Periodontal Preparation of the Adult Patient Prior to Orthodontics

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A large percentage of the population suffers from some form of periodontal disease. Black (1918), utilizing radiographs, studied the loss of interdental bone in different age groups. He reported that there was a 68 per cent and 88 per cent prevalence in the 30 to 39 and over-50 age groups, respectively. There was, however, no differentiation between gingivitis and periodontitis in the study. Varying results have been reported by other examiners. Differences can be accounted for by social, economic, and nutritional factors. Statistics from the National Center for Health Statistics (1972) show that in the adult age group of 18 to 79 years, 74 per cent of the population has periodontal disease.

Loe and coworkers (1965) showed that bacterial plaque is the cause of inflammatory periodontal disease. They later said that, without interference, periodontal disease progresses at a relatively even pace and that such progress is continuous (1978). Although this may be true for large groups of individuals, when an evaluation of individual patients is performed, the disease may not follow this course of progression. Hirshfeld and Wasserman (1979) showed that this progression may not be continuous but exhibits cyclic features in which variable-length periods of quiescence are followed by acute exacerbation. These periods of exacerbation may involve only one or several teeth.

Orthodontic tooth movement induces jiggling forces to teeth. A series of studies were performed to evaluate the effect of these forces on the periodontium. Svanberg (1978) found that when inflammation is localized to the supracrestal fibers, trauma from occlusion does not influence pocket formation. Kantor and colleagues (1976), in experiments on squirrel monkeys, demonstrated that the removal of trauma alone did not result in bone regeneration. Nyman and coworkers (1978) studied tooth mobility on pre-existing periodontitis in dogs. There was an enhanced rate of...
destruction of the supporting apparatus when trauma was superimposed on existing inflammation.

Fixed orthodontic appliances alter the coronal anatomy of a tooth, making plaque control by the patient more difficult. Kloeham and Pfeifer (1974)\textsuperscript{26} demonstrated that fixed appliances increase gingival and plaque indices and produce marked tissue hyperplasia.

In light of the aforementioned information, it is imperative to evaluate the periodontal status of each orthodontic patient prior to therapy.

Periodontal preparation of the adult patient prior to orthodontic therapy can include but is not limited to

- Diagnosis
- Inflammatory control
- Mucogingival corrections
- Occlusal management prior to tooth movement.

**DIAGNOSIS**

A periodontal evaluation should be performed by the generalist, orthodontist, and, if necessary, a periodontist prior to initiation of orthodontic therapy. This should include a complete circumferential probing of every tooth, evaluation of preorthodontic mobility, including buccal-lingual as well as depressive mobility, and an occlusal examination to determine whether there is any frenitus. During the examination, the clinician should observe the tissues for bleeding points as well as for any suppuration, adequacy of attached tissue, presence of excess tissue, and frenum attachments.

Consultations must be made with all treating dentists. Goals and expectations should be set at this time and everyone should understand what and how goals will be accomplished.

**INFLAMMATORY CONTROL**

Tissues that are inflamed must be treated prior to orthodontic therapy. This might require instruction in oral physiotherapy as well as one or more visits to remove both hard and soft deposits from the subgingival regions. The number of visits will depend on the severity of the involvement. Repetition of plaque control instruction and reinforcement are essential, as they will be throughout the case.\textsuperscript{9}

Root planing is an extremely difficult procedure to perform with great efficiency. In cases where pocket depth is 5 mm or greater it may be impossible to remove all calculus. This does not mean, however, that surgery is required in all cases where initial pocket measurements are greater than 5 mm. If a measurement of 6 mm or 7 mm is found initially, it is feasible that it can shrink to 4 mm after one or two visits. This can occur either by coronal shrinkage because of decreased tissue edema or reattachment at the base of the pocket. At this time, the therapist can be more successful in removing all remnants of plaque and calculus. Hence, multiple debridement visits are most productive when a patient has significant pocket measurements.
Waerhaug wrote a series of articles in which he described the difficulty in removing plaque and calculus from the roots of teeth with pockets.\textsuperscript{35, 36} He stated that as the pocket depth approaches 5 mm, the chances for failure of complete plaque removal predominate. In addition, small remnants left behind can fool the clinician by appearing clinically healthy. In another study, Stambaugh and coworkers (1981)\textsuperscript{32} found that even if a tooth were instrumented for 42 minutes, complete plaque removal occurred only to a depth of 3.7 mm on average and in no case deeper than 4 mm.

Re-evaluation should be performed subsequent to the first series of visits. Periodontal surgery should be considered if:

1. There are areas of pocket depth greater than 6 to 7 mm;
2. There is suppuration from an area;
3. The patient is demonstrating excellent plaque control and an area still bleeds readily upon probing.

Periodontal surgery can be utilized as a cleanout procedure, for pocket reduction, or pocket elimination. During cleanout surgery, flaps are raised to gain access to the root structures (Fig. 1A). Flaps usually are beveled internally and either full or split thickness.\textsuperscript{33} The choice of flap design is operator-dependent. At this time there are several different goals that can be attempted. Surgery can be done with apically positioned flaps or with repositioned flaps. This can be performed with or without osseous surgery.

The eventual goal of therapy is to have as minimal a pocket depth as is feasible.\textsuperscript{37} It would seem logical, therefore, if surgery is to be done, to position the flap at the bone crest apically, because this best would accomplish that goal.\textsuperscript{3}

Elimination of pockets greater than 6 mm is best accomplished by a combination of apically positioned flap and osseous resection to provide a bone configuration that will follow the parabolic contours of the gingival tissues.\textsuperscript{34} The question that the therapist must answer is: "What will the bone crest be like at the completion of orthodontic therapy?"

Tooth movement (movement of the root) will alter the shape of crestal tissues.\textsuperscript{18} If resection is contemplated, it is important for the surgeon to sit down with the orthodontist and understand the mechanics of movement through the different phases of therapy. For example, if a tooth will be extruded, significant changes will be made in the crestal level and no osseous resection should be done (Figs. 1B–D, 2A–C). An objective of osseous surgery is to reduce thick bone. Care should be taken prior to orthodontic therapy so that the buccal and lingual plates of bone are not thinned too much. The surgeon must leave a thicker plate of bone than would be left if no orthodontic treatment is contemplated.

It is ideal to perform surgery only one time. Cleanout surgery without apically positioning the tissue or minimal or no osseous contouring usually requires second surgical procedures subsequent to orthodontic therapy. The surgeon can come very close to accomplishing both complete debridement and pocket elimination. This requires consultation with the orthodontist as well as a feeling for where the bone will be at the end of tooth movement.

Wise has stated that it is not always essential to remove all calculus prior to orthodontic therapy.\textsuperscript{39} He has shown a few cases to support this.
Figure 1. A and B, Flaps are elevated to permit the operator access for debridement. C, A steep osseous defect is seen radiographically. Treatment by osseous resection will involve removal of too much bone on the incisor. D, The tooth was orthodontically extruded. The crest of the bone moved coronally to level the deformity.
Indeed, many times a therapist thought that there was complete calculus removal only to find that calculus appears on the root of a molar being uprighted and now is supragingival. While there may be no sequela in pockets of 5 mm or even 6 mm, pockets with greater depths pose a larger liability (Fig. 3A, B). As with any clinical procedure and decision, the therapist involved should weigh the gain versus the price to be paid.

Inflammatory control does not stop when the appliances are placed. Patients must be seen frequently during orthodontic care for preventative treatment. At this time, hard deposits and plaque are removed from teeth, home care is reviewed, and occlusion is checked. Patients, including adolescents, must be seen on a 2 to 3 month interval. The 6 month to 12 month professional cleaning interval most frequently adhered to in the United States is not adequate. This is especially true during orthodontic therapy, when brackets and wires make hygiene more difficult. The 6 to 12 month interval is, in most patients, at best curative, not preventative. There is overwhelming evidence, both bacteriologic and clinical, that an interval of 2 to 4 months is essential for preventative therapy. This has been demonstrated best by two studies. Axelsson and Lindhe (1978) separated two groups of patients by frequency of professional cleaning visits. One group was seen every 6 to 12 months and the other group,
every 2 to 3 months. They were followed for 3 years. At the end of the study the former group had an increase in caries, gingival inflammation and bone loss. The latter group stayed healthy. In a follow up study, the same patients were followed for an additional 3 years (six in total). The results showed that the groups were even further apart in terms of oral health after the additional 3 years.\textsuperscript{3}

Mousques and coworkers (1980)\textsuperscript{27} followed bacteriologic growth in a group of patients. The patients’ teeth were cleaned and cultures were taken. Bacteriologic growth was followed periodically. After 42 to 60 days, bacterial populations became periodontopathic. If we can disrupt the bacterial formations every 60 to 90 days, therefore, it should help keep the periodontium healthy.

When necessary, a chemotherapeutic agent can be used to aid in the control of bacterial growth. Chlorhexidine is an effective antibacterial that can be used as an adjunct to mechanical plaque control.\textsuperscript{22} Side effects such as discoloration of teeth and loss of taste must be monitored closely.

**MUCOGINGIVAL CORRECTIONS**

Attention to three factors: reduction of thick tissue, either distal to the terminal tooth or in edentulous areas; inadequate bands of keratinized tissue; and frenum attachments, prior to orthodontic therapy can make the treatment easier and more predictable.
Reduction of Thick Tissue

Thick tissue, whether it is distal to the terminal molar or in an edentulous region, should be reduced prior to orthodontic therapy if mesial or distal movement will cause bunching up of the gingiva.

It is common, when uprighting a second or third molar, for the tissue distal to the tooth to be a hindrance to movement (Fig. 4A, B). In addition, as the tissue moves coronally on the tooth, a pseudopocket develops. This will be a nidus for bacteria and potential locus for apical migration of the attachment. Tissue resistance caused by bunching up will slow tooth movement considerably.

Inadequate Bands of Keratinized Tissue

It long has been acknowledged that a dense band of keratinized epithelium is better suited to resist the spread of inflammation into the deeper structures than are the loosely arranged connective tissue fibers of the alveolar mucosa\(^{(10)}\) (Fig. 5). Studies have been done to evaluate how much, and when, attached, keratinized tissue is needed. Lange and Loes evaluated the relationship between apico-coronal width and gingival health.\(^{(17)}\) They found that 1 mm of free gingiva plus 1 mm of attached gingiva was the minimal zone required for periodontal health. Miyasato and coworkers\(^{(29)}\) found that gingivitis develops at the same rate in areas of substantially and minimally attached gingiva. Their study, however, did not take into consideration the insult of either orthodontics or restorative

Figure 4. A, The tissue has bunched up on the distal of the second molar. There was a 7.0-mm osseous defect on the mesial that was eliminated by tooth movement. B, Periodontal surgery eliminated the excess tissue. (From Wagenberg BD: The Role of Orthodontics in Periodontics and Restorative Dentistry. Tokyo, Quintessence, 1985; with permission.)
dentistry. The groups studied had relatively healthy periodontium and were followed on a strict maintenance program.

Nevins suggests that, with the intervention of restorative dentistry, the fragile gingival margin will not remain at its present level without

Figure 5. A minimal band of keratinized tissue is present on the cuspid and incisors.

Figure 6. A. During tooth movement, the left lateral incisor was moved labially and recession resulted. B. A free soft tissue autograft was placed to inhibit further recession.
adequate zones of keratinized attached tissue when inflammation is present. A correlation therefore can be made between orthodontic therapy and the plaque-retentive nature of banding or bonded brackets. There is a potential of further recession during orthodontic therapy if the zone of minimally keratinized tissue is not augmented prior to initiating treatment (Fig. 6A, B).

Several authors with differing conclusions have studied the effects of orthodontic movement on increasing or decreasing recession. Dorfman found that only in a small percentage of cases were there visible mucogingival changes that could be correlated with the magnitude and direction of tooth movement. A decrease in width of keratinized gingiva showed in 1.3 per cent of the cases. This occurred with either minimal movement or some labial movement of the mandibular incisors. An increase in keratinized tissue showed in 0.69 per cent, but only with significant lingual positioning (3 mm) of lower incisors. Shiloah and coworkers demonstrated that a dramatic increase in recession could occur as a result of tooth movement. Maynard recommends soft tissue augmentation prior to orthodontic therapy to prevent more attachment loss and root exposure. Boyd recommends, prior to determining if intervention should be made before treatment, first consulting with an orthodontist to determine in which direction the teeth will be moved. Maynard and Ochsenbein unequivocally recommend a free gingival graft prior to tooth movement where insufficient keratinized tissue exists.

It is very difficult for the orthodontist to predict that movement will be only in one direction during treatment. If there is a minimal band of keratinized tissue and the roots move out of the alveolus, there will be recession. If there is an adequate band of tissue, there likely will be no recession and the orthodontist can make the correction in position without creating a problem.

Several reports have been made demonstrating the ability to cover exposed roots. Miller utilized tissue 2.5 mm thick with roots treated with citric acid. Hollbrook and Ochsenbein utilized tissue 1.5 mm thick with margins at right angles to the keratinized surface. A specialized suturing technique must be used to stretch the graft. Langer and Langer showed that an epithelial connective tissue graft predictably can cover exposed root surfaces (Fig. 7A–H; 8A, B).

Although all these procedures can be successful, there still is a question of whether there is a connective tissue attachment to the root. Why should a therapist take the chance of root exposure? A submarginal free soft tissue autograft can be placed in less than 30 minutes by a trained surgeon, with minimal discomfort to the patient. Tissue less than 1 mm in thickness can be used (Fig. 9A; 10A, B) and the outcome of the procedure is very predictable (Fig. 11A–C).

Obviously, there is still controversy in the literature as to the benefits of prior intervention to eliminate the potential for further recession and root exposure during orthodontic therapy. If one considers the benefit of adding keratinized tissue to areas where there is minimal gingiva, there is no question that the treatment should be done. The patient’s unhappiness with the potential of root exposure alone should convince the therapist not to take chances.
Figure 7. A. Recession present on the cuspid, which has minimal keratinized tissue. B. A split thickness flap is raised, leaving periosteum. C. Two incisions are made on the palate. D. An epithelial connective tissue graft is removed. E. Graft in place. F. Graft sutured, with primary flap placed to the junction of the epithelium connective tissue junction. G. Palatal area must be sutured. H. Three weeks postoperative demonstrates attached keratinized tissue. Some grafts must have gingivoplasty to blend them.
Figure 8. A. Increasing recession has occurred subsequent to initiation of orthodontic therapy. B. Epithelial connective tissue grafts were placed to cover recession as per Figure 7. (Illustrations courtesy of Drs. Burton and Laureen Langer, New York, New York.)
Figure 9.  A, Minimal keratinized attached tissue with increasing recession.  B, A graft is placed to provide additional keratinized tissue.  C, Donor site after placement of a hemostatic solution.  D, Note the thin tissue removed from the palate.  E, Histology of the tissue of Fig. 9D shows the section taken is just below the rete ridges.
Figure 10. A, A maxillary impacted cuspid is uncovered in alveolar mucosa. Soft tissue autograft is placed to increase the keratinized tissue. B, During continued movement of the tooth the keratinized band is maintained.

Frenum Attachments

In 1939, Hirschfeld\textsuperscript{12} first called attention to the marginal attachment of the frenum as an etiologic factor in periodontal disease and recommended its excision (Fig. 12). Although much controversy exists as to how much attached keratinized gingiva is required for periodontal health, there is little dispute of the value in removing a frenum when it causes mobility of the marginal tissues or when there is recession in relation to it.\textsuperscript{14}

Corn\textsuperscript{15} describes in detail the classical frenectomy procedure. He states that a thick frenum resists orthodontic forces and could be responsible for relapse of space closure subsequent to orthodontic forces (Fig. 13A–C). The frenum sometimes regrows subsequent to this type of surgical procedure. Placement of a small section of keratinized palatal mucosa into the area of attachment gives the result greater predictability.

Frenum attachments that cause mobility or blanching of the marginal tissue should be treated prior to orthodontic therapy. The orthodontist must decide whether a thick frenum attachment will inhibit or slow down tooth movement. In this latter case, the frenum can be removed during tooth movement or prior to it. If the concern merely is retention, the frenum can be removed at the conclusion of orthodontic therapy.
Figure 11. A, Preoperative view of a patient with advancing recession. B and C, Submarginal grafts were placed in January. The July and December photos show the coronal creepage of the tissues that can occur over 12 months.
OCCLUSAL MANAGEMENT PRIOR TO ORTHODONTIC TREATMENT

Treatment of the adolescent patient requires minimal or no occlusal management prior to orthodontic therapy. The adult orthodontic case, however, may require treatment in one of several areas of occlusal management prior to initiation:

1. Gross occlusal adjustment;
2. Decreasing depressive mobilities;
3. Stabilization;
4. Control of interferences during tooth movement.

Gross Occlusal Adjustment

In the adolescent dentition, teeth frequently are leveled and depressed during orthodontic therapy. Depression is almost contraindicated in the adult. An assessment must be made of current osseous crest levels. There can be a discrepancy between cementoenamel junctions and the level of osseous crests because of bone loss caused by periodontal disease. In such a case, depression of a tooth would create a vertical defect that is difficult to treat. It is far better to reduce the tooth occlusally and improve the crown-to-root ratio (Fig. 14A–E).

When teeth are missing in the opposing arch, it is common to see extrusion of a tooth. In this case, occlusal reduction is indicated prior to banding (Fig. 15). In cases where there is a dual plane of occlusion (anterior to posterior), some arch leveling can be done by equilibration.

Decreasing Depressive Mobility

Many dentists believe that tooth movement is contraindicated if several teeth in the dentition exhibit excessive (especially depressive) mobility. This is not true. An assessment must be made as to why the teeth are

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Figure 13. A. A thick maxillary frenum is present between the two incisors. B. The frenum can inhibit mesial movement of the central incisors. C. Space closure was accomplished but relapsed until the frenum was removed. (Illustrations in Figure 13 courtesy of Dr. Richard Bloomstein, Livingston, New Jersey.)
Figure 14. A and B, The mandibular incisors were in crossbite. They are well above the plane of the posterior dentition. C, The pulp chambers are well into the lower portion of the crowns. This permits 3.0 mm to 4.0 mm of incisal reduction. D, The anterior segment was disarticulated by posterior platforms to permit correction of the crossbite. E, Final tooth position with incisal reduction.
Figure 15. Occlusal reduction corrects the occlusal plane as well as improves the crown-to-root ratio.

Figure 16. A, A maxillary bite plane is fabricated with ball clasps. (Illustration courtesy of Dr. Richard Bloomstein, Livingston, New Jersey.) B, 1.5 mm of posterior opening is optimal. (From Berliner A: Ligature, Splints, Bite Planes, and Pyramids. Philadelphia, J. B. Lippincott Co, 1964; with permission.)
mobile. Are we dealing with primary trauma (there is adequate attachment apparatus or bone to support normal forces) or secondary trauma (there is inadequate attachment apparatus remaining and even forces in the axial direction cannot be tolerated)? In the former case habit control is indicated.

A patient with severe depressive mobility and what appears to be adequate bone support should be placed in a modified Hawley’s bite plane (Fig. 16A). This appliance will disarticulate the posterior dentition and, if worn at least 22 hours per day, will permit eruption of the depressed teeth. It is important that only 1 to 1.5 mm of disarticulation occurs (Fig. 16B). If it exceeds this level, the tongue will interfere with eruption. As the tooth erupts, it should be reduced occlusally to bring it back into the occlusal plane and improve the crown-to-root ratio. Depressible teeth usually will extrude rapidly. The treatment should take only 2 to 3 months, although it can take longer in severe cases.

Rest of the posterior dentition in this manner can lead to less mobility. Coincidentally periodontal ligament spaces can close and osseous defects can be leveled. At this time, orthodontic therapy can be planned without causing further damage to the attachment apparatus.

**Stabilization**

Cases with a compromised attachment apparatus can undergo orthodontic therapy. They require coordination of the periodontist, restorative dentist, and orthodonist. Unlike the adolescent, the adult dentition often may be restored with full-coverage restorations. Many occlusal corrections can be made in restorative dentistry, minimizing the amount of movement necessary. In addition, segments of the dentition that require no movement can be stabilized with provisional restorations or A-splints. These will help anchor the teeth and inhibit any unwanted movement (Fig. 17).

![Figure 17. An A-splint can be used to stop the second molar from moving distally. (From Wagenberg BD: The Role of Orthodontics in Periodontics and Restorative Dentistry. Tokyo, Quintessence, 1985, with permission.)](image-url)
Figure 18. A, B, C. The bite plane opens the posterior occlusion 1.5 mm. It permits unimpeded movement of the dentition without occlusal trauma.
Figure 19. A, B, C, An immediate palatal plate as described by Langer in the Journal of Prosthetic Dentistry serves the same function as the bite plane but can be fabricated chairside. *(From Wagenberg BD: The Role of Orthodontics in Periodontics and Restorative Dentistry. Tokyo, Quintessence, 1985, with permission.)*
Control of Occlusal Interferences During Tooth Movement

A dentition that has lost minimal to no attachment apparatus can withstand the occlusal trauma that occurs during orthodontic therapy. Once bone loss has occurred, the ability to withstand trauma diminishes. In cases such as these, it is essential to control the inflammatory process prior to initiating therapy.

As teeth move during treatment, the cusp-to-fossa relationship will be off. Every time the patient swallows, clenches, or grinds, trauma will be present. In a compromised dentition, the modified Hawley bite plane can be used to minimize trauma (Fig. 18A–C, 19A–C). The appliance can be designed to permit unimpeded tooth movement. By disarticulation of the posterior teeth, there is no hindrance to movement, no undue trauma to the dentition, and a shorter duration of therapy (Fig. 20A, B).

Figure 20: A, An occlusal platform is utilized to disarticulate the dentition. B, During treatment, one by one the teeth were freed from the platform for movement. (Photographs in Figure 20 courtesy of Dr. Richard Bloomstein, Livingston, New Jersey.)
SUMMARY

Evaluation of periodontal status and proposed orthodontic therapy must be made prior to initiating tooth movement. Teeth with a compromised periodontium can be treated. Prior to initiation of orthodontic therapy, it may be necessary to perform periodontal surgery for pocket elimination or reduction, to perform mucogingival surgery, or to correct gross occlusal discrepancies.

REFERENCES

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