CASE REPORT

Class II Treatment of an Adolescent Patient with a History of Acute Lymphocytic Leukemia

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Acute lymphocytic leukemia (ALL) accounts for 80% of all childhood leukemias, with a peak incidence at 3-4 years of age.[1] Recent advances in treatment, including multiagent chemotherapy and radiation therapy, have greatly increased the chances for survival, thus focusing more attention on long-term survivors and their quality of life.

Abnormal dental development and craniofacial growth are frequent findings in young children treated with bone-marrow transplantation or total-body irradiation. The most common problems include arrested root development with V-shaped roots, premature apical closure, microdontia, enamel disturbances, and aplasia.[2] Although such patients often require comprehensive oral care, orthodontic treatment may be complicated by the risk of root resorption and by increased anchorage demands due to abnormal root morphology.

This report describes fixed orthodontic treatment in an adolescent female with a medical history of ALL.

Diagnosis and Treatment Plan

A 13-year-old female reported to our clinic complaining of protrusive upper and lower anterior teeth (Fig. 1). Her medical history indicated a diagnosis of ALL at age 1, followed by treatment with chemotherapy and radiation until age 2. Clinical examination revealed a convex facial profile, incompetent lips, and an acute nasolabial angle. The canines were in a Class II relationship on both sides, but the


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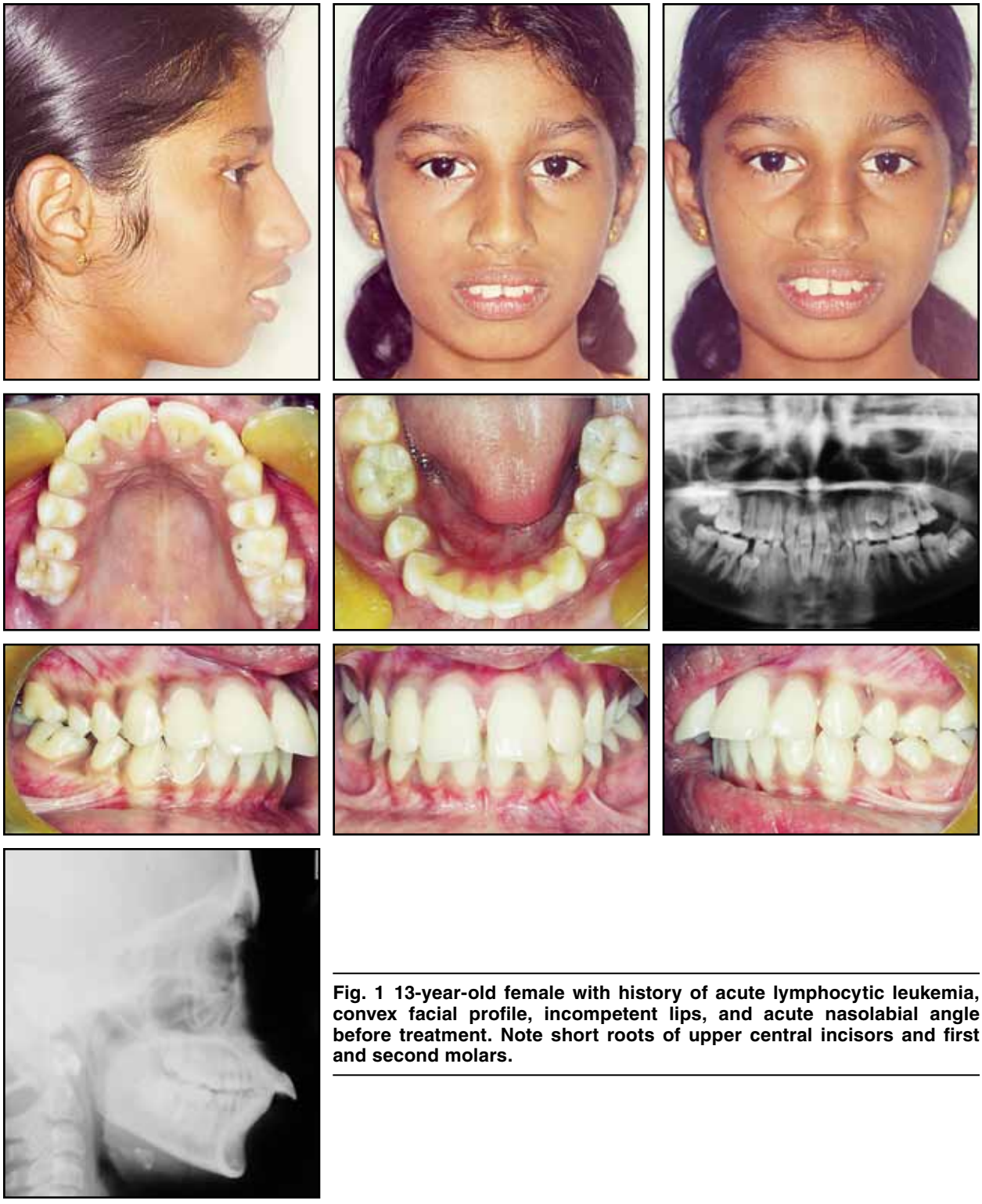

Fig. 1 13-year-old female with history of acute lymphocytic leukemia, convex facial profile, incompetent lips, and acute nasolabial angle before treatment. Note short roots of upper central incisors and first and second molars.

TABLE 1
CEPHALOMETRIC DATA

	Norm[3]	Pretreatment	Post-Treatment
SNA	84.1° ± 3.2°	81.0°	80.0°
SNPg	81.9° ± 3.5°	74.0°	74.0°
ANB	2.3° ± 2.2°	7.0°	6.0°
FMA	29.4° ± 5.4°	26.0°	27.0°
IMPA	98.0° ± 5.6°	105.0°	98.0°
U1-NA	27.4° ± 6.2°	42.0°	24.0°
U1-NA	7.5mm ± 2.6	12.5mm	4.0mm
L1-NB	30.8° ± 4.4°	34.0°	25.0°
L1-NB	7.5mm ± 2.2	11.0mm	8.0mm

first molars were Class I. The overbite was 5mm, and the overjet 10mm. The upper left second deciduous molar was retained.

Cephalometric analysis indicated a Class II skeletal pattern due to a retrognathic mandible, with proclined maxillary and mandibular incisors (Table 1). The panoramic radiograph showed impacted second premolars in the upper left and lower right quadrants. The roots of the upper central incisors and first permanent molars were short, with excessive crown-root ratios. The upper second molars were also relatively small.

Treatment objectives were to improve the facial profile, maintain the molar positions while bringing the canines into a Class I relationship, and achieve an ideal overjet and overbite. All four first premolars were extracted, and the retained upper left second deciduous molar was also extracted to enhance eruption of the underlying premolar. The patient's undersize maxillary second molars and short maxillary first-molar roots were major concerns in this case, requiring controlled force application to reduce the risk of root resorption while attending to the increased anchorage demands in the upper arch.

Treatment Progress

Both arches were bonded with .022" × .028" standard edgewise appliances. Leveling and alignment were completed in five months, using .014" nickel titanium archwires. The impacted premolars erupted naturally during this period. Lower anterior retraction was then initiated with keyhole loops in an .019" × .025" stainless steel archwire.

Micro-implants were placed between the roots of the upper second premolars and first molars on both sides. The upper canines were initially retracted with 50g of force from a nickel titanium closed-coil spring on each side, using direct anchorage from the micro-implants. Because the patient complained of soft-tissue irritation from the closed-coil springs, we replaced them with elastic cotton thread.* The upper incisors were then consolidated with stainless steel ligature wire and retracted on an .019" × .025" stainless steel archwire, applying 100g of force on each side (Fig. 2). The elastic thread was changed at three-week intervals to maintain adequate retraction forces, as measured by a Dontrix strain gauge.**

*TP Orthodontics, Inc., La Porte, IN; www.tportho.com.

**Ortho-Care Ltd., Bradford, United Kingdom; www.orthocare.co.uk.

Fig. 2 Micro-implants placed for retraction of upper anterior segments with elastic thread.

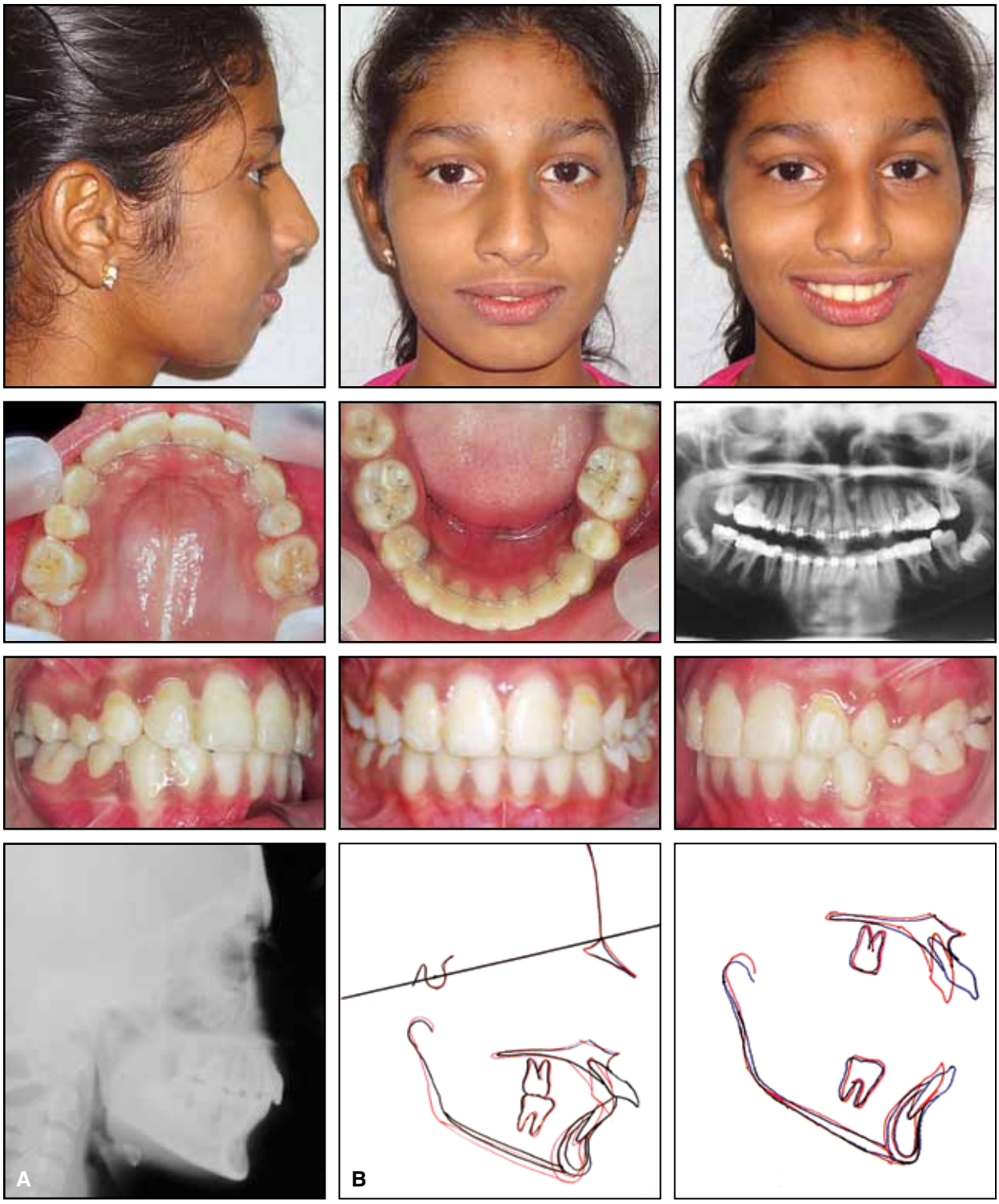

Fig. 3 A. Patient after 24 months of treatment, showing improved profile, competent lips, parallel roots, and no sign of root resorption. (Panoramic radiograph taken at end of space-closure phase.) B. Superimposition of pre- and post-treatment cephalometric tracings, indicating anchorage preservation and significant incisor retraction.

Fig. 4 Patient three years after treatment, showing proper molar and canine relationships, with no significant change in occlusion.

Treatment Results

Space closure was completed in 12 months. Appliances were then removed, and multistranded stainless steel lingual retainers were bonded in both arches.

A Class I canine relationship was achieved bilaterally, while the molars were maintained in a Class I relationship; the profile convexity was reduced, and ideal overjet and overbite were obtained (Fig. 3A). The posttreatment panoramic radiograph showed parallel roots with no signs of root resorption. Cephalometric superimpositions on the anterior cranial base (SN plane) confirmed the preservation of anchorage and a slight inferior movement of the mandible, consistent with dolichofacial growth (Fig. 3B, Table 1). The incisors were retracted significantly in both arches, and molar eruption was within a normal range.

Three years after the end of treatment, records showed that the molar and canine relationships had been maintained, with no significant change in the occlusion (Fig. 4).

Discussion

Because the risk of apical root resorption from orthodontic treatment is magnified by the presence of abnormal root morphology,[4] the effects of chemotherapy and radiation on root development must always be considered when treating a patient with a history of ALL.

The patient shown here presented with a significant facial convexity. The short roots of the upper first molars and central incisors, combined with the undersize second molars, increased not only the likelihood of root resorption, but also the anchorage requirement in the upper arch. Therefore, while bilateral micro-implants were used as direct anchorage for anterior retraction, the retraction force was minimized to prevent root resorption. Direct force application from the micro-implants helped correct the deep bite, since the line of force passed through the center of resistance of the upper incisors. Although a straight-pull headgear could have been used for anchorage in this case, we rejected that option because of an anticipated lack of patient compliance and the increased risk of root resorption. After treatment, the patient's root lengths remained at their pretreatment levels, with no sign of root resorption.

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