Interdisciplinary treatment of localized juvenile periodontitis: A new perspective to an old problem

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What can be done for a 17-year-old girl with localized juvenile periodontitis, a Class II malocclusion, and flared teeth? Is it possible to regain epithelial attachment and rebuild the bone architecture? Is it possible to achieve good esthetics and occlusion with conventional orthodontic treatment, or is an interdisciplinary approach needed? What sequence should be followed? What is the prognosis for the affected teeth in the long term? Our aim in this article was to review the literature and present a clinical case to shed more light on the subject. (Am J Orthod Dentofacial Orthop 2007;131:268-76)

Localized juvenile periodontitis (LJP) is a rapidly progressing form of periodontitis that affects the permanent dentition during the pubertal stage, resulting in loss of attachment of 4 mm or more in at least 2 first permanent molars and incisors. Gingival tissue around the teeth can have normal texture and color, subgingival calculus is not frequent, and the periodontal destruction is not consonant with the presence of local irritating agents. However, longitudinal studies of disease progression in adolescents showed those with destructive periodontal signs at young ages are predisposed to further deterioration. It seems that deterioration is more pronounced in already affected sites and in patients from low-income socio-economic classes. The deterioration can progress in extension (more teeth involved) or in increments of preexisting lesions. The etiology of LJP is believed to be multifactorial but includes familial inheritance. Immunodeficiency plays a role, but the most important factor is the presence of Actinobacillus actinomycetemcomitans and Capnocytophaga in the oral microbiota. The therapeutic treatment of LJP includes open and closed curettage, plaque control, and systemic antibiotics. Other alternatives to treatment of the bony defects include grafting or extraction of the involved teeth, with possible orthodontic movement into the involved sites.

Today, it is possible that, despite bone loss, teeth can be orthodontically moved if the remaining bone and the periodontium can be brought to healthy states. Melsen and Melsen et al found that incisor intrusion in adults with marginal bone loss has beneficial periodontal effects and also reported that new connective tissue attachments can be formed during intrusion of periodontally involved teeth if gingival inflammation is eliminated and root surfaces are adequately scaled. However, Polson et al studied the periodontal response when moving teeth into infrabony defects and found only pseudo- or hemidesmosomal attachments rather than new periodontal ligament attachments. Some authors found that tooth intrusion might deepen the defect and improve blood circulation, which can provide a better environment for guided tissue regeneration procedures. This procedure is thought to be the alternative to rebuilding the bone and periodontal architecture, by providing increased mesenchymal cells, which, in the presence of osteoinductive factors, differentiate into cells capable of regenerating the periodontal structures. Therefore, using this rationale, it seems reasonable to manage a compromised periodontal (LJP) dentition with an interdisciplinary approach of orthodontics and periodontics.

DIAGNOSIS AND ETIOLOGY

A 17-year-old girl with a Class II malocclusion had a history compatible with LJP and restricted areas of bone loss, particularly at the first molars and incisors.
The maxillary central incisors were flared and extruded, and there was a mandibular anterior diastema (Fig 1). She had undergone 2 orthodontic treatment attempts and discontinued the last one because the doctor was afraid of more bone loss. No periodontal treatment had been done. The patient’s chief concerns were the longevity of her front teeth and the possibility of enhancing esthetics. Despite pocket depths of 7 to 8 mm on the aforementioned teeth, a corresponding amount of bacterial plaque was not found in these localized areas or in the entire dentition. No other sites were found with periodontal pockets.

TREATMENT OBJECTIVES

The treatment objectives were to improve (1) the occlusion by establishing better occlusal contacts and anterior guidance, (2) esthetics by leveling the teeth and gingival margins, and (3) periodontal health and provide a better environment for guided tissue regeneration (GTR) in the anterior teeth.

The orthodontic treatment plan consisted of leveling and aligning the maxillary incisors to esthetically harmonize the central incisors’ position in the arch and to distally angulate the mandibular incisor root to minimize the horizontal width of the pocket, providing a better environment for GTR. Additionally, it was assumed that a reduction of the periodontal pocket depths could be achieved by leveling and alignment, with some intrusion of the maxillary anterior teeth, without deepening the periodontal defects, once the apical displacement of the junctional epithelium was repaired by a periodontal-surgical approach to allow adequate root scaling and acid conditioning immediately after the placement of orthodontic appliances.

TREATMENT PROGRESS

In the first step, the patient was periodontally treated until the inflammation was eliminated through control of bacterial biofilm and oral hygiene. This phase lasted about 6 months. When the fixed appliances were placed, reverse beveled open-flap surgery was performed in the buccal and palatal maxillary incisor areas to allow granulation tissue debridement and proper root preparation. The roots were completely scaled, and phosphoric acid was applied for 3 minutes to promote demineralization of the root surfaces and bone wall defects (Fig 2). During all treatments, the patient was seen monthly by the periodontist to prevent plaque formation and gingival inflammation. The first archwire placed was a 0.012-in nickel-titanium, followed by a 0.016-in heat-activated nickel-titanium archwire; by the fourth month, the incisors were already leveled with an 0.018-in round stainless-steel archwire. The alignment proceeded until a 0.019 × 0.025-in rectangular archwire was placed to close the spaces. To intrude the maxillary and mandibular inci-
sors, the stainless-steel archwires had accentuated and reversed curve of Spee incorporated, respectively.\textsuperscript{19} After 9 months of periodontic/orthodontic treatment, the maxillary arch was ready for the GTR procedures (Fig 3). At this time, the clinical examination showed 5 mm of periodontal pocket depth interproximally and 3 to 4 mm palatally, about a 40% reduction.

A reverse beveled marginal incision was again performed from the distal side of the maxillary right lateral incisor to the distal side of the maxillary left lateral incisor in both buccal and palatal sites, raising mucoperiosteal flaps and exposing the involved roots of both central incisors. The granulation tissue was properly debrided and the roots thoroughly curetted. Sequentially, the roots were demineralized in a 2-minute application of neutral EDTA (Pref Gel, Biora, AB, Malmo, Sweden), without burnishing or rubbing\textsuperscript{20} (Fig 4, A-D). The surgical area was thoroughly rinsed with saline solution, followed by grafting of alternating layers of emdogain (BIORA AB, Malmö, Sweden) and autogenous bone particles from the palate. The defect was filled to the level of the preexisting bone crest, and the grafted areas were covered with an alloplastic absorbable membrane from bone collagen. After performing an apical periosteal undermining relaxing incision in the buccal flap, this and the palatal flaps were repositioned and sutured to each other with single isolated sutures to achieve the most intimate adaptation of the flaps to each other and to the teeth (Fig 4, E-H).

Six months after the GTR, when bone mineralization seemed radiographically evident, orthodontic finishing procedures were resumed (Fig 5). Class II

\textbf{Fig 2.} A-C, Open flap surgery performed on same day as fixed orthodontic appliance placement. Reverse beveled marginal incision to remove sulcular, pocket, and junctional epithelium. D, After debridement of granulation tissue and proper tooth scaling, phosphoric acid was applied to surgical site to demineralize root and bone defect.

\textbf{Fig 3.} Nine months after start of periodontic and orthodontic treatment, maxillary arch was ready for GTR. A and B, Periapical radiographic images show changes in bone topography induced by intrusion and space closure (compare with initial X-ray). C, Clinical frontal view shows no significant change in gingival margin level.
Elastics were used for 4 months to correct the overjet. There were some interproximal gingival spaces to deal with in the anterior region caused by the triangular shape of the teeth and the apical position of the bone crest.21,22 Interproximal reshaping was performed to manage this unesthetic detail22 (Fig 6). At the end of treatment, permanent retention was used in the maxillary and mandibular anterior teeth with a .00215 coaxial Penta-one archwire (Masel, Bristol, Pa) as recommended by Zachrisson.23 In addition, a removable Hawley retainer in the maxilla for nighttime wear, to be used for a year, was recommended.

**TREATMENT RESULTS**

The total orthodontic treatment time was 26 months, including the 6-month rest period after GTR. The results show better esthetics, good static and functional occlusion, reduced overjet, and improvement in the crown-root ratio, providing good bone support and periodontal pocket reduction at the maxillary anterior region (Fig 7, A-C). In the mandibular anterior region, the distal aspect of the right central incisor underwent bone modification by deepening and

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**Fig 4.** A-D, Mucoperiosteal open flap surgery was followed by root scaling and neutral EDTA conditioning (Pref Gel); E-G, Vertical defects filled with sandwich-type grafting consisting of layers of emdogain and autogenous bone taken from palate, until level with existing crestal bone; H, positioning of alloplastic membranes (Genius, Baumer SA, Mogi Mirim, SP, Brazil) to protect area and prevent epithelial migration. Compare level of bone margin on buccal surface of both central incisors with Figure 2; little or no change occurred as related to cementoenamel junction.

**Fig 5.** Radiographic image of maxillary incisor area 6 months after surgery shows signs of reconstruction of periodontal structures and some root resorption and remodeling of both central incisors.

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reducing the horizontal width of the defect, increasing the success rate of a future GTR periodontal procedure. The gingival tissues were sound, with proper pink color and firm consistency (Fig 7, D and E). The final lateral headfilm shows improvement in the overjet with consequent favorable soft tissue changes (Fig 8).

Cephalometrically, the maxillary incisors experienced intrusion and a small palatal inclination, whereas the mandibular incisors were protruded, possibly as a consequence of leveling the curve of Spee and the Class II elastics (Fig 9, Table). The maxillary molars moved slightly forward during the
space-closing procedure in the maxilla. The only unfavorable secondary effect observed was some root resorption of the maxillary central incisors. However, there was radiographic evidence of improved periodontium. The patient and her parents were happy with the results and aware that supportive periodontal treatment must be followed to avoid recurrence of the periodontal disease process.

**DISCUSSION**

The selected treatment included initial noninvasive periodontal therapy to control gingival inflammation, followed by orthodontic treatment to reestablish the appropriate occlusal interrelationship. The orthodontic mechanics included leveling, aligning, and intruding the maxillary central incisors, and leveling and aligning the right mandibular central incisor to which distal root angulation was added. Intrusion of the maxillary incisors was obtained with an accentuated curve of Spee in the maxillary arch. Although true intrusion might be controversial to be obtained with continuous arches, the lateral headfilms, the superimpositions, and the respective measurements demonstrate this effect, which could be regarded as relative intrusion of the maxillary incisors to the palatal plane (Figs 8 and 9, Table). Despite the reverse curve of Spee in the mandibular arch, the mandibular incisors showed no intrusion in relation to the mandibular plane, but only leveling. The use of Class II elastics to correct the overjet could cause a collateral effect of extruding the maxillary incisors that were intruded. However, the amount of this collateral effect was not enough to override the intrusion obtained, as demonstrated by the superimpositions.

The clinical results of the first treatment phase, depicted in Figure 3, show that there was not only a reduction in both vertical and horizontal dimensions of the periodontal defects of both maxillary central incisors, but also apparent stability of the relationship between the cementoenamel junction and the bone crest at the buccal surfaces (compare Figs 2, A, and 4, B), contrary to the propositions of Rabie et al., Murakami et al., and Zachrisson. In general, these reports agree that a long junctional epithelium would develop in areas of bone remodeling due to intrusion performed in teeth with no gingival inflammation, or there would be a deepening of the defect when intrusion is conducted in teeth with periodontal pockets or gingival inflammation.

We suggest that our favorable result is probably related to the special care in root preparation through aggressive scaling and acid conditioning that rendered the roots amenable to attract mesenchymal but not epithelial cells—ie, the roots became biocompatible with connective tissue reconstruction.

The bone loss during intrusion of teeth, inducing enlargement of the periodontal ligament space at the cervical area or deepening of the periodontal pockets can be attributed to the displacing junctional epithelium that would require resorption of marginal bone to preserve the periodontal biologic width. In this way, impairment of the junctional epithelium displacement would favor the maintenance of bone integrity.
and perhaps its reconstruction, as suggested in the present case.

Although Stahl and Fromm\textsuperscript{30} and Wikesjö et al\textsuperscript{31} did not find good clinical, histological, or biomolecular results using various acid solutions, techniques, and times of application, several studies had favorable and promising effects of root acid conditioning in accelerating the surgical wound healing stages, enhancing periodontal regeneration.\textsuperscript{32-40} It seems that the reason for the natural surface demineralization produced by giant clastic cells in the very early stage of hard-tissue wound healing is the exposure of intrinsic and extrinsic fibers that will become joined by interdigitation with new bone collagen fibers synthesized by the corresponding blastic cells. This produces a mesh of fibers that will undergo mineralization, thus joining the newly formed tissue to the old existing hard tissue, whether it is cementum or bone.\textsuperscript{35} This biological wound-healing requirement would be improved by surgical demineralization performed in situ.

The X-ray images suggest reconstruction of the periodontal ligament space with decreased pocket depths of the maxillary incisors (Fig 3, B) and deepening of the defect in the mandibular central incisor (Fig 7, B). Therefore, the results of the first treatment phase in the maxillary arch agree with those of Melsen et al,\textsuperscript{13} who found new cementum formation and new collagen attachment after periodontal treatment and orthodontic intrusion in monkeys with controlled oral hygiene.

However, after this phase, a periodontal pocket of about 5 mm interproximally and 3 to 4 mm deep buccally and palatally still required another periodontal surgical procedure to reconstruct a shallow gingival sulcus. Accomplishment of this condition should be the ultimate objective of the periodontal therapy, because a long junctional epithelium is unsatisfactory, and a greater than 3-mm deep gingival sulcus cannot be kept clean.\textsuperscript{41,42}

The regenerative procedure was a combination of root acid conditioning with neutral EDTA, autogenous bone graft, emdogain, and GTR to give the environment all the biological effects of these regenerative alternatives.\textsuperscript{34-36,43-45}

The promising results achieved by combined orthodontic and periodontic treatment in selected cases of LJIP indicate the benefits of this treatment alternative. The only unfavorable secondary effect was some root resorption of the maxillary central incisors, probably

### Table. Vertical and horizontal changes of incisors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Initial</th>
<th>Final</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary incisor-PP (mm)</td>
<td>26.7</td>
<td>25.1</td>
<td>−1.6</td>
</tr>
<tr>
<td>Maxillary incisor-PP (°)</td>
<td>118.2</td>
<td>117.6</td>
<td>−0.6</td>
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<tr>
<td>Mandibular incisor-GoMe (mm)</td>
<td>40.6</td>
<td>41.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Mandibular incisor-NB (°)</td>
<td>36.1</td>
<td>36.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Mandibular incisor-NB (mm)</td>
<td>5.8</td>
<td>7.9</td>
<td>2.1</td>
</tr>
</tbody>
</table>

PP, Palatal plane; GoMe, mandibular plane; NB, line through nasion and B point.

Fig 9. Superimpositions at A, SN (centered on sella) and B, at palatal plane (PP) (centered on ANS) demonstrate relative intrusion of maxillary incisors to palatal plane.
because this was the third orthodontic treatment that the patient received and because teeth in patients with bone loss have a greater potential for root resorption.1,2,46-48

CONCLUSIONS
Orthodontists, when treating periodontal patients, must consider an interdisciplinary approach. A working team must assess all aspects involved to provide the best treatment to the patient. It was shown that changes in bone topography can be obtained by orthodontic movement, if the periodontal tissues are healthy. These changes can enable or improve the results of GTR. In a young person with LJP and extruded and flared teeth with bone loss, the orthodontic/periodontic approach can improve the chances for good results in bone filling. The result will provide better crown-root ratios and preserve the natural dentition. In this way, interaction with the periodontist and the proper chronology of events are important factors for such a patient.6,7

REFERENCES