CASE REPORT

Nonsurgical Treatment of an Adult with Severe Anterior Open Bite

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Open bites associated with digit-sucking habits and tongue thrust are mainly dental in nature and can usually be managed with habit interception and orthodontic treatment. If such habits continue into adulthood, however, the skeletal structures can be adversely affected. Management of this type of open bite often requires both incisor extrusion and molar intrusion.

The case presented here illustrates treatment of an adult with severe dentoalveolar open bite who was treated nonsurgically with conventional appliances and skeletal anchorage.

Diagnosis

A 19-year-old female presented complaining of an unesthetic smile and inability to bite down on food (Fig. 1). She reported having had a digit-sucking habit until her late teens, and she exhibited some speech difficulties and a tongue-thrust swallowing pattern.

Clinical examination revealed a thick right thumb caused by prolonged thumbsucking, as well as a tongue that was slightly larger than normal. The patient showed a mesoprosopic facial form, a long lower face, inadequate incisal display, a mildly convex profile, and incompetent lips. She had an open bite of 11mm extending symmetrically from canine to canine, an overjet of 5mm, and 3mm of spacing in the upper arch. Both the maxillary and mandibular incisors were


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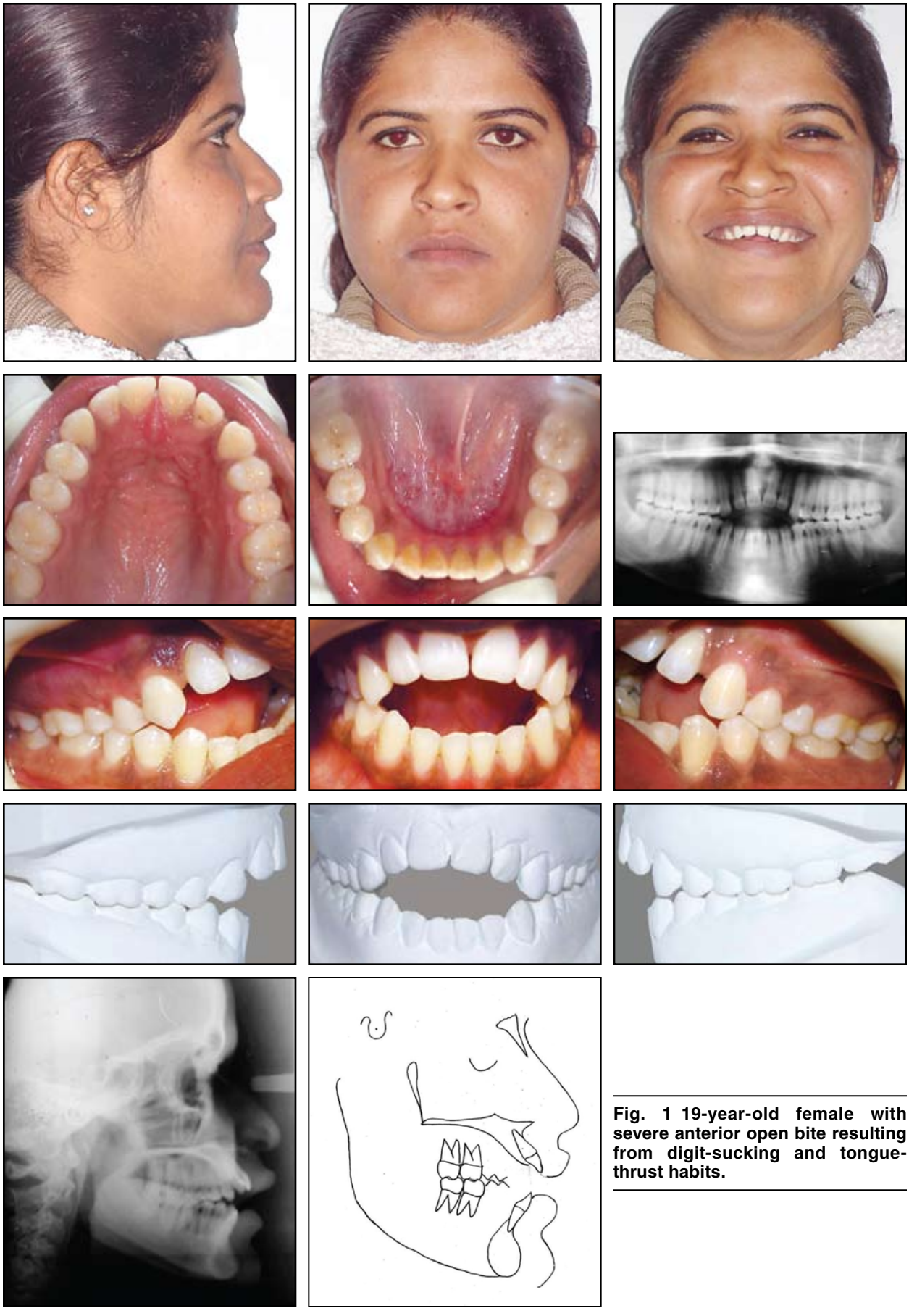

Fig. 1 19-year-old female with severe anterior open bite resulting from digit-sucking and tongue-thrust habits.

TABLE 1
CEPHALOMETRIC ANALYSIS

	Norm	Pretreatment	Post-Treatment	Difference
N-S-Ba	130.0° ± 6.0°	126.0°	126.0°	0.0°
S-N	77.0mm ± 4mm	74.0mm	74.0mm	0.0mm
SNA	82.0°	84.0°	85.0°	1.0°
ANS-PNS	52.6mm ± 3.5mm	56.0mm	56.0mm	0.0mm
Co-A		99.0mm	100.0mm	1.0mm
SNB	80.0°	79.0°	81.0°	2.0°
Go-Pg	81.0mm ± 4.0mm	93.0mm	94.0mm	1.0mm
Co-Gn		134.0mm	136.0mm	2.0mm
ANB	2.0°	5.0°	4.0°	1.0°
Wits	0.0mm	2.0mm	1.0mm	1.0mm
N-ANS	50.2mm ± 2.4mm	56.0mm	56.0mm	0.0mm
ANS-Gn	61.3mm ± 3.3mm	75.0mm	73.0mm	2.0mm
PNS-N	50.6mm ± 2.2mm	55.0mm	54.0mm	1.0mm
SN-GoGn	32.0°	30.0°	28.5°	1.5°
U6/NF	23.0mm ± 1.3mm	26.0mm	24.0mm	2.0mm
L6/MP	32.1mm ± 1.9mm	39.0mm	38.0mm	1.0mm
ODI	74.5° ± 6.5°	74.0°	73.0°	1.0°
Interincisal angle	130.0°	122.0°	133.0°	11.0°
U1/NA	22.0°	32.0°	20.0°	12.0°
U1/NA	4.0mm	6.0mm	3.0mm	3.0mm
U1/SN	103.0°	120.0°	106.0°	14.0°
IMPA	90.0°	93.0°	90.0°	3.0°
L1/NB	25.0°	29.0°	26.0°	3.0°
L1/NB	4.0mm	6.0mm	4.5mm	1.5mm
Nasolabial angle	102.0°	74.0°	83.0°	9.0°
UL/E line	–4-0mm	1.0mm	–2.0mm	3.0mm
LL/E line	–2-2mm	–4.0mm	–2.0mm	2.0mm

proclined. A reverse curve of Spee of about 3mm in the mandibular arch was accompanied by an accentuated curve of Spee of 4mm in the maxillary arch.

Cephalometric analysis indicated a skeletal Class II tendency (ANB = 5°) with moderately excessive lower anterior and posterior dentofacial height (Table 1). The facial axis, *y*-axis, and mandibular plane angle indicated a hypodivergent growth pattern; an ODI angle of 74° suggested an acquired open bite due to digit sucking.[1] The panoramic radiograph showed reduced alveolar bone height in both the upper and lower anterior regions. A dental Class I open bite with a skeletal Class II pattern was diagnosed.

Treatment Plan

One treatment option was to extrude the incisors orthodontically to correct the open bite and improve the incisal display. A second option was to follow the orthodontic extrusion with a maxillary posterior impaction, which would correct the jaw rotations and reduce the anterior facial height. The third treatment approach was to extrude the incisors and intrude the posterior teeth using micro-implant anchorage. Molar intrusion would result in a counterclockwise autorotation of

the mandible, thus improving the long lower face. Considering the relatively low invasiveness and discomfort associated with skeletal anchorage, the patient chose this plan.

Treatment objectives for the maxillary arch were to maintain the anteroposterior and transverse dimensions while altering the vertical dimension through posterior intrusion and by repositioning the anterior teeth downward and backward. This would close the bite and improve the incisor display at rest and in smiling. Objectives for the mandibular arch included maintaining the transverse dimension, reducing the mandibular plane angle, and reducing the lower vertical excess through autorotation of the mandible. Overall goals were to establish a Class I molar and canine relationship with ideal overjet and overbite. Shortening the lower face would improve facial balance and esthetics.

Treatment Progress

Preadjusted edgewise .018" × .025" Roth-prescription brackets were bonded in both arches, along with a fixed tongue crib in the upper arch. Because of the large steps between the lateral incisors and canines, we initially placed segmental .014" nickel titanium wires to avoid any intrusion of the canines that might result from the use of continuous archwires.

After three months, when adequate leveling had occurred, continuous .016" nickel titanium wires were inserted in both arches. Another four months later, a continuous .016" × .022" reverse-curve nickel titanium wire was placed in the upper arch and an .016" × .022" nickel titanium wire in the lower. The fixed tongue crib was replaced with a modified transpalatal arch to counteract the extrusive force generated by the reverse-curve wire in the molar regions.

After 12 months of treatment, the anterior open bite had been reduced from 11mm to 5mm, but an open bite had started to develop in the premolar regions, likely due to intrusive forces from the reverse-curve wire. Because additional extrusion of the upper incisors was needed, .016" × .022" stainless steel wires were placed in both arches, and box elastics ($^5/_{16}$", 3.5oz) were prescribed for the anterior and premolar regions.

After 15 months of treatment, the upper incisor display was near normal, but an anterior open bite of 3mm was still present. Micro-implants (1.2mm in diameter, 8mm long*) were placed bilaterally in the palatal upper first and second molar regions, 5mm from the alveolar crest and 8mm from the lingual cervical margins, as recommended by Poggio and colleagues[2] (Fig. 2). Intrusive forces of 150-200g were applied using elastomeric chain from each micro-implant to distal extensions on the transpalatal arch. After six months of molar intrusion, a 2mm overbite had been achieved. The upper archwire was then sectioned, and finishing elastics were worn for about six weeks.

Fig. 2 Palatal micro-implants placed bilaterally in upper first and second molar regions.

Appliances were removed after a total treatment time of 23 months. Bonded 3-3 lingual retainers were placed in both arches, and a Hawley appliance with an incorporated tongue crib was prescribed for the maxillary arch.

Treatment Results

Facial esthetics and balance were improved considerably by closure of the open bite (Fig. 3). The upper molars were intruded 1.5mm, and the upper and lower incisors were extruded 4mm and 2mm, respectively, as the curves of Spee were leveled. The transverse dimension was maintained in both arches, along with the anteroposterior position of the mandibular molars. Class I molar and canine relationships were established, with ideal overjet and overbite. Centric occlusion was coincident with centric relation after treatment, and a mutually protected occlusion was achieved.

The mandibular plane angle

*Denticon, 260/15, Sane Guruji Marg, Mumbai 400011, India; www.denticon.in.

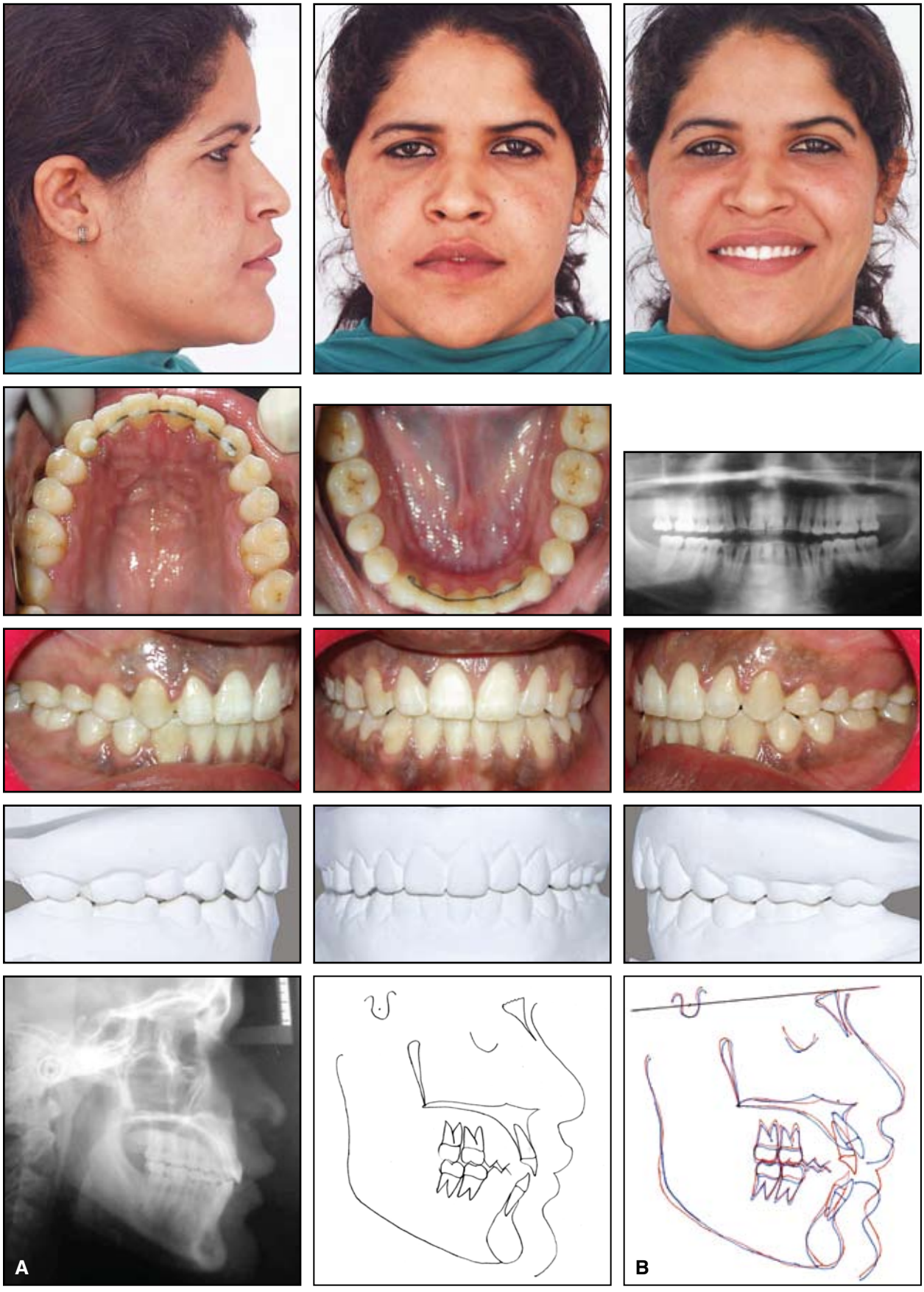

Fig. 3 A. Patient after 23 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

decreased by 2° as the mandible rotated counterclockwise with intrusion of the maxillary molars, reducing lower facial height by 2mm and thus achieving a more balanced relationship (Table 1). The mandibular incisors were retroclined 3°, and A point came forward about 1mm as the maxillary incisors were uprighted. B point and pogonion advanced 1mm when the mandible was autorotated forward.

The treatment results remained stable after one year of retention (Fig. 4).

Discussion

The etiology of open bite is often multifactorial, but it can be divided into three broad categories: digit-sucking habits, abnormal size and function of the tongue, and a vertical growth pattern, which can be either innate or environmental in origin.[3] The importance of distinguishing between dental and skeletal open bite becomes evident when formulating a treatment plan: dental open bite can be treated with orthodontics alone, while a true skeletal open bite requires coordination of orthodontic and surgical approaches to achieve a stable occlusion, acceptable esthetics, and improved function.[4,5]

An open bite associated with a high mandibular plane angle and long-face syndrome is usually skeletal, requiring a combined surgical-orthodontic approach.[6,7] On the other hand, an anterior open bite in a patient presenting with a meso- or brachycephalic facial form, a low mandibular plane angle, a hypodivergent and horizontal growth pattern, a counterclockwise rotation of the mandible, and a strong musculature is almost always due to environmental causes, such as oral or digital habits that prevent proper tooth eruption and maxillomandibular development.[8] Such open bites are commonly dental, but if the habits persist, as in our patient, they can result in a mild skeletal alteration, as well as proclined and spaced maxillary incisors, lingually displaced mandibular incisors, anterior open bite, and narrowing of the maxilla.[8] Overjet, a natural consequence of maxillary dentoalveolar protrusion and mandibular retrusion, is exacerbated if mandibular development is slowed. In these cases, treatment requires coordination of extrusion and intrusion mechanics to achieve functionally and esthetically acceptable results.

The success of incisor extrusion with anterior vertical elastics depends on patient cooperation. Since our patient expressed reluctance to wear anterior elastics, we shortened the period of elastic wear by using reverse-curve nickel titanium wires, which produce extrusion in the incisor and molar regions and intrusion in the premolar regions. The extrusive forces on the molars were counteracted by a transpalatal arch. Once the desired incisor extrusion was achieved, the remaining open bite could be corrected by skeletally anchored molar intrusion. We chose to place the implants in the thicker, keratinized mucosa of the palate, since placement in the non-keratinized mucosa is more likely to lead to miniscrew failure.[9]

Although molar intrusion using micro-implant anchorage is an effective method of correcting open bite, it is also associated with undesirable transverse forces. The 1st-, 2nd-, and 3rd-order relationships of the intruded molars must be constantly monitored to ensure a successful treatment outcome.[10] Posterior torque control is important whenever buccal or palatal intrusive forces are applied, and a stabilizing appliance, such as the transpalatal arch used in this case, is required to prevent molar tipping. In our patient, molar intrusion with skeletal anchorage produced a counterclockwise rotation of the mandible, resulting in closure of the open bite and a beneficial reduction in lower facial height.

Fig. 4 Follow-up records taken one year after treatment.

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