A DISCUSSION OF PRESURGICAL ORTHODONTICS IN CLEFTS

Orthodontist Samuel Berkowitz and I (Millard), have worked together for 28 years. His dental model records have influenced my surgery or, at least, the timing of the surgery. Dr. Berkowitz has continually professed satisfaction with our long-term results from a dental point of view. I have become dissatisfied and therefore determined to improve the plan. This stimulated me to call in Ralph Latham to help us with presurgical orthodontics. Latham, of the University of Western Ontario, was given an appointment in the Division of Plastic Surgery at the University of Miami and with the aid of the Joseph Mailman Foundation we have been able to bring him down regularly to be an active member of our cleft team. Sam Berkowitz opposed this action.

Dr. Latham and I collaborated on one unilateral and one bilateral cleft case, which were reported in Cleft Craft III (Millard, 1980). These two cases show promising results after 10 years. Since 1983, Dr. Latham has been applying presurgical orthodontics on all patients with complete clefts, and this has been followed by gingivoperiosteoplasty and lip adhesion. A total of 81 patients have been operated in this manner. Sam Berkowitz has been invited to keep his own models to ensure critical evaluation by an independent recorder. After 3 years of this program, I called a dinner meeting to have an eyeball-to-eyeball clarification of our progress.

Dr. Berkowitz, Dr. Latham, and Dr. Wolfe attended. All residents who were available that evening were invited. After roast lamb, the sparks began to fly.

Millard: We have come together today, April 24, 1987, to renew and clarify our cleft program. For many years, we have used the closure of the muscle over the maxilla to mold the maxillary elements and in the severely projecting premaxilla this is sometimes a problem. Yet, it has worked and Berkowitz has meticulously followed these cases through the years.

Berkowitz: The concept in any treatment program should be based on an understanding of the nature of the problem and he who starts from the beginning has the best view. We must define the nature of the problem in order to design a treatment with a reasonable prediction of its likely influence on growth.

Millard: As a surgeon, I have been frustrated by several aspects of our previous treatment. First, using lip closure for maxillary molding with an adhesion does not position the premaxilla well enough for closure of the cleft. The persistent anterior fistulae are difficult for the surgeon to close and unpleasant for the patient. The undercorrected premaxilla bulging under the lip at the base of the columella makes it impossible to correct the short columella and depressed nasal tip until adolescence. Yet the residual cleft in the alveolus requires the difficult surgery of bone grafting at the age of 6 to 8 years. Out of this dissatisfaction I welcomed the Georgiade-Latham presurgical correction of the maxillary platform to enable closure of the anterior cleft early (Georgiade and Latham, 1974, 1975).

Berkowitz: The “Holy Grail” for the surgeon has been to arrive at a procedure in the newborn period that will resolve all future problems.
This is where the conflict between the orthodontist and the surgeon began and caused the chaos that existed prior to documentation. Prużansky and others started research programs based upon documentation of these clefts as they developed to see how they changed over time under the influence of conservative surgery. This was done to arrive at a treatment modality that could best achieve the ultimate for that patient’s normalcy and to see if it could be done early or need be postponed to a later period. So there was a basic conflict between the surgeon and the orthodontist. Millard and I have worked together since 1959 with documentation, and I can tell you that we have had some excellent results. We did not have a fixed approach where all cases had to be treated in a certain way. There were some instances where the cleft palate was closed early and some instances where the palate could not be closed until a much later date because of the lack of tissue. The bottom line is that after over 25 years of documentation, we have excellent occlusion, excellent midfacial development, and as good a speech result as there is in most programs. I can understand the surgeon’s frustration in wanting to improve the program with earlier surgery. This is what we are here to discuss.

**Millard:** Berkowitz, greatly influenced by Prużansky and Subtelny, has carried out a very, very careful follow-up using casts and lateral cephaloradiographs. There is no question that the end results have been satisfactory. However, that must not prevent progress. There has to be a better way so that a child does not suffer through so many years of misery. Therefore, we have turned to the Latham appliance.

**Latham:** I appreciate being involved in this discussion. I am here because I was introduced to cleft lip and palate problems in 1960 as a basic scientist. Bill Burston asked me to undertake basic research of an anatomic nature. There was a need to determine when and how skeletal deformities in the unilateral and bilateral clefts developed. I discovered from histologic evidence that the typical deformity of a unilateral cleft at birth actually occurs as early as 6 weeks in uterine life. At birth you are basically looking at a fairly static deformity that presents rehabilitative problems. In the bilateral cleft, the protrusion of the premaxilla is present at 10 weeks in uterine life. Because of dental development, the protrusion becomes more abnormal and proceeds in a forward direction, typically presenting at birth with a rather grotesque deformity.

I have to ask the question of those around this table: Is there a deformity at birth that our society finds unacceptable? If the answer to that is yes, and I believe it is yes, then we have to ask: What are the alternatives? Shall the lip be closed immediately over the skeletal deformity, or should the skeletal deformity be first treated by the orthopaedic approach?

As a person who was immersed in facial growth, I recognized that bones moved in the process of normal growth and that the mechanism of bone movement offered much greater potential for deformity correction than use of a lip adhesion. Furthermore, it seemed unwise to be using the lip, which is an organ with very sensitive esthetic value, to do the orthopaedic work. I believed that the plastic surgeon should be provided with some kind of basic implements and technology for treating the cleft condition. This was something that I embarked on with Dr. N. G. Georgiade in 1972. There appeared to be great promise in this direction. Now, in 1987, we do have some devices specifically developed for the cleft condition that give very gratifying results without apparent compromise.

**Wolfe:** Medicine is an art and a science. In art, there is passion and argument based on personal preference and taste but not on scientific data. I think this boils down to an argument that needs to be settled, not by passions but by use of the scientific method. I propose a very clear question. Does presurgical maxillary orthopaedics and closure of the alveolar cleft early interfere with subsequent maxillary development? We must study the patients for a long enough time and in a large enough number, and it is going to take 15 years before we get the answer.

**Berkowitz:** Let’s go back to the work of Scott (1956), who was an anatomist from Belfast. Latham knows him better than most. Scott came up with the idea of the nasal capsular theory of facial development. Very simplistically, it was based upon the downward and forward development of the nasal septum and its importance to palatal development as it carried the face with it. He believed that if the lateral palatal segments were detached from the nasal septum, they would lose their growth impetus. A philosophy of treatment, the functional orthopaedic concept, followed and was picked up by McNeill (1922), a prosthodontist, and then by Burston (1958), an orthodontist. They presented a hypothesis but no data to support it. A treatment modality arose out of that hypothesis but was followed with no documentation. The theory that the palatal segments in complete clefts are in a collapsed state is not true. The lateral palatal segments, if detached from the vomer, are pulled by muscle systems laterally...
these palatal segments are smaller and deficient in mass being detached from the nasal system and lacking growth impetus. Thus, the orthodontist joined the surgeon in the early treatment of clefts. Unfortunately, there has been no documentation. There has been the belief that these palatal segments are smaller and deficient in mass. What is true is that these segments are distorted in space, and by establishing muscle continuity these lateral distorted segments can be brought medially into a more normal alignment. I do not oppose external elastic traction, the Liverpool elastic, to mimic the muscle action. I would like Dr. Latham to discuss the newborn condition. Sufficient or collapsed? Why does he want to expand it?

Latham: The newborn infant with a unilateral or bilateral complete cleft presents with a skeletal deformity. Research indicates that in the early embryonic period, the septum is an important organ of facial growth (Millard, 1980). However, there is not much evidence that at birth and subsequently the septum has more than a mechanically supporting role. In other words, it has lost a primacy role in facial growth by the time of birth. Therefore, we are forced to ask if the maxillae grow after birth; obviously, they do, and quite well, even though they are detached from the nasal septum. It seems that the question we are asking is: In a cleft condition, will they grow better related to? The answer is that in just about every case of complete unilateral cleft there is a retroposition of the cleft maxilla in relation to the other side of the cleft at the premaxillary region. If you look at the alar bases, you find that the alar base on the cleft side is depressed in relation to the opposite side or that the other side is protruded. Are the molars in the maxillae lying at different levels? I don’t believe they are.

Berkowitz: Latham has stated in Cleft Craft III that in unilateral cases one of the purposes of the neonatal maxillary orthopaedic procedure was to bring the lesser segment forward. That’s the objective.

Latham: What Sam is quoting is quite correct. It is my objective to bring the cleft maxilla forward because we have a wide cleft, and I recognize that the cleft alar base is retroplaced in relation to its counterpart on the other side. When a surgeon operates on the nose, it’s an advantage for him if the nose is on the same anterior posterior level and I am looking at one side in relation to the other across, say a 10-mm cleft. Is that cleft acceptable for the surgeon commencing his reconstructive surgery? I suggest that it’s possible to move the entire maxilla forward, and if I have found a way for doing that, I think that’s good.
Berkowitz: In all complete unilateral and bilateral clefts, not once have we used teeth as criterion for anterior-posterior placement. I don't say that the alar base of the nose doesn't need correction—it is distorted and it needs correction.

Wolfe: I don't think there is any evidence that the maxillary tuberosity is more posteriorly displaced.

Latham: There is a skeletal deformity with a discrepancy of the alar bases, and there is often a very wide cleft that constitutes a problem.

Millard: When you manipulate with your appliance in the unilateral cleft, you produce a better platform for the alar base as well as the alveolar arch.

Latham: I believe I'm exploiting the normal processes of infant maxillary growth at the circummaxillary sutures. The entire maxilla normally displaces downward and forward and slides at the sutures. It has been demonstrated radiologically with implants, and I have seen the evidence histologically. I believe I am accelerating the normal motion of the maxilla to some extent and utilizing the same principles.

Millard: So actually, you have a more sophisticated method of controlling these components than we do when we close the lip over the deformity and try to mold the distorted parts. The lip closure will allow growth of the lateral segment but will not pull them forward; and so I would say that this orthopaedics is a step ahead and not much more traumatic than merely closing the lip over it.

Berkowitz: As an aid to surgery, I find no fault with orthopaedics, only with overstated benefits. For example, Dr. Latham just used a term "accelerate the development of the maxilla." Unproven—it doesn't accelerate—it manipulates. It may retard, but we have no evidence of that.

Latham: I don't believe I'm molding the segments in the cleft condition; I'm simply moving them from one place to another. The process by which I do that could be called rapid orthopaedic correction, as opposed to the McNeil technique, which was a slow molding process.

Millard: OK, I appreciate the appliance manipulation, because, first, it gets the alveolar arch in reasonably good alignment. Therefore, a platform for the lip and nose is presented. Once this has been done, I'm able to dissect out the mucoperiosteum from the edges of the cleft, simply at the edges, and turn them out so that a two-layer closure is possible without tension, forming a tunnel from bone on one side to the bone on the other. Latham's interdigitating flaps reconstruct the alveolus. This is a very physiologic action. I can see no harm in the joining of the mucoperiosteum across the cleft for a closed unit and letting the clot allow bone to come in—and we hope, eventually, teeth. This will bypass the need for bone grafting later. When we finish the operation, it is almost impossible to tell that there has even been a cleft. Closure of the remaining hard and soft palate cleft later is facilitated. Now, our question is—what effect is this going to have on the future growth? Berkowitz is following a lot of the cases. Sam, you've studied a few and you have something you can say on what you have seen so far.

Berkowitz: Will this procedure inhibit the growth at this area—will it cause crowding in that segment so that the teeth cannot erupt properly—will it lead to midfacial deformity? We have avoided this in our previous regimen. With the new approach, we have seen some anterior crossbite. This could mean that there is a retroactive force of the lip against these teeth, or it could be a displacement of teeth, not necessarily an inhibition of midfacial development. So the mere fact that an anterior crossbite exists may not be reflective of the skeletal condition. However, I caution the surgeon because in our nonorthopaedic cases of, say, 36 complete unilateral cases, we never had a unilateral crossbite or an anterior crossbite.

Millard: I think one of the key questions, of course, will be the final influence of closing the cleft with mucoperiosteum, forming a channel across the gap. We hope that bone will grow into it. In fact, we are seeing evidence of this.

Latham: In the specialty of dentistry, there are exciting new methods being used to assist facial growth. An example would be the Frankel appliance. It behooves members of the dental profession involved with treatment of cleft lip and palate to make available to the cleft individual anything that would assist the development of the maxilla and the maxillary teeth along normal developmental lines. There is an exciting future ahead of us. I think we will be defaulting if we don't explore the benefits that these new ideas could confer in the areas of cleft palate and facial development.

Millard: At best, we accomplish unilateral cleft closure of the alveolus and anterior hard palate and a lip adhesion by the age of a few months. I have postponed rotation-advance ment of the unilateral cleft until the child is 4 to 6 months old to let the tissues settle, so not to put undue strain on this alveolar closure. Then the remaining palate cleft is closed when the child is about 18 months old or somewhat sooner. In the bilaterals, the problem is a bit different, and here again we are getting the
three maxillary elements into reasonable alignment with undercorrection of the premaxilla, and then we close both sides at the same time in a gingivoperiosteoplasty, including the anterior hard palate. No raw areas are left open. The two layers form a tunnel between the maxillary bones and the premaxilla on each side so the clot can form and bone develop. It isn’t like the island flap procedure or the V-Y and other push-back operations that leave large raw areas anterior to contract. The mucoperiosteal tissue is brought out into the normal position, sutured without tension, and then soft tissues are closed across for gentle molding.

Berkowitz: Latham and Georgiade proposed a very forceful retraction device on the premaxilla that I have studied cephalometrically and by CT scan. It is an interesting procedure and may have a place if properly utilized, but not in all cases. We have seen from our longitudinal studies that there is a lateral bending of the nasal septum, with the fulcrum being the vomer-nasal septum cartilage junction. With time, however, this premaxilla returns to its original position and growth of the palatal segments does proceed. The question of enough future growth still has to be proven. Use of another appliance, like the Quinn appliance, does not retract with the same force as the Georgiade-Latham appliance. The Quinn appliance causes a ventroflexion of the premaxilla, with the fulcrum being the premaxillary vomerine suture. That fulcrum activity is no different than a closed lip. The difference only is that Quinn controls the lateral palatal segment, so a better geometric relationship is achieved.

Latham: I heard Sam deliver the paper where he criticized the management of the first infant with bilateral cleft treated by Millard and myself. I don’t believe Sam showed a deviated septum in that particular case. It is interesting how the premaxilla repositions. It goes back by sliding at the premaxilla-vomerine suture. If I didn’t know about this sliding, I wouldn’t be doing it. There is an actual telescoping of the premaxillary bones over the vomer bone. You can actually see the premaxillary segment increase in width as the two premaxillary bones separate, going around the vomer. At the present time, we are not finding ventroflexion to be a problem.

Millard: In the more recent cases, I do believe we have very little septal deviation. There is compression on the premaxillary stalk, which, if you remove the compression or do not close the lip, the premaxilla will go back out into projected form. In other words, there has not been irreversible damage because the compression is not surgical resection. It is merely a compression until the elements of the mucoperiosteum can be joined, and then possibly when it is turned loose, the growth should proceed in reasonably normal fashion. That is what we have to follow, and that’s why we are counting on you, Sam, as well as Latham to keep records and to evaluate these records to see the results.
of what we are doing. Only in time can we tell whether or not it is going to be totally successful. Now, at best, it’s wonderful. At worst, we’ve got secondary maxillary problems.

Wolfe: I find that the late bone grafting of bilateral clefts, even when they’ve been brought into good alignment by the orthodontist and when the cleft space is not particularly great, is technically a very difficult procedure. Obtaining complete closure of the palate in bilateral cases is particularly difficult because of the fact that two anterior palatal clefts come together in a “Y” behind the premaxilla and for the bone grafts to take successfully the palatal mucosa must be closed in an absolutely water-tight fashion. This requires dissecting a flap off the posterior portion of the premaxilla, which is a devilishly difficult undertaking. The operating time and blood loss are greater in this surgeon’s hands for the bilateral alveolar cleft closure than for a LeFort I advancement. Also, if there is intact alveolar bone all the way around the maxillary arch and no clefts present in the alveolus, a bone graft probably would not be necessary if and when a LeFort I advancement were to be required.

Millard: Well, it looks like the worst we can anticipate is the need for an occasional LeFort I. The best is a normal arch without fistulae and completed by the age of 18 months with a platform that will allow us to proceed with a forked flap early in bilateral clefts to produce a good nose and lip. This offers a reasonable risk.

Berkowitz: I can’t accept Dr. Wolfe’s justification for doing it early. Wolfe does do an excellent secondary bone graft and has done it repeatedly very well. If he has a failure rate, I don’t think it is more than 10%. I just wonder what the failure rate of the periosteoplasty will be and what other consequences to growth can result. We need the time to find that out.

Millard: In bilateral cases, by our old method
the premaxilla bulges under the lip, the nose is terribly distorted, the columella is short, and there is nothing that can be done about this until late in the teenage years. Berkowitz calls this "normal"—which is totally abnormal but may eventually grow toward normal.

Berkowitz: I am not saying that this is a bad procedure. All I am saying is one cannot generalize—one has to use differential diagnosis—that a procedure is good in one instance. The same procedure performed in another may be a disaster.

Millard: Sam, all clefts, no matter what degree, need to be corrected and tissues placed into normal position. Fifteen years from now we will know if growth has been influenced.

Latham: I'm very interested that what might be good for one bilateral cleft with protrusion of the premaxilla might not be good for the next one. We are looking for a good formula, and when you find something that's good for one case with a given skeletal deformity, why wouldn't it be good for the next one with the same skeletal deformity?
Millard: I agree, and we are finding this true.
Berkowitz: I have a research program that, hopefully, will answer some of these questions. I want to see if there are parameters that predict at the newborn stage what will happen at some subsequent stage.

Millard: Let's study our first bilateral cleft using the Latham presurgical orthodontics and periosteoplasty. Of course, experience has improved our timing and technique, but we do have a 10½ year follow-up. Our first patient (Fig. 1) was born February 5, 1977 and was 4½ months of age before Latham applied his appliance to begin positioning the premaxilla and maxillary segments. This was completed in 2 weeks so a bilateral gingivoperiosteoplasty and bilateral lip adhesion were accomplished on July 14, 1977. The cleft palate was closed when the child was 13 months old, and a forked flap was advanced out of the lip into the columella when the child was 3½ years old (Fig. 2). Subsequent growth has been followed by Berkowitz and is promising in the child who is now 10½ years old (Fig. 3).

Berkowitz: Analysis of several casts and cephalometric radiograms show that use of the Latham appliance at age 4½ months resulted in 9 mm of retraction of the premaxilla (from 39 to 30 mm) (Fig. 4 A,B). When the infant was 5½ months of age, the periosteoplasty and lip adhesion were carried out (Fig. 4C). By the time the child was 11 months of age, the premaxilla returned to the original position but did not increase in the next 3 years. The lateral palatal segments increased in length because of growth at the maxillary tuberosities. A severe incisal overjet-overbite relationship existed when the child was 11 months of age with gradual decrease. Bilateral class II occlusion was seen at 3 years, 9 months (Fig. 5). When the child was 10½ years of age, the right buccal segment was in crossbite and a 2-mm anterior open bite was present. The central incisors were severely rotated and tip to tip with mandibular incisors. Lateral cephalometric analysis revealed, when the infant was 2 months of age, that the angle of facial convexity was 131 degrees. After premaxillary retraction, it increased to 152 degrees. When the child was 10½ years of age, the angle of facial convexity was increased to

FIGURE 4A  Projecting premaxilla in bilateral complete clefts of lip and palate. B, a 9-mm retraction after Latham presurgical orthodontics. C, 6 months after periosteoplasties and lip adhesion.

FIGURE 5  Reasonably good dental relationships as reflected by casts; child is 3 years 9 months of age.
171 degrees. The ANB angle is 2 degrees, which is well within the normal range. Occlusal radiographic films show a crowded anterior segment. My concern is that the male growth spurt at 12 to 15 years will be greater in the mandible than the maxilla.

Latham: The facial profile in this 10½-year-old patient with presurgical orthodontics and periosteoplasty is good. The maxillary cast shows a well-aligned dental arch. The original alveolar cleft sites are not easily located, and there are no fistulae. The maxillary permanent central incisors are moderately rotated distolabially, and they occlude with the incisal edges of the mandibular incisors. Molar width appears to be good; however, the left molars occlude cusp-to-cusp and the right molars are in crossbite. Orthodontic treatment now will consist of simple alignment of the incisors, which will produce a normal overjet and moderate expansion of the molars. At 10½ years, his dentofacial growth and development appear very satisfactory (Fig. 6).

Wolfe: This patient, 10 years after presurgical orthodontics and periosteoplasty, reveals interesting findings. The x-ray shows excellent bone

FIGURE 6 Casts of child 10½ years of age reveal encouraging dental relationships, which is being improved with orthodontia at this time.
formation without there having been a bone graft (Fig. 7). There is some diminution in the intercuspid distance, and because of that, the incisors are having to descend with some rotation. This approach achieves better bone formation than bone grafting and avoids one or two operations. Should a LeFort I osteotomy ever be required, with an intact alveolar arch and normal bone, this will be a straightforward maxillary advancement that can probably be done without intermaxillary fixation using miniplates. The following may seem to be a heretical statement to nonsurgeons, particularly those who have never seen these operations performed. It is my feeling that a LeFort I advancement with an intact alveolar arch is a much easier procedure both for the surgeon and the patient than attempting to close large bilateral alveolar clefts with oronasal and anterior palatal fistulae.

Berkowitz: I want to explore these procedures without being involved. I would rather be just a documenter and a reporter.

Millard: Well, that's just what you are, Sam, so relax. It is important for Latham to teach more young dentists to do this presurgical orthodontics! The Shelly La-Fortune Swartz Fellowship is going to help accomplish this.

Latham: I'd like Sam to know that I'm not out to prove him wrong.

Millard: Of course not! (Much laughter.) I think we have come to a reasonable decision as a team. We will evaluate this new form of treatment. Berkowitz will record and evaluate, and Wolfe is ready for maxillary surgery, should it ever be necessary.

REFERENCES


FIGURE 7 X-ray of child at age 10½ reveals bilateral bone bridging across the clefts following early periosteoplasties.