Orthodontic Treatment and Tongue Surgery in a Class III Open-bite Malocclusion

a Case Report

Roberto M. Ruff

A long-term (13yr) report on treatment of macroglossia and associated malocclusion with partial glossectomy and orthodontic therapy.

KEY WORDS: • GLOSSECTOMY • OPEN BITE • TONGUE •

Tongue malfunctions and abnormalities, particularly macroglossia, present complex problems in orthodontics. Today's clinician has so many tools to aid in making a proper diagnosis that it is often possible to organize an effective treatment plan and feel that it will lead to a successful result. This is often **not** true in the patient with tongue problems, and it is most frustrating after so much dedication and hard work to see a failure caused by such an uncontrollable physiological factor. Open bite is one such effect.

Etiology and Diagnosis of Macroglossia and Open Bite

Many causes can be listed for open bite, including thumb sucking, tongue thrusting, stress and tension, poor neuromuscular pattern (particularly in retarded or emotionally disturbed children), and of course, macroglossia. It is not the purpose of this paper to describe abnormal pathological cases such as Beckwith-Weidemann syndrome, cleft palate, and Pierre Robin syndrome (SOKOLOSKI, OGLE & WAITE 1978) or lymphangiomatous macroglossia (KEMPER & BLOOM 1944), but it is appropriate to include a few words on pertinent literature related to the various problems connected with the case reported here.

Macroglossia is defined in BOUCHER'S CLINICAL DENTAL TERMINOLOGY (1982) as a tongue enlarged due to muscle hypertrophy, tumor or endocrine disturbance. While many pathologic conditions may cause tongue enlargement, the subject of this paper did not present any of those pathologic conditions; only a non-specific excess of the muscle mass.

Author Address:

Dr. Roberto M. Ruff
Paseo De Las Palmas
No. 745 Desp. 1105
Lomas De Chapultepec
11000 Mexico, D.F.
MEXICO

Dr. Ruff is in the private practice of Orthodontics in Mexico City, and Professor and Past Chairman of the Graduate Department of Orthodontics at the National University of Mexico in Mexico City. He is a Dental graduate (D.D.S.) of the University of Southern California at Los Angeles, and holds a Certificate in Orthodontics from the Graduate Department of Orthodontics at the National University of Mexico.

RICHARDSON'S (1981) classification of open bites relates the etiology to skeletal pattern, soft tissue abnormalities and poor habits. This case presents a skeletal problem combined with macroglossia.

SUBTELNY AND MUSGRAVES' (1973) article on open-bite treatment suggests that treatment centered on the cause and not on the effect of the anterior open bite offers the best promise of success in controlling the downward rotation of the mandible.

Subjective interpretation of tongue size relative to open bite has been supplanted by more objective findings based on cephalometric roentgenology. THOMPSON (1938), MCKEE (1956), and Brodie have described the gradual reduction of tongue size in relation to total oral volume as the individual approaches maturity. Bench has evaluated tongue size and posture as assessed in normal growth by the position of the hyoid level relative to the third, fourth and fifth vertebrae. FABARON (1974) quotes Andran and Kemp, Shelton, Sloan, Meyer-Klatsky, Tulley, Hanson and Bernard, Cleall, Moll and, in France, Fieux and Noix, all of whom reported on studies using cinefluoroscopy to determine the position of the tongue while swallowing and at rest.

GENSIOR (1970) describes the true Class III malocclusion in the mandibular arch as a forward displacement, and classifies it skeletally as a maxillary insufficiency or a mandibular overgrowth, or a combination of both. However, he does not describe overall enlargement of the mandibular arch, particularly lateral enlargement in width as existed in this patient.

GERSHATER (1972) concludes in his article on the perspectives of open bite that the 32.3% incidence of open bite malocclusions in the Edenwald School, in which the children were both mentally retarded and emotionally disturbed, was mainly attributable to their poor neuromuscular patterns and pernicious oral habits. He further states that in addition to the decided influence of congenital and inherited patterns on the growth and development of oral facial structures, adverse environmental factors can markedly exaggerate open-bite deformities. Potential open-bite malocclusions can often be avoided by proper handling of tonsil and adenoid problems in the *early* stages of growth.

The Author's various studies on Otomi Indian tribes in Mexico (RUFF ET AL. 1950A, RUFF ET AL. 1950B, AND RUFF 1957) have showed that there were no Class III nor open bite malocclusions in the 172 cases studied. These ranged in age from 6 to 65 years. Furthermore, no thumb sucking or tongue thrusting habits were found. This may be linked to the fact that infants are breast-fed, so artificial nipples or bottles are never used. They are always carried wrapped in a serape, in contact with the mother, thus enhancing their emotional development by reinforcing feelings of security.

In WATSON'S (1981) editorial, where he discusses the work of Mayers, Nahum, Horowitz and Benedicto, Proffit, Subtelny and Sakuda, and Horowitz and Hixon, he touches most of the important points related to open-bite malocclusions. He quotes Proffit as stating that the tongue and lip "pressure" never balance, even at rest. Tongue pressure is greater than lip pressure, and tongue pressure is actually less in patients with open bite. Watson further reports that, even though the incidence of open bite in the United States is low (3.5% white and 16.3% black, as he quotes Kelly), it is high on the clinician's list of problems because of its high potential for frustration and failure. He also mentions that the etiological factors are very complex, and any clinician's attempt to correct open bite following a rulebook cure will eventually lead to questionable compromises, relapse, or failure.

Mason and Proffit cite spontaneous reduction of open bite in American children between 6 and 12 years.

It is clearly evident that proper diagnosis is essential for each individual case and even those treated with orthognathic surgery can fail if all factors are not fully considered.

Treatment of Macroglossia and Open Bite

Fabaron (1973) and Biourge (1966) found that the tongue in young adults can vary from small to normal and on to double the size of the buccal cavity. They also found that the volume of the tongue is greater in the male, and that there is no interrelation between the size of the cranium and the volume of the tongue and oral cavity. They state further that, in cases of mandibular prognathisms presenting a wide oral cavity, it seems logical to surmise that the lingual etiology (by pressure) in regard to malposition of the tongue is more than a volumetric enlargement of the tongue.

Severe macroglossias, which fortunately do not appear frequently, can sometimes be treated by neuromuscular reduction or orthopedic treatment of the lingual hyoidian. This therapy is probably much superior to glossectomy, but unfortunately it only partially helps the problem and rarely produces permanent results.

Maisels and Knowles (1979) reported a case of open bite in a girl age 6½ years, in whom a lymphangioma was diagnosed and successfully operated with a large crescent shark's-mouth excision as described by R. O. Dingman and W. C. Grabb. This surgery resulted in complete regression of the anterior open bite. They report that the first description of macroglossia is attributable to Virchow in 1854; however, a medieval carving in the church at Chipping in Lancashire indicates it was known much before Virchow. There are, of course, many causes of macroglossia, of which lymphangioma is but one.

As early as 1937, in a discussion of Milo Hellman's (1937) paper, G. W. Grieve of Toronto, Canada mentioned that he was sorry that Dr. Hellman had not said something about the tongue in connection with this open-bite type of case, and it seems that Dr. Blair and Dr. Federspiel had both done operations for the removal of certain portions of the tongue. Dr. Blair, in particular, took a "piece of apple pie" out of the center of the tongue to reduce its size.

Safirestein and Burton (1983) mention that successful treatment of severe skeletal open-bite malocclusion has always demanded the utmost of the orthodontist. They mention that combining the best of surgical and orthodontic disciplines offers these cases an optimistic outlook for the first time. They present a case which was treated orthodontically and surgically, stating that the latest techniques in orthognathic surgery have greatly expanded our orthodontic horizons, bringing with them new vistas and challenges; yet they do not mention tongue size.

Bjüggren, Jensen and Strombeck (1968) describe the different types of tongue resections according to Dingman and Grabb, which they performed on seven female patients aged 11 to 21 years in Stockholm between 1958 and 1967. All the patients presented anterior open bites and speech difficulties. With the exception of two, all had received preoperative speech therapy for various periods of time, and two had achieved substantial improvement. Six patients had central wedge excisions from the tip, and one a more oval excision from the dorsal surface of the tongue.

According to Bjüggren, Jensen and Strombeck, there is a low incidence of

this type of malocclusion, since they only operated on seven patients from 1958 to 1967, and those seven came from an area of more than 1,000,000 persons.

Of the seven operated cases, two had been orthodontically treated preoperatively. Treatment was continued postoperatively, with satisfactory results in one, and slight relapse of the open bite in the other.

MATTHEW FEDERSPIEL (1937) describes the surgical treatment of certain cases of macroglossia as either removal of a wedge-shaped piece of tongue or a marginal resection following the technique of Samson Handley. He mentions that he prefers the latter because the tongue can be reduced in size without altering its shape or interfering with its underlying muscular structure. In the marginal resection a V-shaped incision is made above and below, cutting as much of the margin as necessary, taking care to remove more from the papilla-bearing dorsum than from the under surface of the tongue. This leaves the smooth mucous membrane against the teeth, and the remaining papillae will not be irritated.

Long-term evaluation of these cases is not often seen in the literature, perhaps because the results are so often disappointing.

Description of the Reported Case

The patient is a Caucasian Mexican male of Spanish descent, who first presented in 1953 with an end-to-end open bite, a Class III molar occlusion and macroglossia. A speech impediment and tongue thrusting were present. Maxillary and mandibular incisors were crowded; there was a bilateral maxillary posterior lingual crossbite and protrusion of the face.

The mandibular angle was a steep 42°. Incisors were markedly inclined anteriorly, with a bimaxillary protrusion and open bite. He had a a Class III molar occlusion, an open bite of about 5mm, and the size of his teeth was in the 95th percentile. As he was only 14 years old, treatment was not started immediately in order to further evaluate his facial growth.

He could hardly speak because of the macroglossia, and at age 15 he was sent to a speech therapist where he was under treatment for several years. After completion of speech therapy and tongue retraining, the patient did learn to swallow properly, but still had difficulty in doing so unconsciously. His speech had not improved very much, but he was able to express himself sufficiently to be able to enter dental school in 1960.

During the years of speech therapy his occlusion was checked continually. Records were taken periodically, and treatment was finally started in September of 1960, when diagnostic records finally indicated that he appeared to have stopped growing. He was then 21 years old.

Diagnosis and Treatment Planning

Since teeth had to be removed because of crowding and protrusion, and because of previous pulpectomies on his upper first molars, the two mandibular first bicuspids and the two maxillary first molars were removed. In consultation with the plastic surgeon, it was decided that the macroglossia should be operated, with the timing of the operation to be determined after orthodontic treatment was started.

Radiographs were exposed on September 2, 1960, extractions completed November 15, and bands were placed on the maxillary molars and bicuspids in January, 1961. Sectional arches were placed, with Bull loops heavily activated to hyalinize the area of the bicuspids in accordance with Reitan's concept to facilitate moving the maxillary molars

mesially. The upper sectional arches were activated every three weeks.

The Plastic surgeon and the Author felt that surgery should follow this treatment. After careful study, a special type of operation was planned, and accomplished in March, 1961.

Partial Glossectomy

The vast majority of techniques for partial excision of the tongue have been designed for the excision of tumors. A major objective of these procedures is to preserve function and avoid scars that could impair movement. Such procedures are not always adequate when we want to decrease the tongue size. With a diagnosis of dental malposition caused by the tongue, it is extremely important to determine the exact location and direction of the forces acting on the teeth.

It was evident in this case that the total volume of the tongue was disproportionate to the size of the oral cavity. Length, width and thickness were all excessive. The plan was to remove more than 1cm of tongue all around the margin. It was therefore necessary to design an operation to modify the size of the tongue in all three dimensions.

The decision was to make a W-shaped incision of the tip in order to remove a considerable amount of tissue while still preserving the central portion. A wedge-shaped strip of tissue was also to be resected laterally along each side of the tongue from the lateral limits of the W to the posterior third of the tongue, in order to decrease the transverse dimension as well as the thickness and length. The surgeon's report was as follows:

C.F.D., Age 21. First seen March, 1961, with a dental occlusion problem resulting from macroglossia.

On examination he had an extremely thick tongue with longitudinal and transversal dimensions larger than normal. There was no evidence of enlargement produced by tumor. It was decided to do a partial glossectomy which would decrease the length, the width and the thickness of the tongue.

On March 21, 1961, under general endotracheal anesthesia through the right nostril, a triangular section measuring 4×4×5cm was excised from the tip of the tongue (Fig. 1). At the same time a wedge including mucosa and muscle was excised from both lateral edges of the tongue (Fig. 2), and the edges were sutured with a careful approximation of the muscle layers, leaving a longitudinal line of suture at the midline (Fig. 3). This wedge decreased both transverse dimension and thickness of the tongue.

The patient had an uneventful postoperative period. There was considerable edema of the mouth with significant discomfort, but without impediment of respiration. Sutures were removed the seventh and tenth postoperative days and healing was completed at that time.

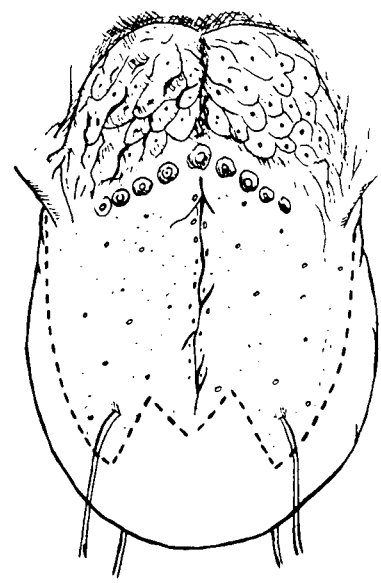

Fig. 1
Drawing of macroglossia prior to surgery

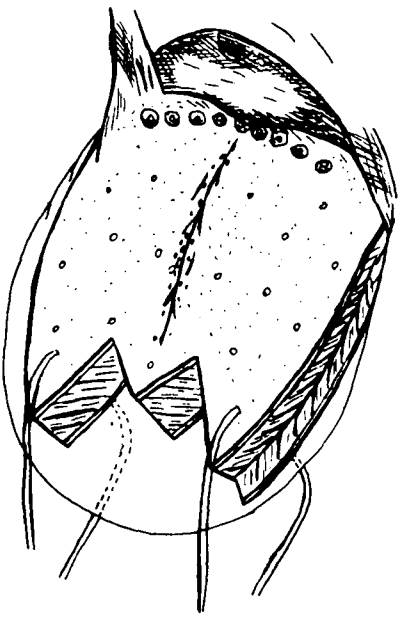

Fig. 2 Surgical cuts at time of operation

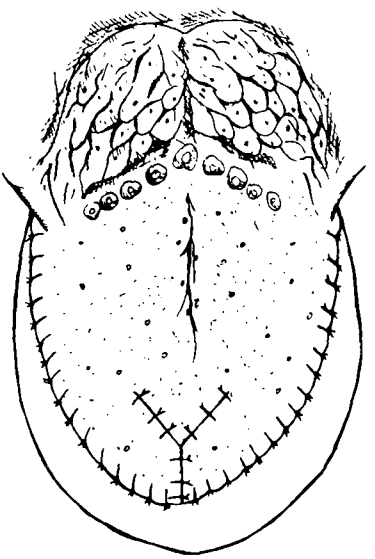

Fig. 3 Sutured tongue after operation

The edema subsided completely by the end of the second week. Speech difficulties persisted for about a month after surgery, but there was complete recovery of normal speech.

Once the wounds were closed, a shorter, narrower and thinner tongue was evident. The original shape was preserved.

This operation is similar to that done by Federspiel (1937), with the exception that he did not remove the tip of the tongue as was done in this case. Both the Plastic surgeon and the Author who devised this operation felt the necessity of shortening the length of the tongue as well as reducing its volume for complete success. This has fortunately proven to be a correct decision, as is demonstrated by the success of the reduction of the open bite and the stability of the orthodontic correction.

In April, 1961 the upper sectional arches were again activated and the mandibular arch was partially banded. A lingual arch was made to start contracting the mandibular molar width, and it was progressively shortened as the treatment proceeded.

In June the mandibular left lateral incisor and the right mandibular central incisor were banded as gingivally as possible in order to extrude them. An .018″ mandibular arch was constructed with loops to start closing spaces, and the lower lingual arch was contracted and torqued.

In the same month a contracting .018″ arch was placed in the mandibular arch and adjustment bends were placed in the arch to elevate the incisors. The patient was fully banded in July, and a maxillary .016″ multiloop arch placed and activated with an extreme reverse curve of Spee.

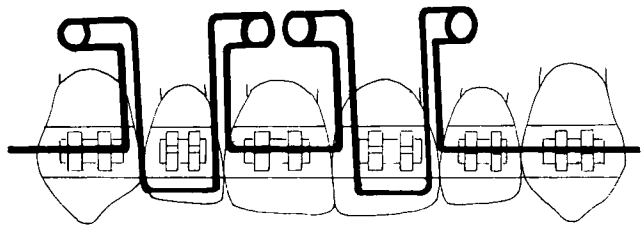

Fig. 4 Arch wire designed to extrude right maxillary lateral incisor and left maxillary central incisor to disrupt interdental fibers.

Succeeding arches were placed with slight expansion of the maxillary arch and contraction of the mandibular arch, and cross-bite elastics were used in the posterior segments. In October, 1961 the open bite was closed according to the technique utilized by Reitan, first extruding the right lateral and left central incisors with an .016″ arch wire (Fig. 4) with vertical elastics to disrupt the interdental fibers, along with posterior cross elastics.

This was followed in December by applying the same procedure to the opposite lateral and central incisors. As can be seen from the radiographs, no permanent damage was done to the root apices, periodontal tissues or supporting structures. This technique has proven very effective for the Author through many years with open bite cases.

Subsequent arches were used to finish closing the spaces and correct the rotations. In April, 1962 the buccal grooves of the lower first molars were deepened and reshaped to accomodate the buccal cusps of the second bicuspids. In June, 1962 finishing rectangular arches were placed with proper torque, reinforced with vertical elastics, and adjusted periodically.

Bands were removed in August and a positioner made to help him overcome the slight tongue thrusting habit which remained. He wore the positioner for six months and was then retained with maxillary and mandibular Hawley retainers for two more years. "Final" records were taken in December, 1962 at the age of 23 years.

Posttreatment Findings

The patient was checked regularly every year, and new records were taken in 1975 and again in 1977. He was visually checked in December, 1982, and the results were completely stable up to that time. This treatment can be considered a complete rehabilitation of a patient who had many handicaps to overcome. He is quite conscious of dental care and his gingival tissues are in excellent condition. He is now a practicing orthodontist, and communicates well with his patients.

In order not to confuse the cephalometric analysis, only three superimposed cephalometric tracings are shown; the first at the age of 15 years in March, 1955, the second at the conclusion of treatment in December, 1962 at 23 years of age, and the third a follow-up film made in February, 1975 at age 36, *thirteen years after treatment* (Figs. 5 and 6).

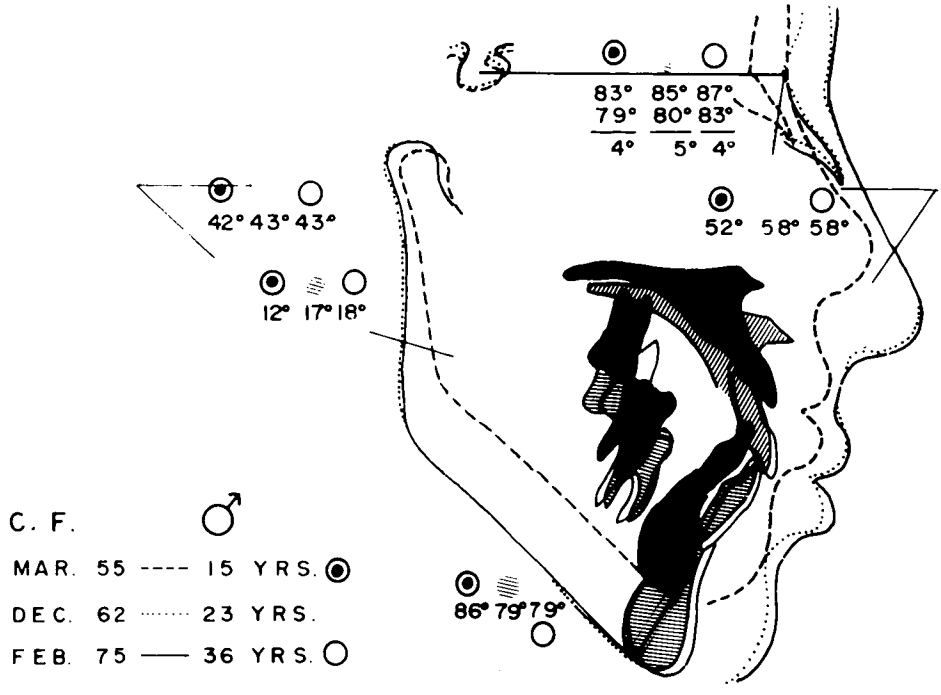

Fig. 5 Cephalometric superimposition, 15–36 years of age

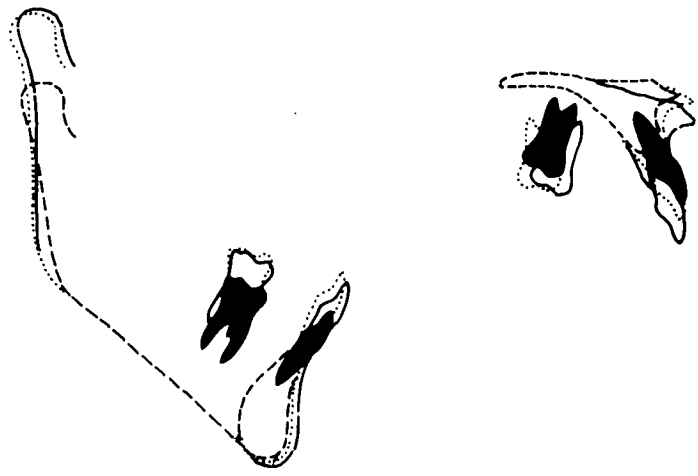

Fig. 6 Pretreatment, posttreatment and 13yrs posttreatment superimpositions.

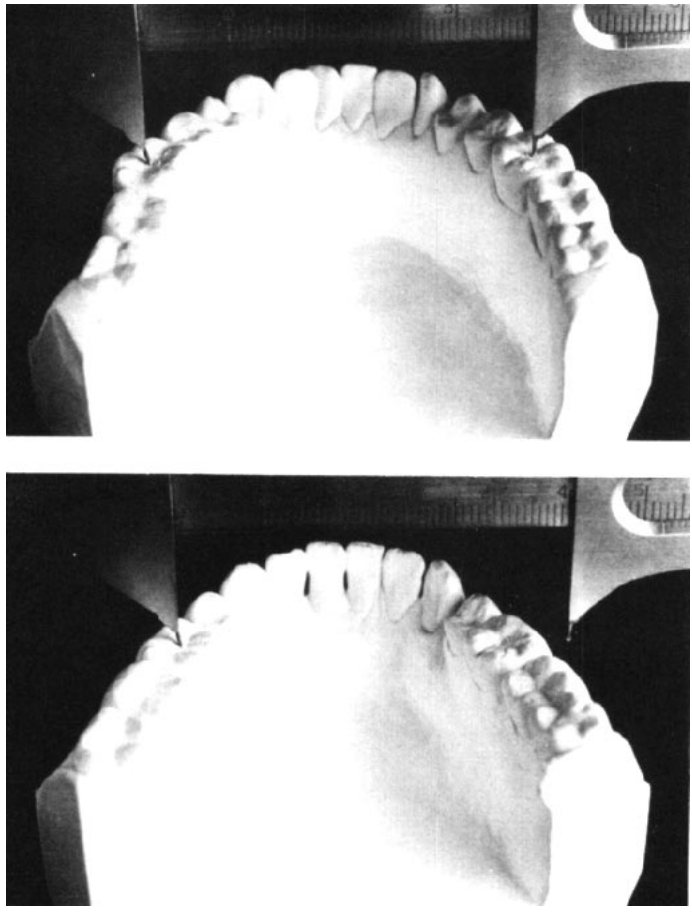

Fig. 7 Mandibular arch before and after treatment

The Frankfort mandibular angle to S-N increased only 1° — from 42° to 43°. The occlusal angle increased from 12° to 18°. The mandibular incisor was moved back, with the angle to the mandibular plane decreasing from 86° to 79°. The Frankfort/incisor angle improved from 52° to 58°. The pretreatment S-N-A angle was 83° and the posttreatment angle was 87°. We had been able, through the use of Class III mechanics, to advance the maxilla 4° as measured at S-N-A; however, the mandible kept growing, so the A-N-B angle of 4° persisted from 15 to 36 years of age.

Dental changes can be seen in Figs. 7-9. The mandibular arch width measured 52.5mm between the central grooves of the first molars before treatment and 30.5mm after finishing. The maxillary arch width as measured from the central grooves of the upper first molars remained the same. The mandibular cuspid width also remained the same.

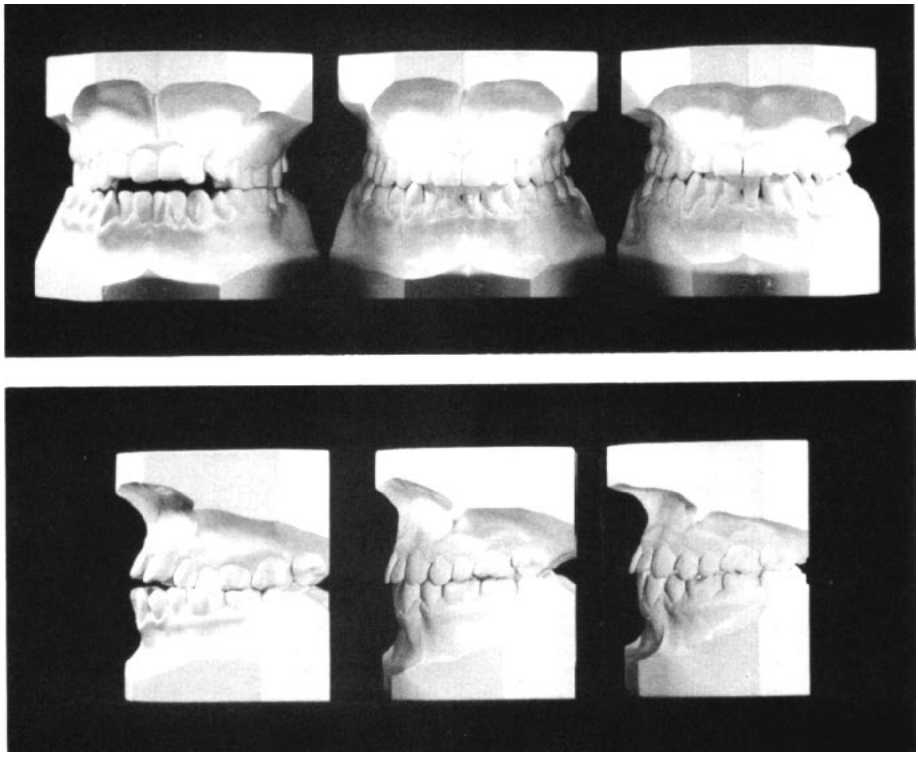

Fig. 8 Frontal and left lateral views before treatment, after treatment and 13 years after treatment.

Fig. 9 Patient's mouth 13 years after treatment

— Discussion —

We were able to successfully correct this malocclusion partly because most of the patient's growth was downward and not forward. It is important to note that the mandible continued to grow forward from 23 to 36 years of age.

This gives us an important clue in regard to orthognathic surgery, and it is the Author's personal feeling that orthognathic cases are often operated too early, both in male and female. Just as the orthodontist is trained to overtreat to counteract a certain amount of relapse, it is the Author's belief that orthognathic surgeons should also overcorrect in their procedures to allow for some of the relapse that does occur in most cases.

The Author, practicing in Mexico City, sees and treats many orthognathic cases, especially Class III, and in 33 years of practice has treated at least 10 prognathic cases per year both surgically and nonsurgically, depending on the type of problem. Of these, the Author has seen three which have experienced small relapses due to further growth of the mandible.

Even though it is sometimes assumed on the basis of averages that facial growth in females finishes between 16 and 20 years, and in males between 18 and 24 years, there are exceptions to every rule. This is especially true for rules based on averages. A few individuals *do continue to grow* after those chronological ages.

The case presented here is one of these exceptions, clearly showing a small amount of growth between 23 and 36 years of age on the tracings.

It has been found in many cases that after surgery the tongue readjusts to the new width of the oral cavity. In this case, there was a decrease in the width and size of the mandibular arch with orthodontic treatment and after the operation there was a further decrease in width. The tongue did not return to its original width, but on the contrary, its new size remained stable after the operation.

— Summary and Conclusions —

Cases such as this are a real challenge to clinical orthodontists. They require patience as well as proper diagnosis and treatment planning. The orthodontist must also help the patient psychologically by treating the teeth and surrounding structures and by treating the patient as an individual.

It is the feeling of both the Author and the Plastic surgeon in this case, Dr. Fernando Ortiz Monasterio, that this type of surgery would be successful in most nonpathological macroglossia cases. It appears that the sutured areas might be said to develop more dense epithelial tissue, not allowing the tongue to expand and readapt so readily to the position of the teeth in the mandibular arch. This is indicated in the present case, as is demonstrated by the decrease in width of the mandibular arch from the first molar area to the anterior part of the mouth.

It should be noted that orthognathic surgery was not as widely used at the time that this patient was studied and treated as it is today. If this case had presented for the first time this year, it is likely that the treatment plan of most orthodontists would have combined orthognathic and tongue surgery, with orthodontics to lessen trauma to the supporting structures of the teeth from the extreme and complicated mechanics which would have to be used in treatment.

The psychological aspects of this case were of tremendous importance; the treatment results have undoubtedly changed his life completely (Fig. 10). Once unable to speak clearly with his oversize tongue, he has since gone on to complete his education and is now a successful orthodontist.

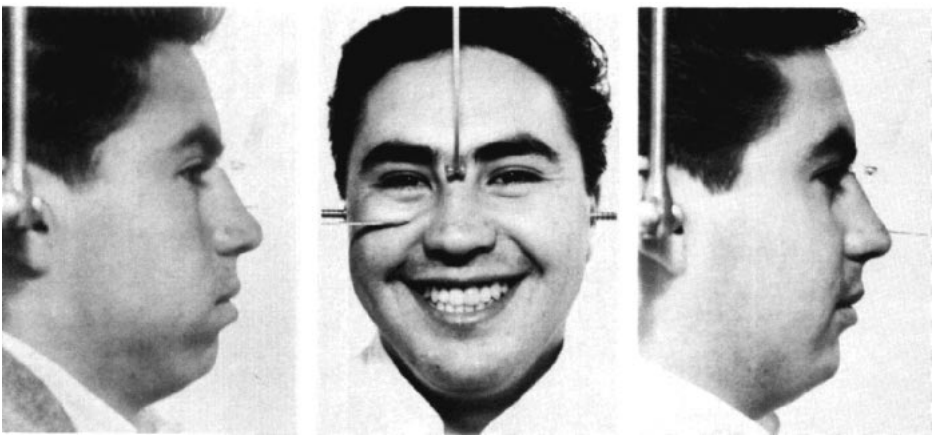

Fig. 10 Before treatment (left) and 13 years after treatment (center and right)

References

Bell; Proffit; and White, The V excision for partial glossectomy. In *Surgical correction of dentofacial deformities, Vol. II* Phiadelphia: W.B. Saunders Co.

Biourge, 1966. Macroglossie et Microglossie. *L'Orth. Francaise.* 37:345.

Bjüggren, G.; Jensen, R.; and Strombeck, J. O. 1968. Macroglossia and its surgical treatment. *Scand. J. Plast. Reconstr. Surg.* 2:116-24.

Fabaron, J. P.

1973 *Volumetrie Anterieure de la Langue et de la Cavite Buccale.* These 3eme cycle de Sciences Odontologiques, Bordeaux. No. 1.

1974 Interet de la Radiocinematographie en Incidence Frontale dan les Asymetries du Comportement Lingual. *L'Orth. Francaise.* 45:329-33.

Federspiel, M. 1937. Malocclusion caused by Macroglossia. *Int. J. Orthod.* 23:1235-43.

Gensior, A. M. 1970. The tongue and Class III. *Am. J. Orthod.* 57:256-61.

Gershater, M. M. 1972. The proper perspective of open bite. *Angle Orthod.* 42:263-73.

Gorlin, R. J., and Goldman, H. M. ed. 1970. *Thoma's oral pathology* Congeniatal Macroglossia. St. Louis: C.V. Mosby Co.

Hellman, M. 1937. An introduction to Class III malocclusion of the teeth as a part of the general problem in orthodontia. *Int. J. Orthod. and Oral Surg.* Feb.:120-47.

Kemper, J. W., and Bloom, H. J. 1944. Lymphangiomatous macroglossia: Report of a case. *Am. J. Orthod. and Oral Surg.* Nov.: 718-24.

Maisels, D. O., and Knowles, C. C. 1979. Spontaneous regression of anterior open bite following treatment of macroglossia. *Br. J. Plast. Surg.* 32:309-14.

McKee, T. L. 1956. A cephalometric radiographic study of tongue position in individuals with cleft palate deformity. *Angel Orthod.* 26:99-109.

Ortiz Monasterio, F. Application of craniofacial surgery to esthetic surgery. In *Recent advances in plastic surgery,* ed. Ian T. Jackson, pp. 165-74. Edinburgh, London, Melbourne: Churchill and Livingston.

Reitan, K. Biomedical princliples and reactions, In *Current orthodontic concepts and techniques.* ed. T.M. Graber. pp. 77-87.

Richardson, A. 1981. Classification of open bite. *Eur. J. Orthod.* 3:289-96.

Ruff, R. M. 1957. Prevencion de las deformidades maxiofaciales. *Rev. Asoc. Dent. Mex.* 14:150-54.

Ruff, R. M.; Aguilar, E.C.; and Martinez Garza, P.

1950 Dental and periodontal lesions of Mexican Indians. *Trans. Am. Dent. Soc. of Eur.* 22-30.

1950 Estudios del indice CFD-DMF en los Grupos Indigenos Tarascos y Otomies. *Rev. Asoc. Dent. Mex.* 7-3 May/June 117-42.

Safirestein, G. R., and Burton, D. J. 1983. Open bite - A case report. *Am. J. Orthod.* 83:47-55.

Sokoloski, P.; Ogle, R. G.; and Waite, D. E. 1978. Surgical correction of Microglossia in Beckwith-Weidemann Syndrome. *J. Oral Surg.* 36:212-215.

Subtelny, J. D., and Musgrave, K.S. 1973. Open bite treatment: The why of success or failure. In *Trans. 3rd. Intl. Orth. Congres.* ed. J.T. Cook, pp. 432-45. St. Louis: C.V. Mosby Co.

Thompson, J. R. 1938. A Roentgenographic Study of the Position of the Tongue. *Angle Orthod.* 8:100-125.

Watson, W. 1981. Open bite - A multifactorial event. Editorial. *Am. J. Orthod.* 80:443-46.