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Case Report

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Oral Dyspraxia-Malocclusion: A Case Report

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The subject of this report is a white female of North-European ancestry with a confirmed diagnosis of congenital cerebral palsy. At age 14 years, several problems were noted, namely oral dyspraxia, hearing and visual impairments, mental deficiency, and anxiety disorders. Medical reports listed the following test results. The patient failed the far point vision screening test with a 20/50 acuity in the right eye and 20/30 in the left eye. The patient failed the hearing screening test. Oral motor dysfunction (oral dyspraxia) was demonstrated, with difficulty in chewing hard solid foods. The psychological evaluation revealed the patient to be functioning in the mentally deficient range, with a Wechsler Scale I.Q. of 69. A 20-point discrepancy between the verbal and performance scales suggested a significant learning disability component in the area of performance. A significant separation-anxiety disorder was found in an evaluation of emotional state. A learning evaluation demonstrated age-appropriate reading and spelling skills with severely depressed math and written language abilities. There were marked difficulties with visual memory, visual perception and visual motor integration. Mild to moderate language comprehension and expression deficits were found, evidencing inter- and intra-test scatter. Impairments in abstract integrative language skills were discovered. These were suspected of being secondary to overall cognitive levels (*Matthews, personal communication).*

Fig. 1

Fig. 2

ORAL AND DENTAL FINDINGS

Orofacial dysfunction during chewing and swallowing was observed, along with lack of masseter muscle contraction, a teeth-apart swallow, chronic low tongue resting posture, with the tongue resting over the occlusal surfaces of posterior teeth, full anterior tongue thrusting against both upper and lower anterior teeth, lack of lip seal during resting posture, and excessive contractions during chewing and swallowing of the mentalis, orbicularis oris, buccinator, and other facial muscles (Figs. 1, 2). A diminished gag reflex was noted. Attempts to alter chewing patterns of the patient during the examination were unsuccessful. General sensory and motor functions of orofacial musculature were normal.

Visual examination of the oral cavity revealed excessively narrow dental arches, severe hyperplastic gingivitis and localized periodontitis with advanced recession at the lower right central incisor, Class I dental occlusion of molars and canines, extreme lower dental arch tooth-

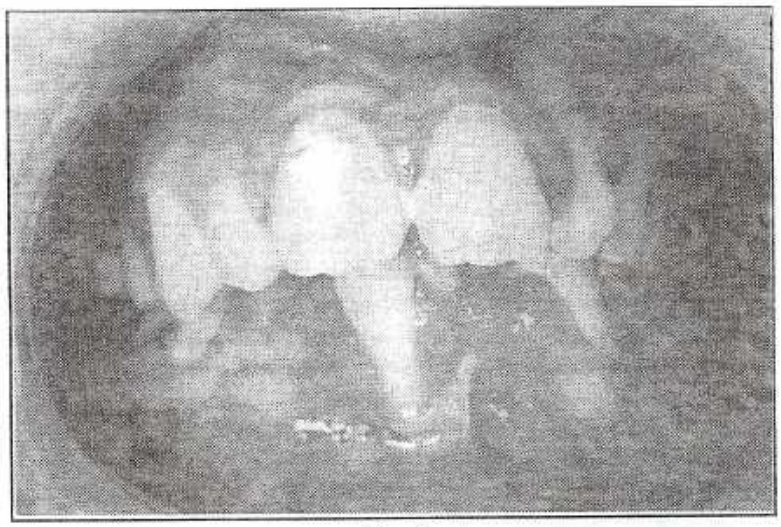


Fig. 3

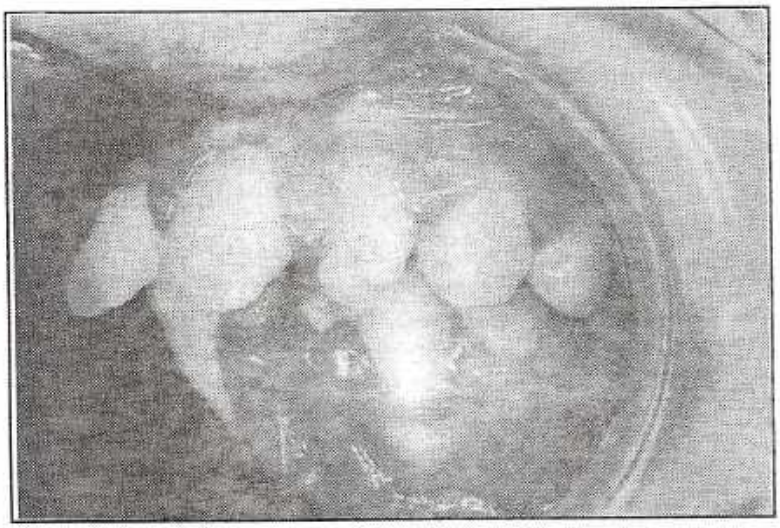


Fig. 4

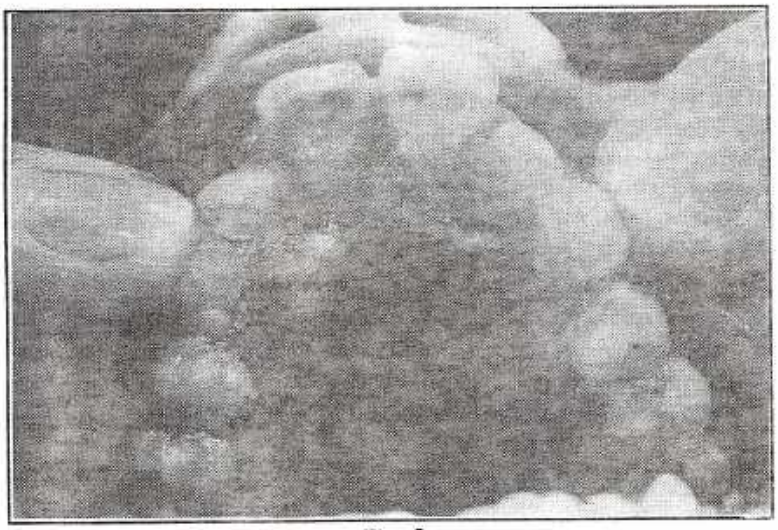


Fig. 5

to-tooth crowding, diastemas and flaring protrusively of upper anterior teeth, excessive heavy dental plaque over all teeth, upper incisors with unworn mamelons (three tubercles were present on the cutting edges of the incisor teeth that are normally worn off on or before 8-10 years of age), numerous dental caries, decalcification of dental enamel, and deep or closed bite. (It should be noted that a posterior open bite can result from the tongue's resting between upper and lower posterior teeth instead of inside them, thereby applying an apical vector impeding their eruption (*Thurow, 1977*). (See Figs. 3, 3a, 4, 5, 6.)

Barrett and Hanson (1978), in addressing normal and abnormal deglutition, describe a bilateral tongue thrust resulting in a bilateral open bite in the molar region. This is similar to what we observed in this case, especially the apparent "closed bite" anteriorly which masked the open bite posteriorly. Many dentists miss or do not diagnose this abnormality.

All intake of solid foods had to be prepared with a food blender. Swallowing and chewing a normal diet was impossible for this patient. Parents had to brush the patient's teeth. This was most difficult because the patient's extreme facial and oral muscle contractions resisted their efforts. Clinical management of this case presented a challenge far exceeding any other that we had undertaken in our practice of dentistry. Therapy demanded a multidisciplinary approach, namely, diagnostic, oral myofunctional, periodontal, restorative, orthodontic/orthopedic, plus constant parental support. Cephalometric radiographs were taken prior to therapy and after. (See cephalometric tracings and illustrations in Figs. 7, 10a, 11.)

TREATMENT

Patient acceptance and parental cooperation were the initial objectives of therapy by means of education and motivation. Without these goals being achieved any hope of treatment success would not be forthcoming. Initially, orthodontic/orthopedic therapy preceded orofacial myofunctional treatment. It has been our experience that establishing an oral environment that permits proper muscle function during chewing and swallowing facilitates the results desired by the orofacial myologist. In other words, we feel strongly that providing a "parking lot" for proper tongue posturing at rest and during function is recommended prior to the initiation of orofacial myofunctional therapy whenever possible.

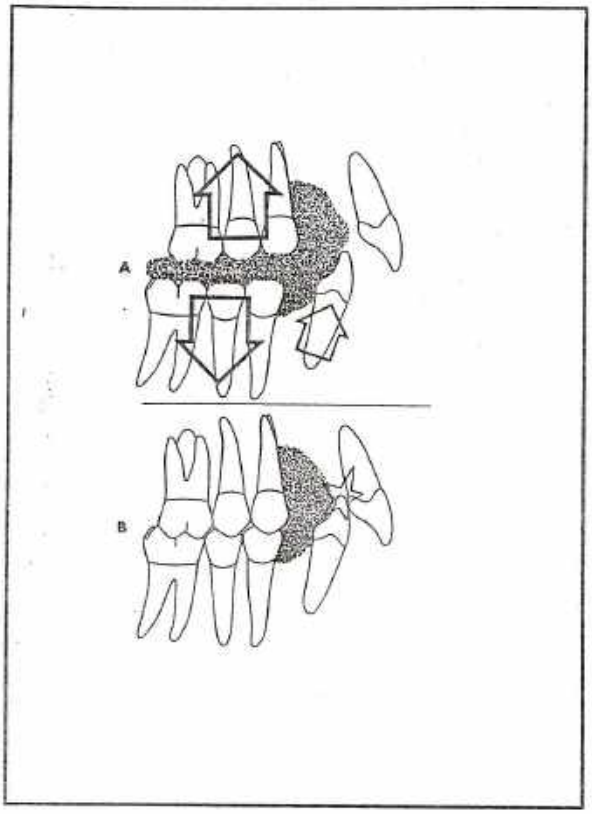


Fig. 3a

An open bite of all the buccal teeth (A) can allow the incisors to overclose (B). An apparent closed bite can thus be a symptom of an actual open bite (Thurow, 1977). The tongue resting between the buccal teeth instead of inside them can apply an apical vector impeding their eruption. If all the buccal teeth are subject to this influence, the mandible can then close farther than normal, allowing the anterior teeth to overclose. On clinical examination this gives the illusion that the anterior teeth have overerupted when the problem is actually retarded buccal (posterior tooth) eruption. (Courtesy of Dr. R. C. Thurow.)

This treatment approach creates less frustration for both the oral myologist and patient when the palate is high and narrow. It has also been our observation that certain patients perform better during therapy when no dental appliances are present, though, this is not always the case.

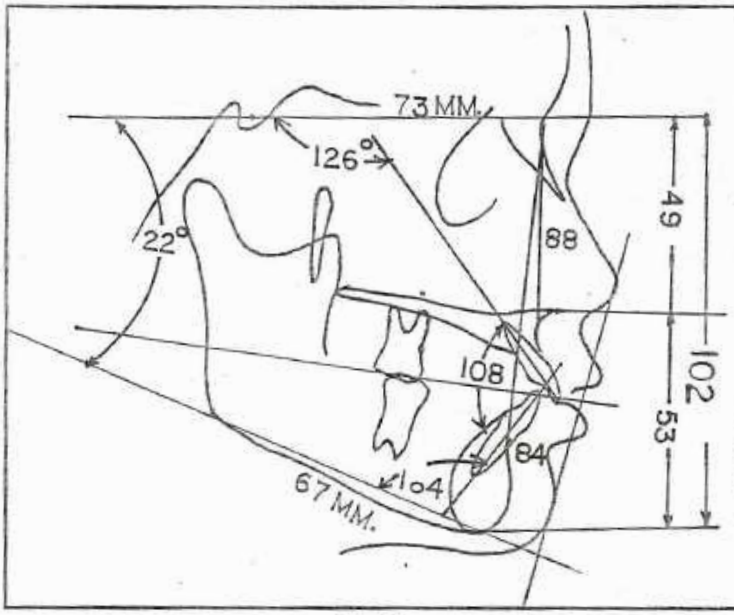
Removable orthopedic/orthodontic functional appliances were used during the entire course of therapy. We selected the Crozat type of appliances primarily since they are removable, allowing for better oral hygiene when extensive plaque and dental caries are present. Moyers(1973),in discussing the Crozat appliance, writes *It is indicated when caries are a factor; it is a tried and proved appliance; it is sightly; no bands are used. It is clean because it is removable.* Narrow dental arches are reliably expanded and teeth repositioned simultaneously. The appliances use extremely light forces that are not painful, and root resorption is nonexistent when they are used properly. (Figs. 7a, 8.)

Problems were encountered initially in the placement of the appliances due to the patient's diminished ability to perform motor skills. This was overcome by teaching the patient the correct placement under supervision. Patient acceptance and cooperation proved to be the keys to achieving bony orthopedic changes needed as well as tooth repositioning. Narrow maxillary and mandibular dental arches were developed. (Figs. 9, 10.) The period of time involved was 3 years 2 months. Of special note--the mandibular intercanine width increased seven millimeters, from 23 mm to 30 mm. This remarkable degree of arch development allowed for the alignment of lower anterior teeth without resorting to extraction of the lower right central incisor. After active appliance therapy, the patient was placed on a tooth positioner (T P Orthodontics) to fine-tune tooth position and restrict tongue thrusting. The positioner appliance was worn at times during the day, but was mainly for nighttime use.

Fig. 6

Orofacial myofunctional treatment commenced after favorable dental arch remodeling was accomplished. Myofunctional exercises consisted of (1) tongue tip placement, (2) middle tongue placement, (3) masseter and temporalis contraction, (4) slurp and swallow, (5) resting tongue and lip postures and (6) phonetics.

It should be noted that the patient has never been able to chew hard solid foods. Habituation of a normal oral swallow without facial grimace



Cephalometric Analysis of 10 /85 (pretreatment) depicting abnormal short Total Anterior Facial Height of 102 mm. According to Isaacson et al (1977) the mean for this patient's Vertical Jaw Relation should be 110.2 mm. Excessive labial inclination of the upper central incisor of 126 degrees (Mean 100-102 degrees). Excessive labial inclination of the lower incisors of 104 degrees (mean 90 degrees to the Mandibular plane). Short mandibular corpus length of 67 mm (GO-ME). According to Riolo et al (1974) the mean for female age 14 years is 74.8 mm. The interincisal angle of 108 degrees is excessively low with the mean for this angle being 132 degrees. Note the protrusion of the lips beyond the Ricketts facial esthetic line. "Wits" skeletal appraisal 4.0 mm.

Fig. 7

and extreme muscular contraction was not possible in this case. This may be due to neurological impairment.

Occupational therapists at the Children's Hospital Rehabilitation Center, Denver, Colorado, noted that the patient at times could execute a normal chewing pattern, but when attention was directed to her chewing activity all normal chewing patterns ceased. No food asphyxiation was reported to the treating physician. The patient's problem appeared to be confined the oral to phases of deglutition, although, we observed an improvement in the oral phases of deglutition. We could not achieve normality or habituation. It is possible that the improvement of the patient's oral environment (dental and bony dental arch development) contributed to the progress made. It would seem reasonable to conclude that orthopedic/orthodontic changes, along with contributions of the orofacial myologist, assisted the patient in adapting to the treatment appliances.

Oral hygiene and periodontal treatment were important aspects of total patient care. The patient at 14 years of age was not able to brush or floss her teeth. The dental hygiene that was available was only that performed by the patient's parent. We found it necessary to utilize oral prophylaxis at close intervals coupled with

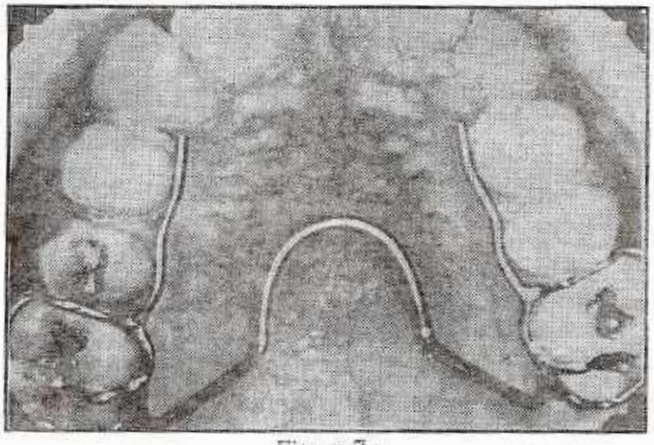


Figure 7a

View of Maxillary Crozat orthopedic/orthodontic type of removable functional appliance. Useful for those patients in which oral hygiene is essential to achieving orthopedic bony jaw remodeling and tooth repositioning. Dental caries and rampant gingivitis in this case could have defeated the objectives of total treatment.

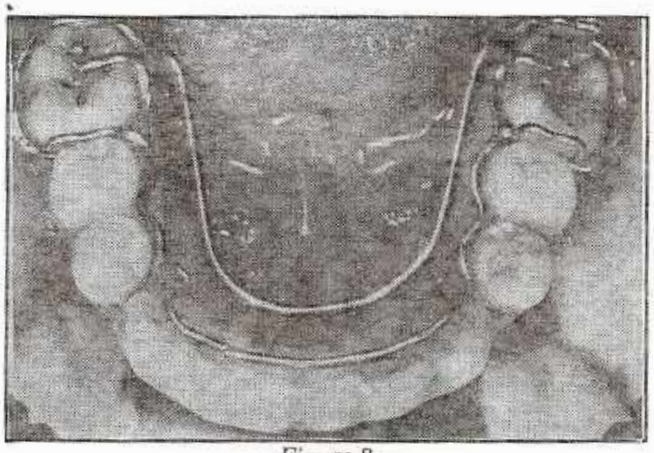


Figure 8

Mandibular Crozat orthopedic/orthodontic type of removable functional appliance. This appliance was introduced by orthodontist George Crozat in 1920 and is still in use today by many dentists.

special oral hygiene instructions. At the time of termination of therapy, an acceptable degree of oral hygiene was being achieved. The previously noted gingivitis was also improved. A gingival graft was placed to cover the denuded root of the lower right mandibular incisor. This was accomplished after tooth alignment had been completed (Figs. 12, 13, 14). It is well known that tooth malposition is a major factor in initiation of periodontal disease. Tooth malpositions predispose the patient to periodontal disease in that the function of the interdental embrasures formed by the interproximal contour of the teeth adjoining one another cannot act as spillways for food to escape during mastication. The result is food impaction, irritation, tissue damage, gingival bleeding, gingival hyperplasia, and ultimately infection. Posttreatment observation of the patient revealed no relapse or return to the tooth crowding or gingival problems after a period of one year.

DISCUSSION

A question might be raised about the evolution of this patient's dental problem. We would advance the premise that the patient's adverse function of the orofacial musculature during resting, mastication and swallowing caused (1) pathological tooth migration, (2) facial distortion, (3) emotional stress, (4) malocclusion and (5) periodontal disease. Utilization of Crozat orthopedic/orthodontic appliances, restorative dentistry, periodontal therapy, and orofacial myofunctional treatment all played a role in treating these problems. To be sure, there were and are factors that we were not able to evaluate or identify. These factors may well stand in the way of a totally successful management. Unfortunately, the treatment of this case was terminated in an untimely manner due to circumstances beyond our control.

Subtelny (1982), addressing abnormal deglutition and dental relapse states--*Cineradiographic observations have clearly demonstrated that patterns of muscle function during deglutition adapt to alterations in form when it is anatomically and physiologically possible to establish correct relationships. Follow up cineradiography on these same patients subsequent to the removal of retention clearly indicated that the patterns of adaptation maintain themselves during the swallowing act. Relapse to the original malocclusion has not been noted.* This may be one reason we did not observe any relapse posttreatment for a one year period.

However, more time would be needed to evaluate this aspect. Subtelny further states--*If reasons are to be sought for relapse tendencies, it may be that the skeletal jaws are not growing adequately and in a favorable direction, that severe adverse, skeletal relationships exist, that the tongue mass is excessive, or even that the orthodontist has created an inadequate dimension to the environment to accommodate the tongue.*

At any rate, any procedures followed by general dentists, orthodontists, and periodontists that promote better oral hygiene, healthier teeth, and more optimal intra- and inter-maxillary space would seem to be preferable to those that mitigate against these conditions.

An important contribution to pediatric dentistry with relevance to orofacial myology was a research report by McInaney (1980). In this study a total of 22 cases diagnosed as having space discrepancy problems in the deciduous and early mixed dentitions showed that treatment by early expansion therapy with Crozat appliances had eliminated the need for extraction of deciduous canines or permanent premolars. Dentists were strongly urged to examine young patients for possibly crowded dentition no later than the emergence of the mandibular permanent central incisors so that treatment, if needed, might maximize optimal orofacial development. An additional inference that can be drawn is that later need for orthognathic surgery and problems of relapse in these patients as they reach adulthood can often be avoided. Stuart, an authority in gnathology (Hockel, 1983), states — *dentists have found that by providing an environment in which deformative influences are cancelled out or overcome, the direction of growth can be controlled.*

Proffit (1986) states — *Only brain-damaged children retain a truly infantile swallow in which the posterior part of the tongue has little or no role.* Moyers (1973) describes a retained infantile swallowing behavior after the arrival of the permanent teeth. He states — *Fortunately, very few people have a true retained infantile swallow. Those who do, demonstrate very strong total contractions of the lips and facial musculature, often visualized as a massive grimace. The tongue thrusts violently between the teeth in the front and on both sides. The facial and buccal musculature is powerful; particularly noticeable are contractions of the buccinator muscle. Patients with a retained infantile swallow have serious difficulties in mastication. The gag threshold is typically low. These patients may restrict themselves to a soft diet and state frankly that they do not enjoy eating. The prognosis for conditioning of such a primitive reflex is very poor.* The references by both Proffit and Moyers above most closely describe the patient we have chosen for this case report.

Graber (1966) states — *Whenever there is a struggle between muscle and bone, bone yields.* Weinmann and Sicher (1955) in describing "Wolff's Law of Transformation" state — *If it be true that functional stresses shape the bone, then it is equally true that a change in the strength or direction of forces will lead to changes in the form and structure of bones.* This concept can be interpreted to mean that form and structure follow function. In our case study, adverse musculature forces coming from the mentalis and buccinator, as well as the tongue's abnormal resting posture and anterior tongue thrusting could mean conceptually that form and structure follow function. This gains credence with the added compo-

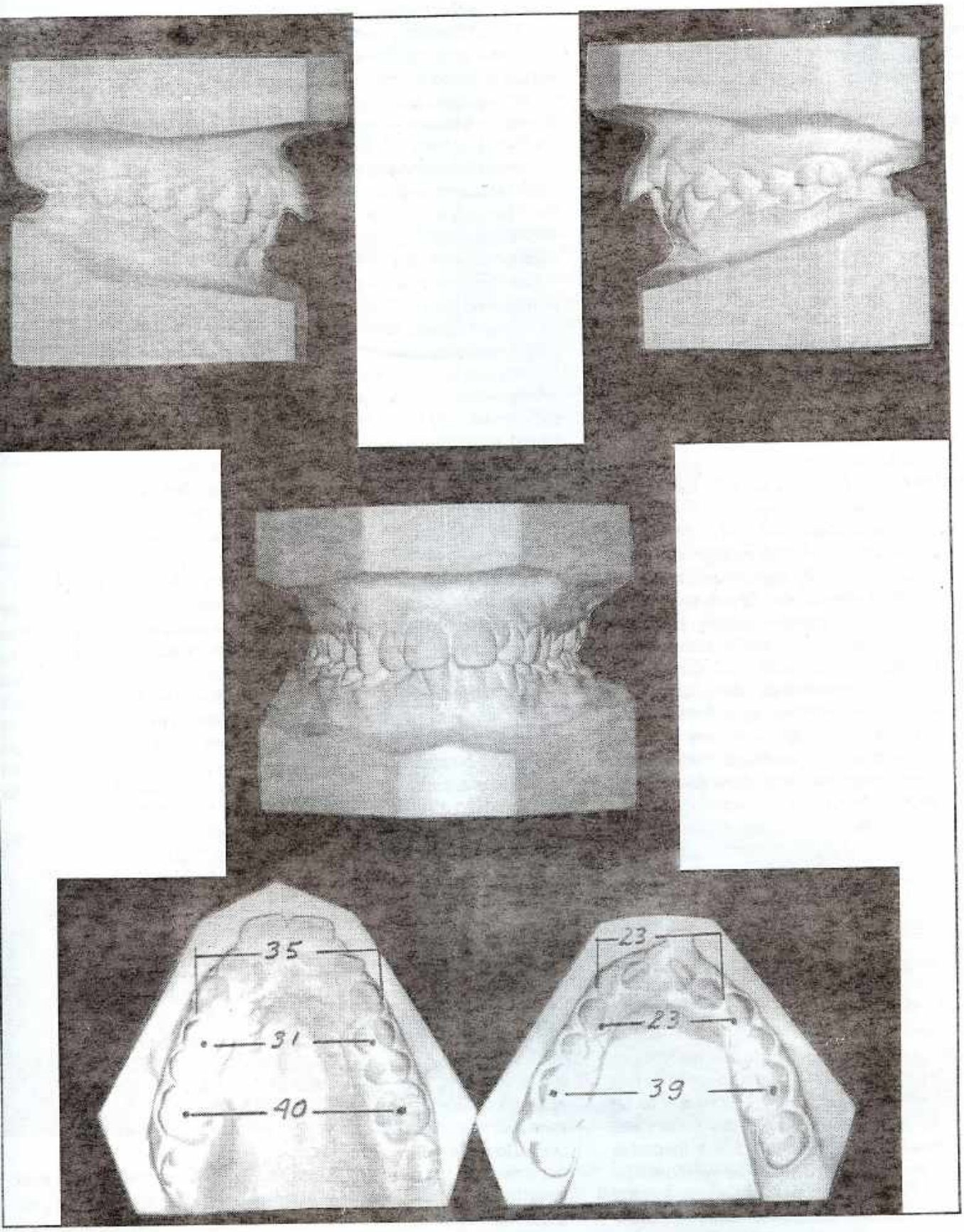


Fig. 9 - 10/86

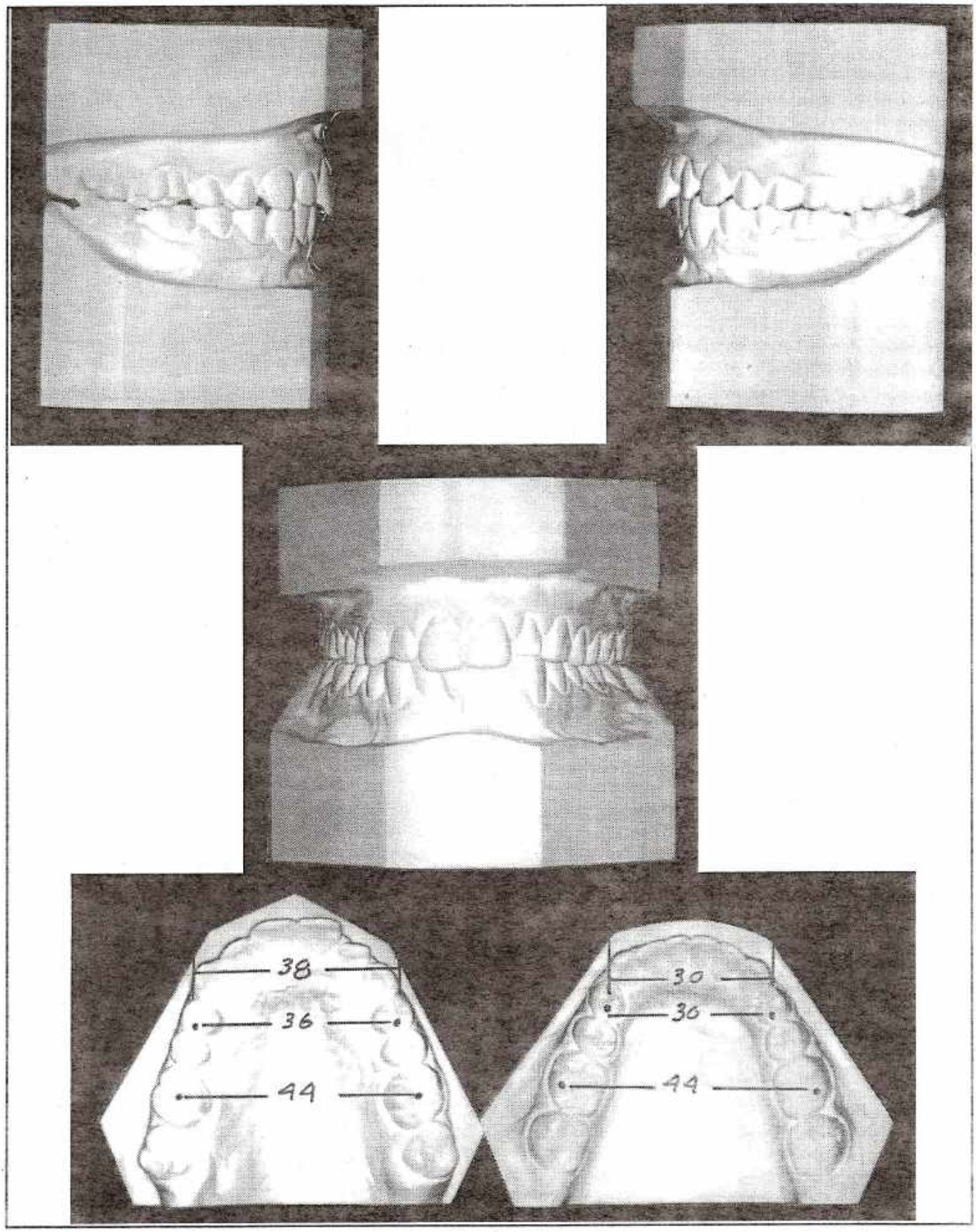


Fig. 10 - 12/89

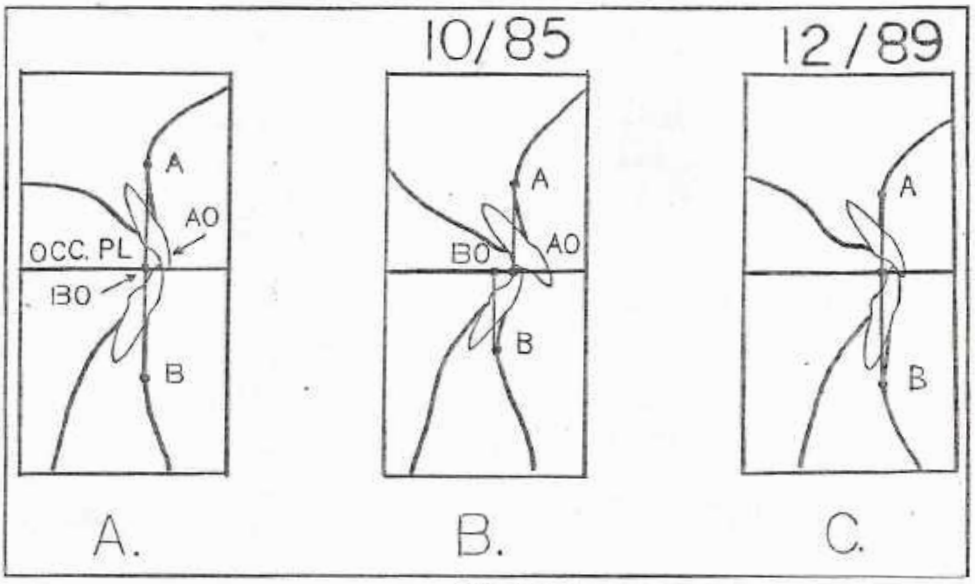


Fig. 10a

The "Wits" (Jacobson, 1975) appraisal of jaw disharmony is a diagnostic aid whereby the severity or degree of anterioposterior jaw disharmony can be measured on a lateral cephalometric head film. Figure 10a is a diagrammatic illustration of (A) essentially normal maxillary and mandibular skeletal relationships with (female) patients having excellent dental occlusion. Point "A" is located at the deepest point on the contour of the maxilla between the anterior nasal spine and the alveolus. Point "B" is the point at the deepest curvature of the outline of the symphysis of the chin. The average jaw relationship according to the "Wits" reading is 1 mm in males and 0 in females. In skeletal Class II jaw dysplasias, point B0 would be located well behind point A0 (a positive reading). Illustration (B) depicts the B) point 4 mm behind the A0 point of our patient prior to commencement of treatment. Illustration (C) depicts the change skeletally at termination of treatment. Note "A" point and "B" points are equal denoting a favorable skeletal change according to the "Wits" appraisal of jaw disharmony. Super-imposition of Cephalometric x-rays of 12/89 and 10/85 revealed a 3 mm bony increase of the mandible.

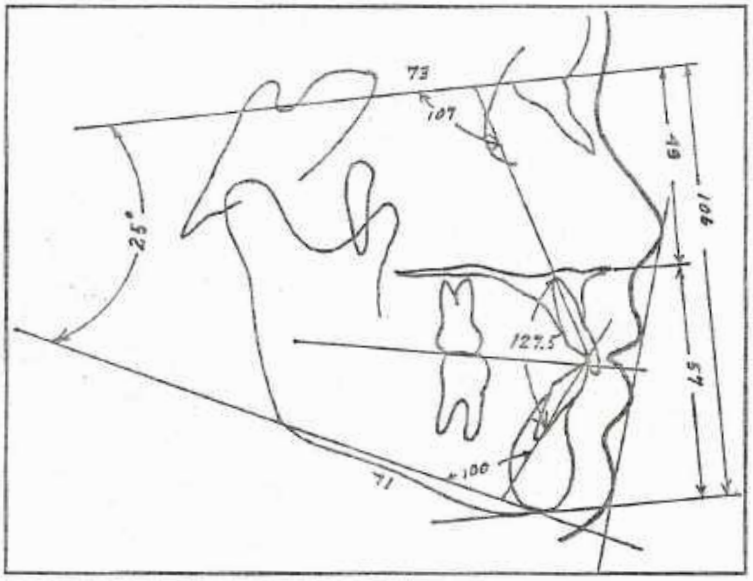


Fig. 11

Cephalometric Analysis of 12/89 (Posttreatment) depicting an increase in Total Anterior Facial Height from 102 mm pretreatment to 106 mm. This increase is within 1 SD of the Mean of 110.2 mm. The "Wits" appraisal for anterioposterior skeletal jaw relationship changed from 4 mm to "0" posttreatment. The interincisal angle increased from 108 degrees pretreatment to 127.5 degrees posttreatment. The Ricketts facial esthetic line dramatically improved. Protrusion of the upper and lower lips beyond the linear line from the chin to the tip of the nose pretreatment changed to the upper and lower lips located on or slightly behind that line posttreatment. A favorable change occurred in the SN/MP angle, from 22 degrees to 25 degrees. This may be due to the enhancing of molar eruption with dental arch remodeling and possible influence of orofacial myofunctional treatment and growth.

nent of brain-damage causing intrauterine cerebral palsy and later manifested as oral dyspraxia. Other unidentified factors or variables may contribute to this patient's problem. One such factor could be nerve damage to VII so that muscle function is compromised in stabilizing the mandible during the swallow, as described by Moyers.

Wilson (1988) states — *Not to be overlooked is the influence of the functional factor on the developing dentition. If one is to recognize the validity of Wolff's law, which correlates the relationship of function to form, the influence of adequate function on the deciduous and developing dentition cannot be dismissed lightly. An early malocclusion with its associated malfunction may have a directional influence contrary to the optimum*

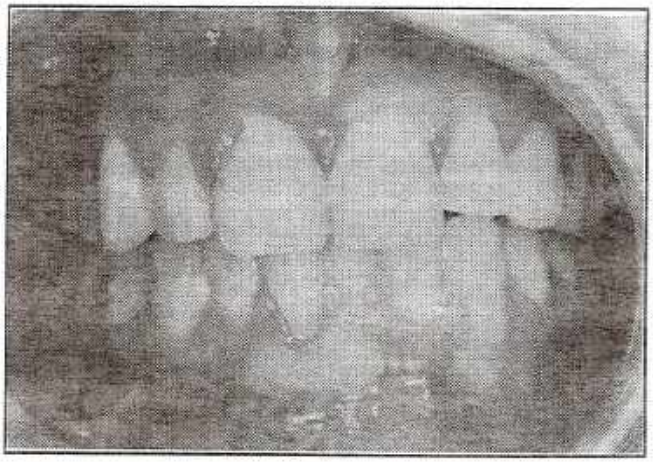


Fig. 12

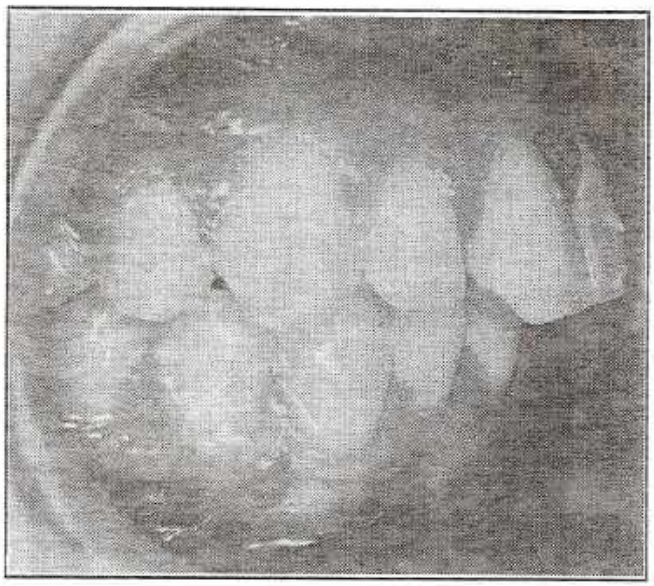


Fig. 13

Fig. 14

Patient, age 17, at the time of termination of therapy. Note smile line and a visibly happy patient. Prior to treatment the patient made concerted efforts not to smile due to embarrassment about her obvious protruding upper incisors and chronic hyperplastic gingivitis. The dental condition of this patient prior to treatment had affected her adversely in the form of a marked anxiety disorder.

development of that occlusion. Cases are commonly found in which the buccinator muscle may be two or three times the normal thickness. In such cases there may be a high incidence of constriction of the arch through the buccal area. This relationship is not to be dismissed lightly and should be considered in treatment planning involving expansion and posttreatment stability.

Mason (1988) has stated — *Generally, most orthodontists need to be challenged to recognize potential sources of relapse and build in adjustment for possible relapse into their treatment plans.* Wilson addresses the relapse problem from one standpoint of orthodontic mechanics as follows — *Each orthodontist can adhere strictly to a system of orthodontic mechanics and can achieve satisfactory results in cases to which the system is adapted. However, the diversity and complexity of orthodontic problems demand a whole spectrum of appliance functions not found in any single appliance. The concept of the so-called "pure" appliance historically has proven to be an illusion. It creates restrictive treatment concepts for unidirectional appliances. Multi directional treatment reduces the necessity for exceeding the tolerable limits of any one treatment direction, which would limit or strain the readaptive process, enforcing a degree of relapse and risking iatrogenic side effects* (Wilson, 1988).

To be sure, when addressing the problem of relapse, one should be aware that this is a most complex problem. Complex problems do not have simplistic answers. It can be stated that if a deformity such as malocclusion merits correction regardless of treatment modalities, it follows that the maintenance of the result is equally important. It has been expressed in another way by

some orthodontists as: *Orthodontic treatment begins with retention.* In our practice we have seen many patients over the years who have undergone orthodontic therapy that appeared successful initially , but the result was destroyed later by an uncontrolled myofunctional disorder. Some of these cases also manifested severe periodontal problems. Orthodontics and periodontics along with oral myology seem to be of necessity interdependent if successful management of patients' problems are to be resolved. Restorative dentistry is also involved with complications due to uncontrolled oral facial muscles imbalances. Dawson (1989), addressing severe anterior open bites: states, *Very often severe open bite problems are the result of habits that were caused by other habits. The anterior open bite that results from a thumb-sucking habit is often perpetuated by a tongue thrust swallowing habit. The tongue thrust results from an attempt to seal off the anterior opening to develop negative pressure for the swallow. Combining occlusal correction with myofunctional therapy has the capability of solving the problem if the patient can cooperate, but it has an uncertain prognosis because it is difficult to predict patient cooperation in changing such a set swallowing pattern. Nevertheless, it should be tried if there is no need for immediacy. If the problem is habit caused, orthodontic procedures can almost always be used successfully to realign the anterior teeth. The only problem is keeping them there after they are moved. Solving the problem of achieving a stable anterior relationship may require a three-pronged attack: (1) Orthodontic correction of anterior tooth relationships, (2) myofunctional therapy to eliminate tongue or lip habits, (3) occlusal equilibration to eliminate the need for protective tongue or lip habits.*

CONCLUSIONS

This case history dramatically illustrates the influence of adverse orofacial muscle imbalance on (1) facial distortion, (2) pathological tooth migration, (3) emotional stress and (4) periodontal disease. It is our opinion that tongue posture during resting phases as well as during swallowing played an important role in this patient's deformity. The etiological factors of an infantile retained swallow behavior coupled with probable nerve damage (intrauterine cerebral palsy) and mental deficiency were evident. Orthodontic/orthopedic therapy utilizing Crozat appliances resulted in a better dental occlusion and oral environment for the performance of the oral phase of deglutition. Orofacial myofunctional therapy was not able to achieve desired habituation. Nevertheless, an improvement in the form of the patient's oral environment (dental arch development and tooth repositioning) contributed to this patient's overall well being. At the time of termination of therapy, the patient was not able to masticate solid foods in spite of sensory and motor data that the oral motor musculature as intact. The patient's inability to achieve orofacial musculature balance and harmony in the future may affect the results achieved. Factors were discussed relating to relapse and dental mechanics employed in treating dental deformities, their possible effect on stability, and relapse of treated orthodontic cases, as well as implications affecting oral myofunctional objectives. Treatment modalities and concepts regarding orthodontics and orofacial myology are still evolving. The contributions of these two fields to the profession of dentistry and medicine are immense.

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