Fiberotomy and Reproximation Without Lower Retention, Nine Years In Retrospect: Part I

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Stability has always been the key objective in orthodontic treatment since, without stability, both ideal function and/or ideal esthetics may be lost. Perhaps the most predictable and frustrating of all orthodontic relapse (physiologic recovery) is the recrowding of the mandibular anterior segment during the postretention period. It is especially disconcerting to follow cases which apparently have met all the criteria for good orthodontic treatment only to have some recrowding of the lower anterior teeth during the postretention period. The literature describes many factors involved in this type of relapse; these include musculature, apical base considerations, occlusion, intercanine width, displaced connective tissue, muscle habits, third molars, incisor shape, direction of mandibular growth, eruptive patterns, and tooth-size discrepancies. Historically, attempts to prevent or reduce posttreatment relapse have been focused on orthodontic mechanics. We use a new type of appliance, or lighter forces, or a bonded retainer, but the results are frequently disappointing. However, within the past ten years a significant improvement in mandibular anterior tooth stabilization has resulted from our ability to identify and better understand certain factors which now allow us to redirect or "control" the biology of that area.

Recently, many articles have appeared concerning the efficacy of the circumferential supracrestal fiberotomy (CSF) in preventing or mini-

mizing tooth rotational relapse.[1-6] Another subject of renewed interest is the reproximation (stripping) of lower anterior teeth and its purported ability to reduce lower incisor recrowding.[14,20] To date, however, there have been no reports in the literature concerning the long-term effectiveness of CSF and reproximation on the stabilization of the mandibular anterior area, and few assessments have been made of the possible periodontal sequelae which might result from these procedures.

In this report, material covering a four to nine year period of investigation will be presented. The purpose of this study was to evaluate the long-term effectiveness of fiberotomy and reproximation on the posttreatment stability of previously crowded lower arches which had undergone orthodontic treatment. In addition, an attempt was made to evaluate the periodontal health of those tissues which were associated with the fiberotomy and reproximation procedures. This study will be divided into two parts. The first deals with the clinical applications and implications of fiberotomy and reproximation which form the basis for this study. The second part will consider the long-term clinical findings plus a periodontal assessment of fiberotomy and reproximation on crowded mandibular arches which were treated orthodontically and never retained.

CIRCUMFERENTIAL SUPRACRESTAL FIBEROTOMY

As a result of the research performed over the past several years, there is little doubt that relapse of
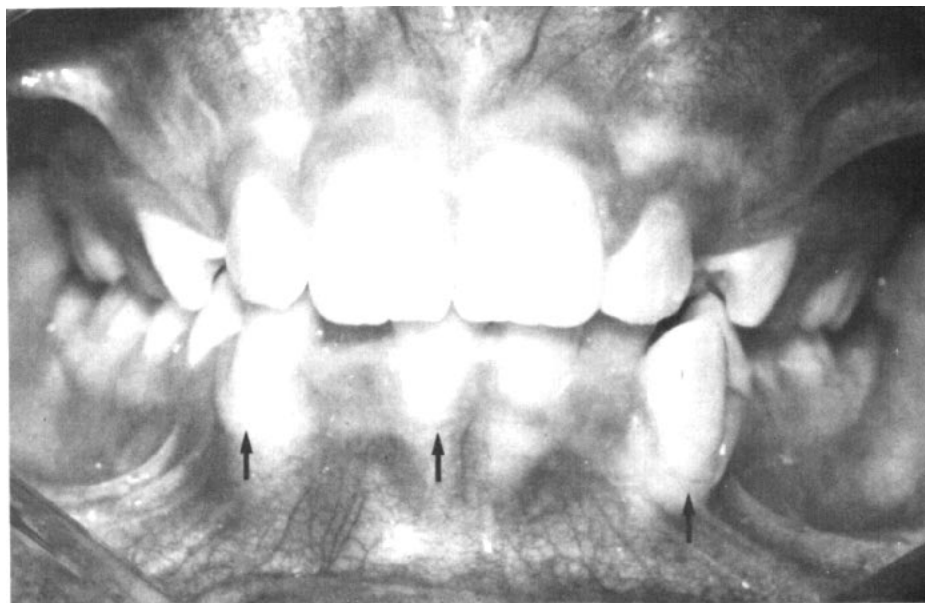
Fig. 1

orthodontically rotated teeth is primarily due to the displaced supra-alveolar connective tissue fibers.[9-12] In 1970 Edwards[1] described a surgical procedure designed to eliminate rotational relapse in clinical orthodontic patients. This surgical procedure, now referred to as circumferential supracrestal fiberotomy (CSF),[2] has become well-documented.[1-8] The utilization of this technique varies with participating orthodontists. A survey, conducted by Kaplan,[3] showed that one-third of the orthodontists performed the surgery, approximately one-fourth referred the patient to a periodontist, and the others sent the patient to either an oral surgeon or a general practitioner. At this point a discussion of CSF is important. Based on the clinical experiences derived from this procedure over the past nine years, a brief review of the indications, contraindications, clinical procedure, timing, postoperative period and postsurgical failures seems warranted.

CSF is indicated for any case where the supragingival fibers have been markedly displaced. Examples are found in moderately to severely rotated teeth, markedly crowded or bunched teeth, displaced impacted teeth, and severely tipped teeth. The procedure is contraindicated in the presence of bacterial plaque, chronic gingivitis, chronic periodontitis and should avoid areas with little or no attached gingiva (Fig. 1). CSF is not necessary or recommended in cases which exhibit mild to moderate displacement of incisors in a bucco-lingual direction (Fig. 2). Patients with systemic medical problems can be treated but should be covered with the appropriate therapeutic agent.

Timing transection of the displaced supra-alveolar fibers can best be accomplished after band removal since there is usually a decrease in gingival inflammation and, subsequently, a marked improvement in tissue tone following debanding. In addition, surgical access is much

Fig. 2

easier following removal of fixed orthodontic appliances.

Before the patient is anesthetized, a study of the original casts should be made to identify those areas of previous rotations. Once the surgical site has been identified, an anesthetic containing 1/50,000 epinephrine is administered by interpapillary injection using a 30 gauge extra short needle. Use of an anesthetic containing 1/50,000 epinephrine is useful for hemostasis.

The surgical procedure is essentially the same as Edwards originally described with one major difference. No attempt is made to incise the mid-labial portion of gingival tissue on the mandibular incisors or cuspids, since some gingival recession was evident in earlier cases which had complete circumferential incisions.[8] A No. 11 Bard Parker blade is inserted into the gingival sulcus and a circumferential incision (avoiding the mid-labial) is made following the long axis of the tooth. The incision traces the alveolar crest which can be felt. A No. 12b Bard Parker blade is highly recommended in situations where access is difficult, particularly on the lingual of lower incisors (Fig. 3). Since all candidates for surgery should possess a periodontium which is within normal limits, periodontal packs or dressings have not been necessary and healing has been uneventful. However, for those patients with a medical history of slow connective tissue healing, one should consider placement of a periodontal pack for approximately 10 days.

Vanarsdall[7] recommends a procedure other than the Edwards' technique, especially for patients with a history of previous periodontal disease. He utilizes a reverse bevel incision extending beneath the gingival epithelial attachment to the depth of the alveolar crest. Walters[13] does not recommend electrosurgery to accomplish CSF because marked tissue recession and increased postoperative discomfort have occurred.
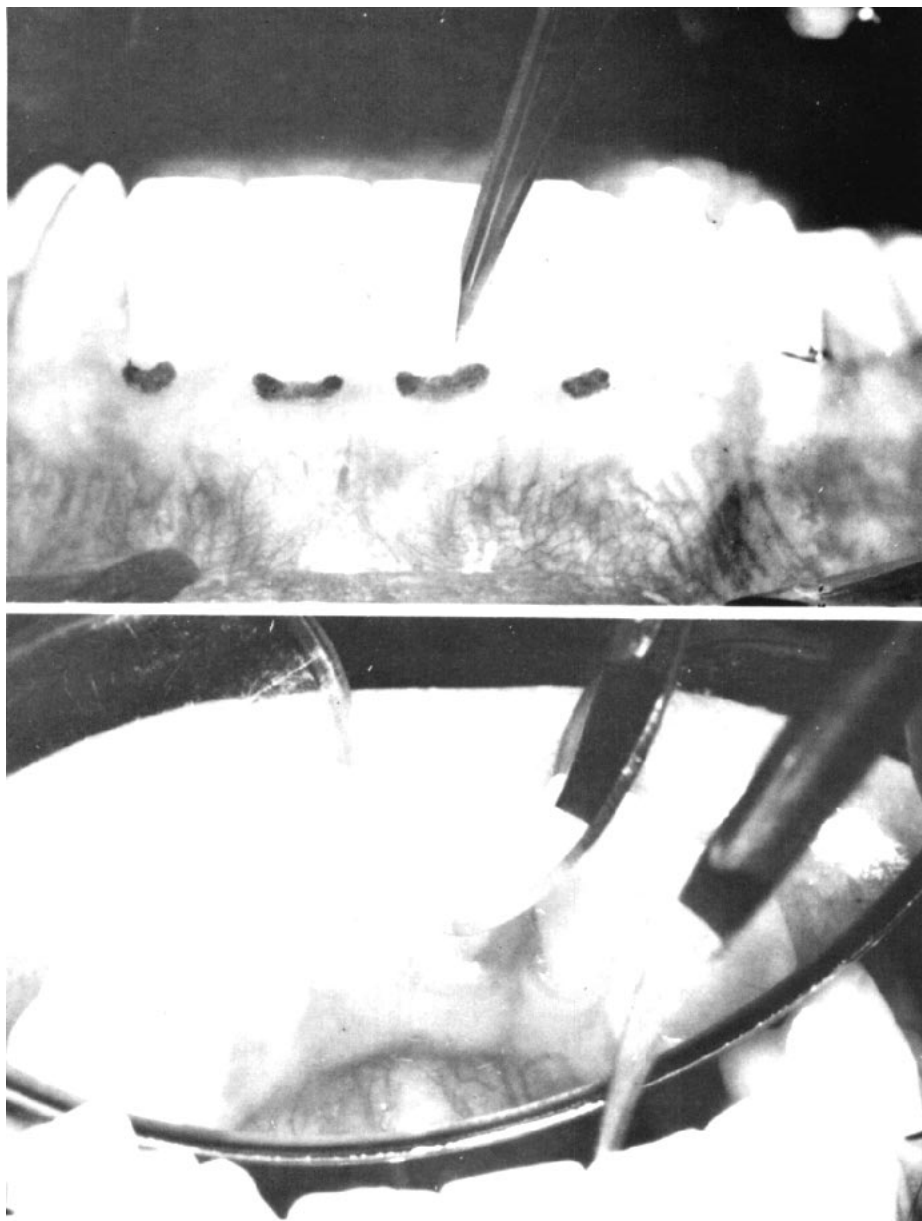
Fig. 3

Following CSF the most striking feature is an increase in mobility of the surgerized teeth. This increased mobility is due to the cutting of transseptal fibers which splint tooth to tooth. However, mobility gradually diminishes within a two-four week period. If mobility does persist for more than four weeks, factors other than CSF should be considered; for example, the occlusal prematurities which are due to prominent marginal ridges on the maxillary central or lateral incisors. Another observable
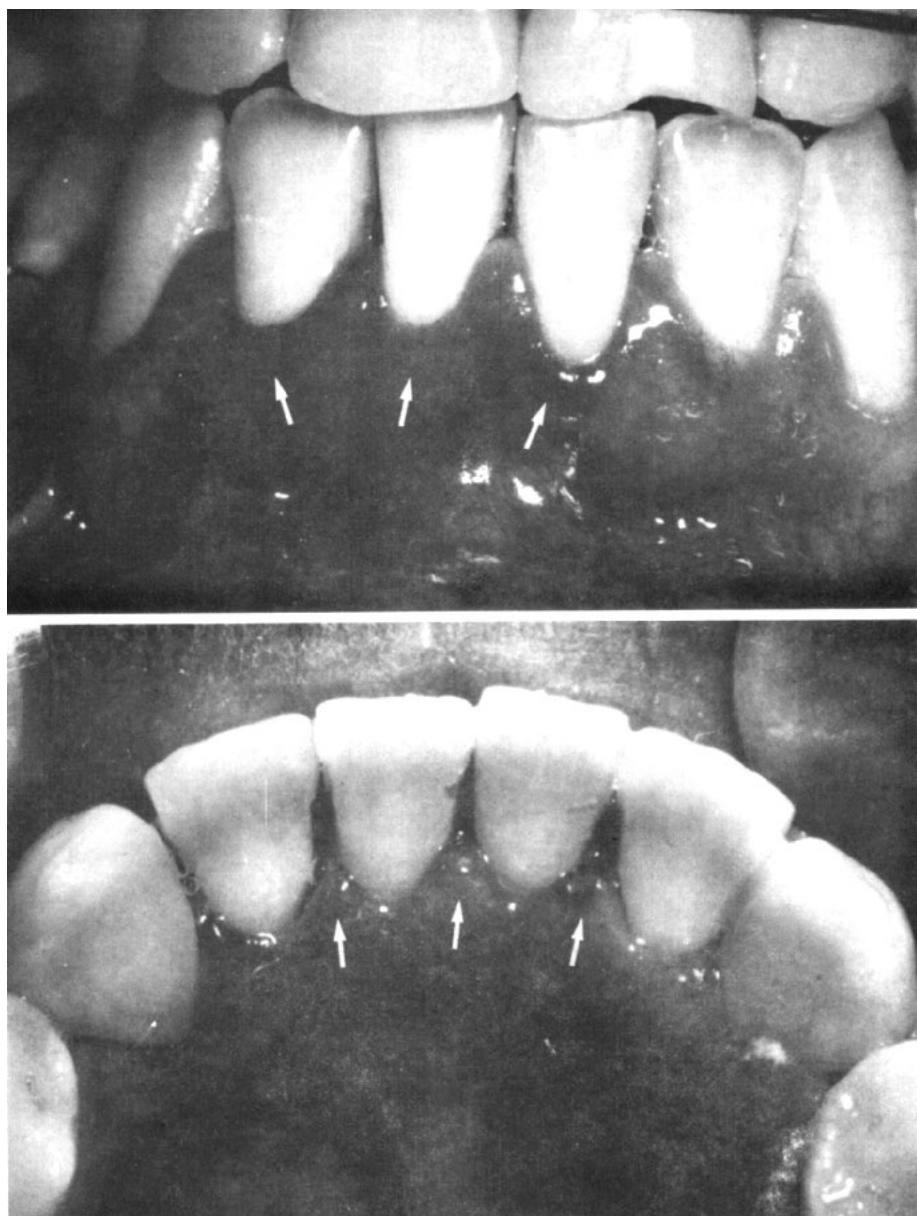
Fig. 4

feature is a slight degree of spacing between the surgerized teeth. This spacing is transitory in nature and may be attributed to postsurgical edema which can occur within the periodontal space as a result of CSF. Postoperative bleeding has not been a problem and patient discomfort is minimal. During the postoperative period saline rinses and glyoxide applications are worthwhile adjuncts; glyoxide, in particular, decreases inflammation, promotes healing, and reduces patient discomfort. Each pa-
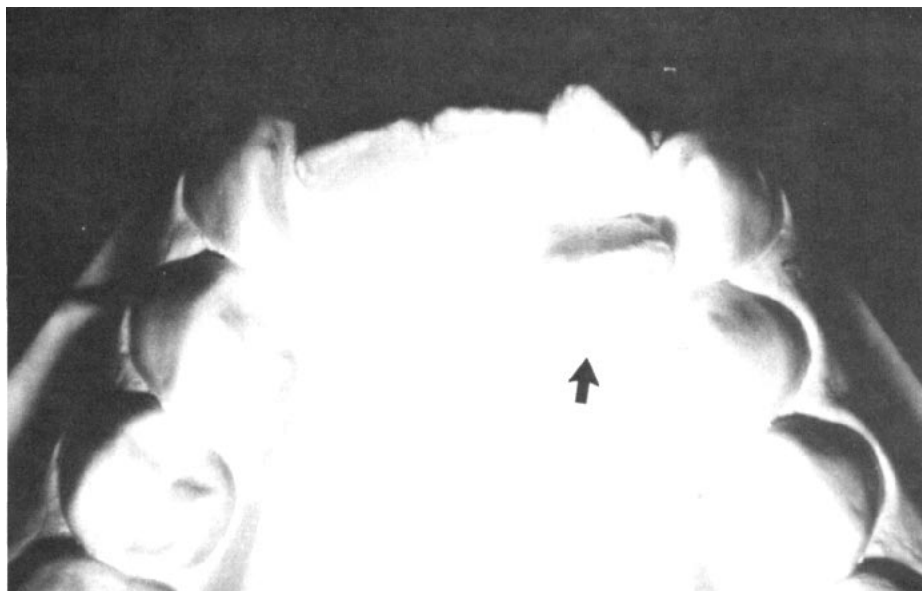
Fig. 5

tient must be recalled within one week after surgery so healing and oral hygiene can be examined. The one occasional postsurgical complication has been a secondary infection due to poor oral hygiene following CSF (Fig. 4). The complication can be easily treated in its early stage by local debridement, glyoxide and saline rinses. The most important factors for successful postsurgical healing are a clean mouth before surgery and good oral hygiene afterwards.

Of course, when evaluating postsurgical relapse of CSF, one must realize that the primary purpose of this procedure is to eliminate rotational relapse. In most cases CSF alone cannot stabilize the entire lower anterior segment. The main factor in relapse of surgerized rotated teeth is an insufficient period of axial stabilization immediately following rotational correction, assuming that surgery has been properly performed. Boese[11] demonstrated two distinct phases of tooth rotational relapse in monkeys. The first phase can be attributed to the displacement of principal periodontal fibers which in monkeys appear to stabilize within eight weeks. The second phase of relapse was attributed to displaced supra-alveolar fibers which remained disoriented for a much longer period of time. If a rotated tooth is aligned late in treatment and debanded shortly after its alignment, relapse will occur even if CSF is employed since the principal periodontal fibers also contribute to the relapse force and are not affected by the surgery. A clinical impression based on the review of many posttreatment cases suggests that a six month period following rotation correction is sufficient to allow for principal fibers reorientation.

Another significant factor in relapse is failure to completely correct the rotation *prior* to CSF. If normal contact point relationships cannot be produced before surgery, a degree of relapse is inevitable. The clinician
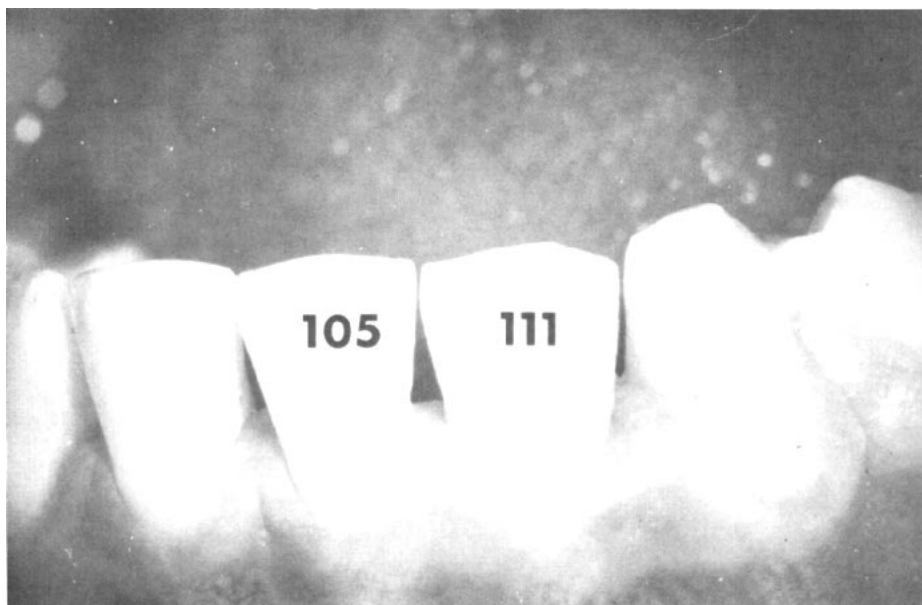
Fig. 6

should attempt to produce a slight overcorrection of a rotated tooth prior to band removal. Relapse following CSF has been observed in those cases where lower incisors have originally been bodily displaced labiolingually and subsequently aligned with insufficient root torque (Fig. 5). In addition, a small amount of relapse can be attributed to occlusal prematurities that result from prominent lingual-marginal ridges on maxillary central and lateral incisors.

REPROXIMATION

The practice of "stripping" mesial and/or distal tooth structure in conjunction with orthodontic treatment to reduce postretention crowding has a long history. This reduction of lower incisor width is often the last resort at holding tooth alignment and is usually employed after all conventional measures have failed. Its application has been empirical and its long-term effectiveness questionable. The procedure often evokes the con-

cern of many practitioners who mention the possibility of associated periodontal destruction plus an increased caries susceptibility in the mandibular anterior area.

However, in 1972 Peck and Peck[14] reported that well-aligned mandibular incisors possess distinctive dimensional characteristics; these teeth are significantly smaller mesiodistally and significantly larger faciolingually, when compared with average population tooth dimensions. Their report showed that a substantial relationship exists between mandibular incisor shape and the presence and/or absence of mandibular incisor crowding. It also described a mesiodistal (MD/FL) faciolingual index as a numerical expression of mandibular incisor crown shape when viewed incisally. According to the standards recommended by Peck and Peck, ideally shaped lower centrals have a MD/FL index of 88-92 percent, while the lower laterals recommended range is 90-95. They concluded that well-
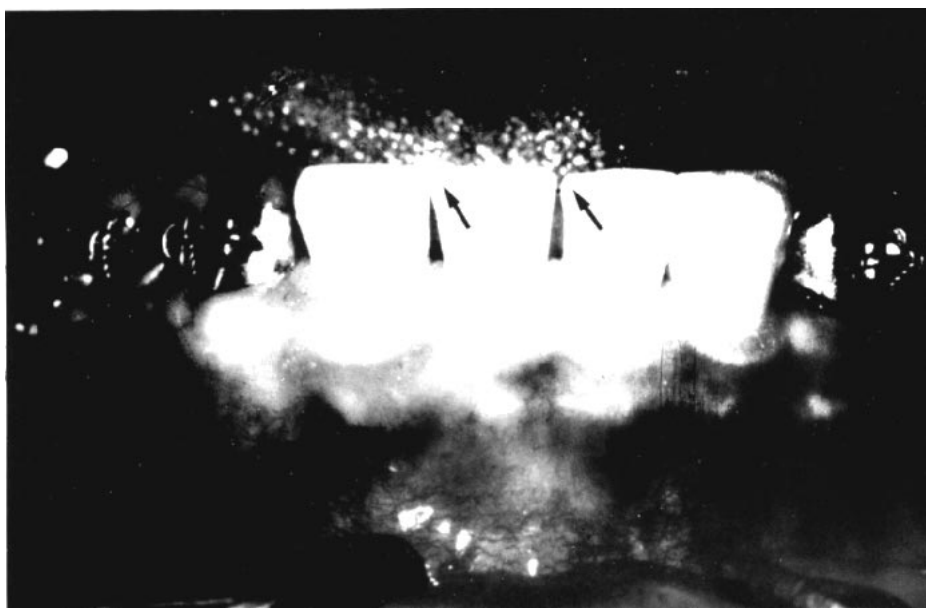
Fig. 7

aligned mandibular incisors usually have MD/FL indices significantly lower than those of crowded incisors and recommended reproximation as a mechanical method of reducing unfavorable incisor shapes (Fig. 6).

Based on these findings, clinical application of reproximation has become much less empirical and more predictable. Reproximation is indicated in all cases with crowded lower incisors which exhibit poor MD/FL ratios and on teeth with unfavorably shaped contact points (Fig. 7). Serial reproximation can also be employed to compensate for the natural loss of arch length which appears to occur in many patients especially during periods of marked horizontal mandibular growth.

The significance of reproximation resides in two main benefits. It provides broader contact point areas and thereby furnishes greater contact stability, plus reproximation increases the amount of available space in the mandibular anterior area. The proc-ess of providing space is extremely useful when working within a biologic framework that usually limits our ability to increase arch length or drastically change basic mandibular arch form.[22]

In spite of the benefits of the procedure, every conscientious orthodontist must be fully aware of the inherent dangers. Reproximation obviously is not a reversible process; once the enamel is removed and the shape of a tooth altered, the result is permanent. To begin with, reproximation should be employed only after the lower incisors have been completely aligned because it is impossible to be both conservative and precise in establishing broad new contact areas if the teeth are still malposed. Every effort must be made to avoid excessive stripping. The removal of more than one-half the enamel cap could be excessive since this may lead to dental caries plus increased sensitivity to thermal changes and sweets. And of course, clinicians should consider the

positive correlation that exists between an increase in anterior overbite with an increase in the amount of lower incisor stripping. Finally, excessive reproximation could theoretically reduce the amount of transseptal bone between the lower incisors which might predispose those areas to periodontal disease.

The timing of reproximation appears to fall in three distinct phases, based on the clinical experiences gained from treating many crowded lower arches without use of lower retention. Most reproximation is done as soon as alignment of the mandibular anteriors has been accomplished. This will provide good lower incisor shape early in treatment and allow for ideal overbite correction which can be maintained following band removal. Obviously, the maxillary anterior tooth size relationships are affected by lower incisor stripping. Fortunately, most cases with unfavorably large lower incisor MD/FL ratios usually possess a lower anterior tooth-size excess.

The second phase of reproximation, if no lower retention is used, takes place shortly after band or bond removal. If the intercanine width has been expanded or basic arch form significantly altered, a periodic check of the mandibular anterior segment with dental floss will often reveal an increase in contact point pressure. This is observed in both extraction and nonextraction cases. Some degree of reproximation is usually performed serially over a four-six month period following band removal; at each maxillary retention visit the contact points of the lower incisors are evaluated. If some movement appears to be taking place or contact points become extremely tight, reproximation is performed.

The timing and degree of third phase reproximation is related to any significant change in lower anterior arch form and to the amount and direction of mandibular growth. Usually little reproximation is necessary after the first six months; however, Siatokowski,[15] DeKock,[16] and Schudy[17] recognize that uprighting of lower incisors is frequently seen during the terminal phase of growth, especially in counterclockwise growers. The uprighting of these teeth is responsible for secondary crowding which often occurs following treatment. Prior to beginning the third phase of reproximation, one must exercise sound clinical judgment and consider the degree of stripping already performed, the amount of enamel remaining, shape of the lower incisor, degree of overbite, and the anticipated amount and direction of mandibular growth.

In describing these phases of reproximation the reader may have received the impression that a great deal of tooth structure has been removed. Analysis of the clinical results contained in the second part of this paper shows this is usually not the case.

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