplished without hindrance. (Fig. 17).

Most of the equilibrating is done for lateral excursions because most of our food is ground during this function. (Fig. 18). Many cases that appear to be successful in centric position (Fig. 18) are faulty in lateral excursion. (Fig. 19). Our objective in this excursion is to secure simultaneous contact of as many teeth as possible on the working side. The *balancing* side contact is desirable although it is dangerous if premature contact exists. With carbon paper in place on the working side, the patient bites with his normal chewing stroke from lateral to centric position. It is *extremely* important that the registration be made in this manner instead of the usual way of sliding from centric to lateral because the chewing stroke *must* be guided by the condyle and not by the newly placed teeth. The cuspids are clearly the main point of interference and will be relieved first. This is very common and can be minimized during treatment by soldering cuspid brackets toward the incisal edge. Remembering our basic rules, we are careful not to remove that part

of the upper tooth which contacts in centric position. In Figure 20 this area is represented by the portion of the carbon mark nearest the gingiva. The area on the cuspid which enters into lateral excursion has been ground, (Fig. 21) while the part of the carbon mark representing centric position has been carefully avoided. I should say here that, if *too much* tooth structure needs to be taken from the upper cuspid to allow function in this lateral movement, it is permissible to grind the *lower* cuspid provided the part of the tooth contacting in centric position is not disturbed.

We again test with articulating paper. (Fig. 22). The first bicuspids



are the main points of interference. The white area inside the blue mark on the lower second bicuspid shows us the area of excessive contact. Again, remembering the principles outlined, we grind the *complementary* mark on the buccal cusp of the upper bicuspid. Once more we test the lateral excursion. (Fig. 23). The patient immediately notices interference on the balancing side and this is verified by spacing between all working side contacts. So we check with carbon paper and find (Fig. 24) the buccal slope of the lingual cusp of the *upper* second molar contacts (Fig. 25) the lingual slope of the buccal cusp of the *lower* second molar. We now have reduced the steepness of the guiding planes above

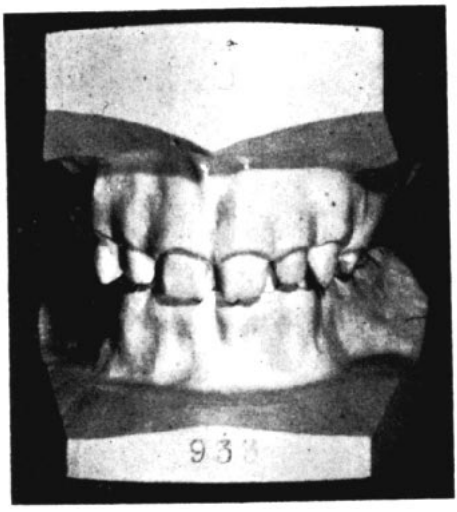


Fig. 31—The original malocclusion as it presented for treatment; preceding figures deal with the occlusal equilibration of the case following active treatment.

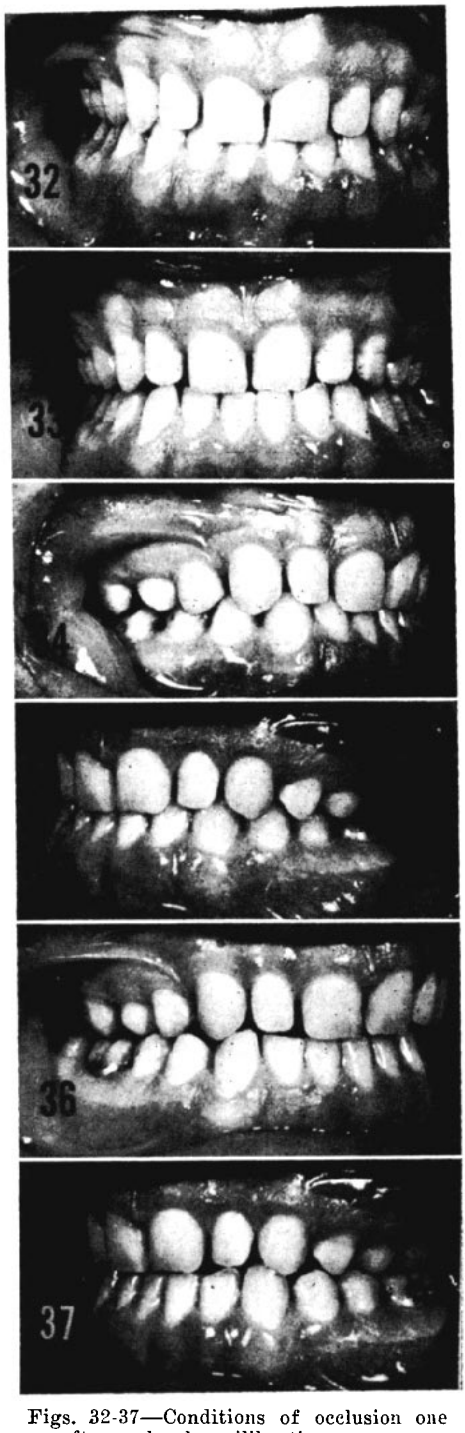
and below on the balancing side until the working side is uniformly in contact during lateral excursion. (Fig. 26). Notice that the upper lateral contacts the lower lateral on its high distal point. This is the reason that the point was not removed while improving the esthetics in protrusive position.

Finally, the carbon paper shows us that there is simultaneous contact of all opposing teeth on the working side. (Fig. 27). The opposite working side is relieved in the same manner. (Fig. 28). We see right excursion before grinding (Fig. 29 and afterwards. (Fig. 30). Occlusal adjustment is now completed.

Since the case just shown was somewhat more complicated than the general run of cases needing equilibration, it might be of interest to view the same mouth a year later.

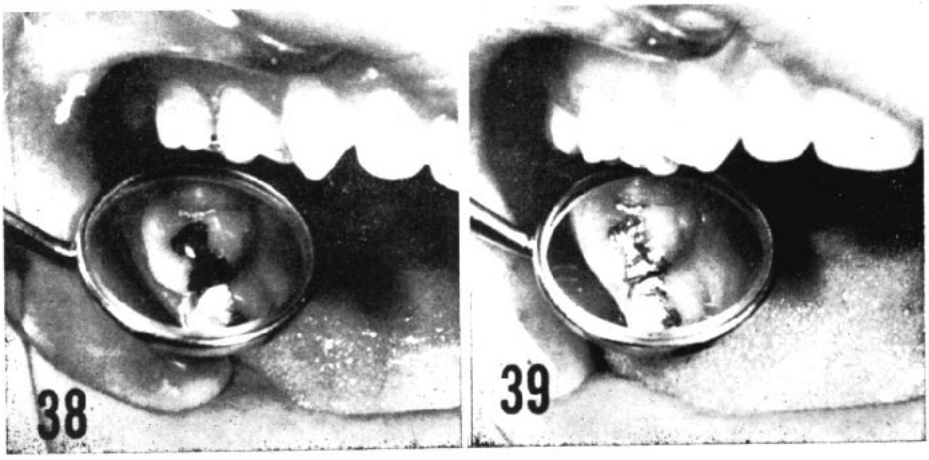
The next six photographs were taken one year later for purposes of comparison. Originally the malocclusion was a deep overbite. (Fig. 31).

So far there has been no recurrence as we see in centric position. (Fig. 32). Protrusive position shows no change and protrusive excursion was normal.



Figs. 32-37—Conditions of occlusion one year after occlusal equilibration.

(Fig. 33). The mesio-distal relationship of the cusps in right centric (Fig. 34) and in left centric (Fig. 35)



Figs. 38-39—A situation where occlusal equilibration is indicated *before* treatment. Here it was necessary to provide some anatomy in a dental restoration.

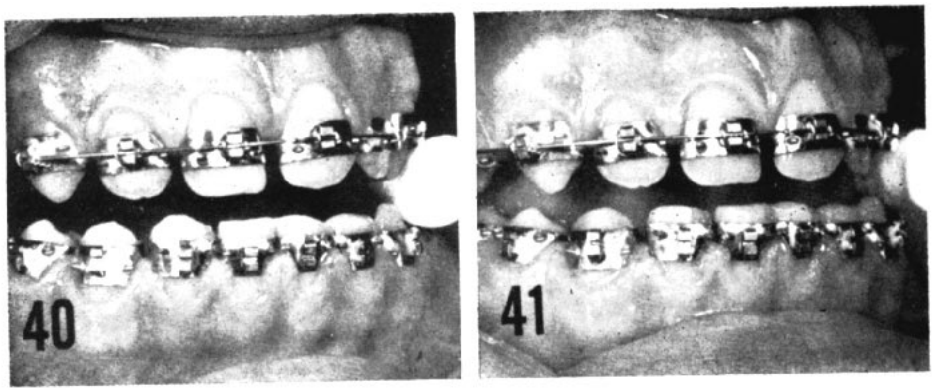
have not changed. Right lateral excursion remains appreciably the same except that the right lateral is slightly out of contact. (Fig. 36). This was easily corrected by a small amount of grinding on the upper cuspid and first bicuspid. Left lateral excursion has not changed. (Fig. 37).

It was previously stated that most of the equilibrating is done during the first few months of retention. At this point, I would like to illustrate some of the exceptions to this statement:

Often it is expedient to do some grinding before the placement of bands, sometimes during active treatment and on occasions, as long as two or three years after retention.

In Figure 38 we have a restoration which is devoid of anatomical carvings. Notice the round bright area in the center of the filling denoting overocclusion. Fig. 39 shows the same tooth after the anatomical carvings have been restored previous to band placement. If there are any teeth which are obviously malformed, they should be touched up to give some semblance of the normal.

In Fig. 40 bands have been placed, taking into consideration the irregular and projecting incisal edge of the



Figs. 40-41—Equilibration at time of band formation: adjusting incisal level of lower right lateral incisor.

Fig. 42—A transverse ridge which should be modified before treatment.

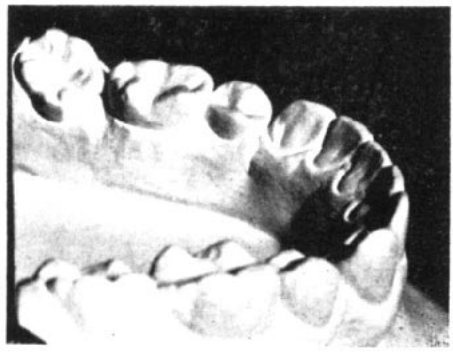


Fig. 43—A mesially inclined and rotated second molar which requires grinding.

lower right lateral. If left projecting, it might interfere with the mechanics of treatment. So the lateral is reduced at this time, to its normal size *before* treatment is started. (Fig. 41).

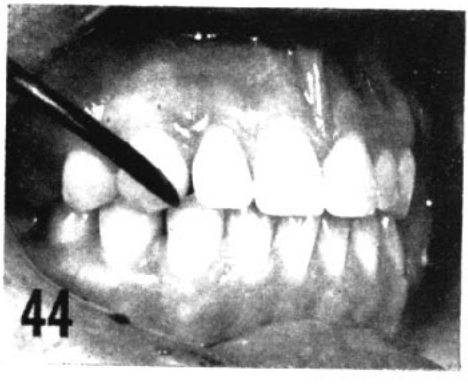
During treatment we may find that overly large transverse ridges and malformed cusps and fillings interfere with Class II mechanics. Notice in Fig. 42 the transverse ridge on the upper left first bicuspid which undoubtedly would strike buccal cusps below during class II mechanics. An adjustment of the appliance is not always the answer and often some grinding is indicated.

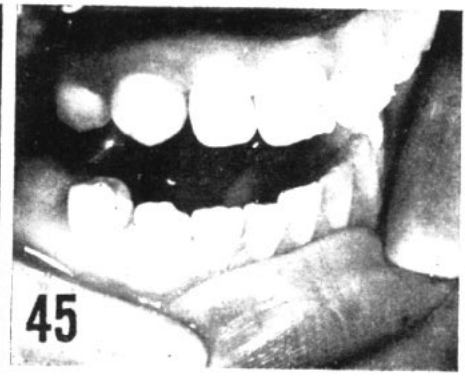
In rare instances, long after treatment is concluded, we will find that a mesially inclinded second or third molar is disturbing occlusion. (Fig. 43). Since these teeth are not readily movable, mandibular displacement often follows with the usual untoward symptoms in the fossa area. The offending teeth should be relieved according to the principles we have learned.

For the purpose of re-emphasizing the fact that teeth can be *displaced* or *traumatized* by over-occlusion, I would like to show the following photographs:

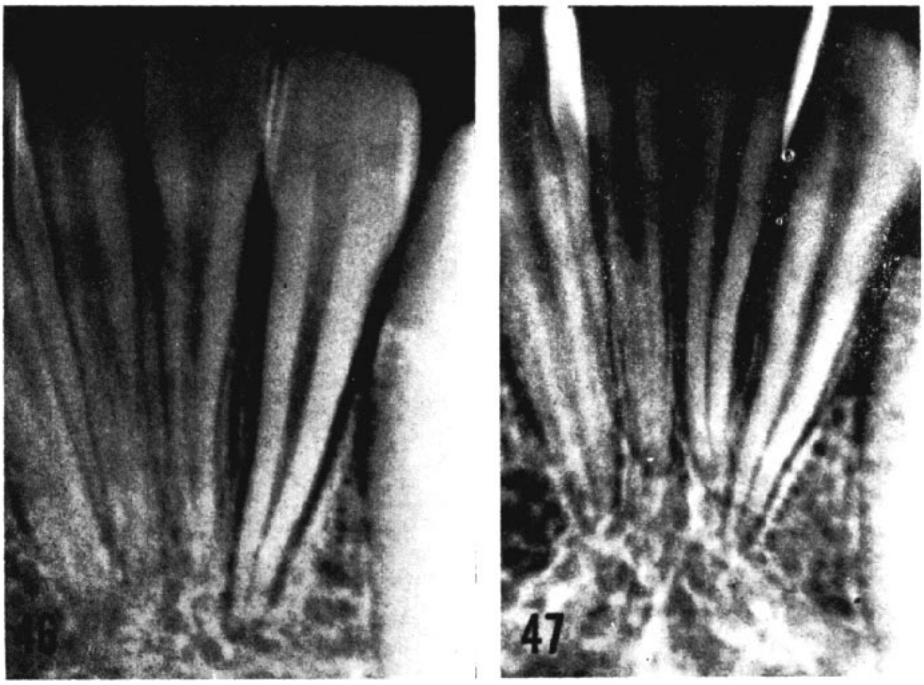
(Fig. 44) To illustrate teeth being displaced, our first photograph shows a condition of over-occlusion on the mesial slope of the upper cuspid against the distal slope of the lower cuspid.

The lower cuspid, lateral and central have been moved mesially en masse from the forces exerted during right lateral excursion. (Fig. 45). The correction is made by grinding the mesial





Figs. 44-45—Showing heavy occlusion on a mandibular cuspid and the consequent irregularity in the mandibular incisors.



Figs. 46-47—Roentgenographic evidence of the beneficial tissue changes which can follow occlusal equilibration.

slope of the upper cuspid and the distal slope of the lower without disturbing the centric points of contact.

(Fig. 46) As an illustration of the results of traumatic occlusion, the roentgenograms show a definite enlargement of the peridental membrane about the root of the right lateral. The occlusion was adjusted and after an interval of two months we find this improvement in the affected area. (Fig. 47).

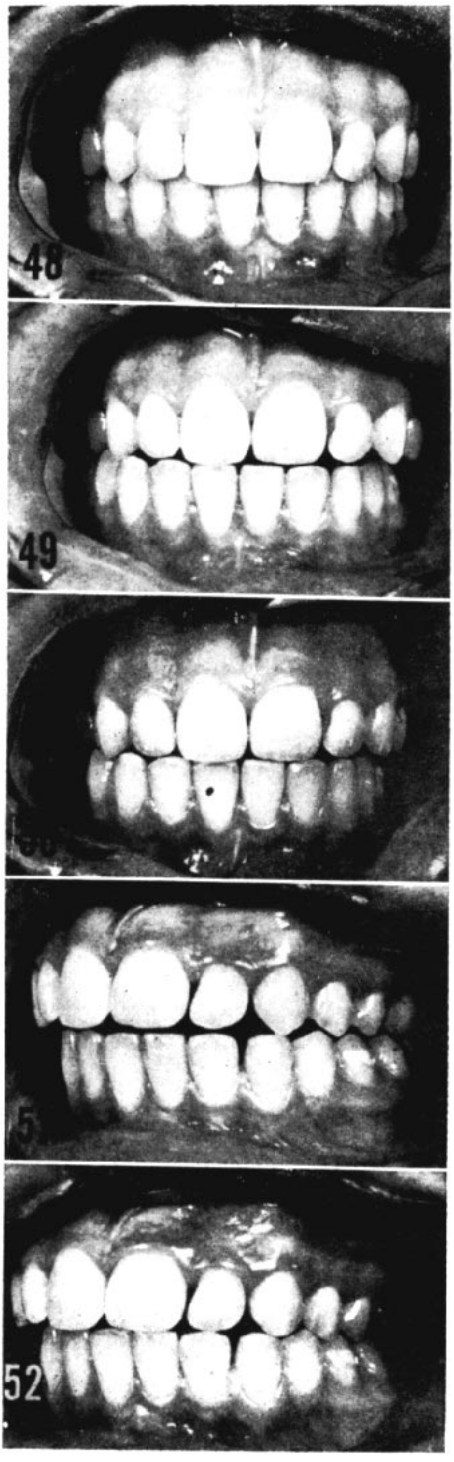
The next case is representative of the *small amount* of equilibrating that is needed in most mouths which have been treated orthodontically.

Céntric position needed no adjusting. (Fig. 48). Protrusive position needed a slight correction. (Fig. 49). This was accomplished by relieving the lingual incisal of the upper right central. (Fig. 50). Protrusive excursion was normal. The left cuspids were the only interfering contacts in lateral movements. (Fig. 51). The upper cuspid was ground with this improvement in function. (Fig. 52).

If one follows the method for equilibration presented herein, over a period of time it will become apparent that the rules mentioned in this paper, like all rules, have their exceptions. By using ingenuity and good judgment one will recognize these exceptions and become more and more proficient with his technique. However, we must always bear in mind that *tooth structure once removed is lost forever,* and that irreparable damage can be caused if we do not use the greatest of care.

Summary

It is my belief that the judicious elimination of points of interference in our finished cases will do much to stabilize the teeth in their new positions and will help avoid trauma with its resultant damage to the teeth



Figs. 48-52—A case in which a slight amount of equilibration produced a distinct improvement in occlusion.

and to their surrounding tissues. I further believe that this can best be accomplished — not through haphazard measures — but by having a definite plan of procedure instituted at the beginning of treatment and completed as nearly as possible at the time the teeth have definitely settled into occlusion.

Finally, all of our grinding should be done with small stones, preferably diamond. The ground surfaces should be polished with rubber disks. *Abrasive pastes are definitely contra-indicated* since they are not selective in their work and they will close the bite if used to any extent. There is very seldom the need to grind enough tooth surface away to produce sensitivity. However, if this does occur and will not gradually disappear, one or two applications of zinc ferro cyanide solutions will remove the sensitivity. The relief of interefering surfaces will not make a way for caries because the areas involved are self-cleansing.

Selective spot grinding has a definite place in orthodontic therapy and its application will undoubtedly assist us in achieving the highest objectives in treatment.

1824 State St.

(*References appear on the following page.*)

REFERENCES

[1] ARVINS, ALLAN N.: Equilibrated Occlusion Factor in Periodontal Treatment, *Jnl. A.D.A.*, Vol. 30, March, 1943.

[2] COLEMAN, ROBERT E: The Equilibration of Occlusion in Orthodontics. *Jnl. A.D.A.*, Vol. 34, No. 10, Oct., 1948.

[3] COLLINS, CECIL H.: Personal Communication.

[4] DAY, HERBERT WARD: Normal Functional Occlusion — Its Importance in Prevention and Treatment of Pyorrhea. *Jnl. A.D.A.*, Vol. 33, April, 1946.

[5] FRASER, E. S.: Personal Communication.

[6] LINN, J. A.: Personal Communication.

[7] MCLEAN, DAVID W.: Diagnosis and Correction of Pathologic Occlusion. *Jnl. A.D.A.*, Vol. 29, July, 1942. Also: Pathologic Occlusion — A Major Clinical Problem, *Jnl. A.D.A.*, Vol. 31, Dec. 1944.

[8] MOORE, ALTON W.: Personal Communication.

[9] RADUSCH, D. F.: Grinding for Relief of Occlusal Trauma Associated with Periodontoclasia, *Jnl. A.D.A.*, Vol. 30, March, 1943.

[10] SCHUYLER, C. H.: Fundamental Principles in the Correction of Occlusal Disharmony, Natural and Artificial. *Jnl. A.D.A.*, July, 1935. Also: Correction of Occlusal Disharmony of the Natural Dentition. *New York State Journal,* Vol. 13, 1947.

[11] SORRIN, SIDNEY: A Comparison between Grinding of Occlusions of Natural Teeth and Artificial Dentures. *New York Journal of Dentistry.* Vol. 14, No. 11, Nov. 1946.