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Rib implant for mandibular ankylosis in a five-year-old child: clinical report

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Abstract

This clinical report describes how a child with temporomandibular joint ankylosis benefited from the combined skills of the pediatric dentist, oral and maxillofacial surgeon, and other health professionals.

Temporomandibular joint (TMJ) dysfunctions are rare in young children. More than 50% of TMJ ankylosis conditions arise before age 10.[1-3] The child whose trauma leads to TMJ ankylosis becomes debilitated and disfigured. The pedodontic and surgical management of a 5-year-old child with bilateral ankylosis is described.

Background

TMJ ankylosis is a fibrous or bony fusion of the condylar head of the mandible to the articulating portion of the temporal bone.[4] Mandibular movement is restricted only in fibrous ankylosis, but with bony ankylosis the patient's mandible and temporal bone are united and the TMJ no longer functions normally. Both fibrous and bony anklyosis may allow some movement at the incisors. A vertical or interincisal opening of 5 mm or less indicates full bony union of the mandible to the temporal bone.[5]

The three main causes of TMJ anklyosis are trauma, inflammation, and infection.[6,7] Damage to the fragile vasculature at the condylar heads during intrauterine fetal movement is a possible etiology for congenital ankylosis.[1,2,8] Trauma sustained by the newborn during a difficult forceps delivery and trauma inflicted by an abusive adult have been implicated.[1] Both untreated fractures or badly comminuted condylar head fractures treated by immobilization for extended periods have resulted in ankylosis. Any mechanical trauma which is sufficient to produce hemarthrosis, meniscus disruption, or fracture of the condyle or temporal plate can result in ankylosis.[3,6] The presence of a scar may point toward a traumatic etiology for ankylosis, but the probability of ankylosis following TMJ injury is reported to be around 0.2%.[9] Inflammatory causes are rheumatoid arthritis, Felty's syndrome, Still's disease, and Marie-Strumpell disease.[1,2,10,11] Childhood infections including otitis media, dental infection, mastoiditis, parotid abscess, osteomyelitis, tuberculosis, actinomycosis, scarlet fever, septic arthritis, and mastoiditis of the temporal bone can cause ankylosis after their spread to the TMJ.[1,6,12] Paget's disease, metastatic neoplasms, and the effects of radiation therapy also must be included in a differential diagnosis of TMJ ankylosis.[8,13]

Characteristics

TMJ ankylosis in children results in arrested condylar growth. The loss of growth and function results in muscle and bone atrophy and, in time, micrognathia, microgenia, and retrognathia.[8,12,14] Ankylosis is more often unilateral, causing facial assymetry.[5,8] The earlier the ankylosis occurs, the more severe the deformity.[5] The tongue position, pattern of swallowing, activity of the muscles of facial expression, and oral habits are functional causes or contributors to the deformity.[15] The child may ingest a poor diet which contributes to a failure to thrive and diminished growth. The restricted airway can cause problems with respiration and with articulation and speech fluency.[5,14]

The psychological toll varies. Some children cope adequately with the problem, but others are psychologically disabled by their disfigurement,[14] and become shy, moody, and reclusive. Their oral restrictions cause great frustrations during eating or speech. As

a result they may be unable to adjust socially and may have difficulty with school.[5]

Diagnosis

Certain characteristics help distinguish fibrous from bony anklyosis. Patients with fibrous anklyosis will find forceful opening of the mouth painful while bony ankylosis patients will not.[4] Some fibrous anklyosis patients will be able to protrude the mandible slightly while bony anklyosis patients will not.

Photographs, cephalometric and panoramic radiographs, TMJ joint tomograms, or CAT scans are valuable in documenting the actual site and extent of ankylosis.[15-17] In ankylosis the coronoid process usually is enlarged; in long-standing cases, the antegonial notch appears severely depressed and the TMJ area may be obliterated with dense sclerotic bone.[6]

Dental Treatment

Ankylosis of the TMJ affects the child's preventive and remedial dental care. Poor oral hygiene is likely because toothbrushing is difficult, laborious, and may have been abandoned in frustration.[15,18] The combination of poor diet and inadequate home care practices makes the child especially prone to dental caries and periodontal disease.[19,20]

The first dental visit may be to relieve a toothache.[19,20] The child may not be able to tolerate intraoral radiographs or study model impressions, anatomic landmarks are distorted, anesthetic administration is difficult, and access to the mouth is inadequate. Therefore, prudence suggests delaying definitive dental treatment until after surgical correction.

Treatment Team

The child with an ankylosed TMJ is treated best by the coordinated efforts of a pediatric dentist and an oral and maxillofacial surgeon. The pediatric dentist makes the stabilization surgical splint and during corrective surgery can provide emergency dental care. Usually the young patients's surgical sites have healed sufficiently in 4-6 weeks for remedial dental care to be completed.[6]

The pediatrician must evaluate the child's nutritional status and ability to withstand surgery. The anesthesiologist should be prepared for a difficult nasotracheal or orotracheal intubation.[16] Lateral neck radiographs may be helpful in evaluating the airway. Preoperative consultation with the anesthesiology department is important since a conscious nasotracheal intubation might be needed and rapport between the child and anesthesiologist is critical. With ankylosis, the vocal chords cannot be visualized through the mouth and nasotracheal intubation may have to be completed blindly. An intravenously administered narcotic may be required to gain adequate cooperation for intubation. A local anesthetic also can be supplied to the nasal tissues to act as a vasoconstrictor. A fiberoptic pediatric bronchoscope may aid in a difficult intubation.. When nasotracheal intubation cannot be completed, retrograde intubation through the cricothyroid membrane may be done. Tracheostomy may be necessary in establishing and maintaining the airway.

Surgical Options

Several surgical options are available to treat an ankylosed TMJ:[21] excision of the bony area,[20] excision and implantation, or excision and grafting tissue (such as a rib). The treatment of choice remains controversial.

When bony ankylosis is present, bone extending to the lingula (in a small child), much of the ascending ramus, and sometimes the areas in which the second and third molars are forming may have to be removed. An interpositioned implant, such as Proplast®[a], may prevent an open bite or reankylosis.[16]

Autogenous grafting of a rib between the mandible and the temporal bone has several advantages.[22,23] It restores the continuity of the mandible, is not rejected, and has desirable growth potential. The graft can grow to the contour of the mandible or be used to advance it. Less bone is removed from the mandibular ramus if the mandible is advanced or the ramus lengthened. Finally, the rib often reforms in the child's chest.[23] Disadvantages to grafting include a second surgical site in the patient's chest,[1] the difficult surgery,[20] and the unpredictable growth potential of the graft.[24]

Postoperative physiotherapy may maintain adequate vertical dimension[23] using intermittent forceful opening of the mouth with screw exercisors, tongue depressors, or other mechanical mouth openers. Such therapy can be painful and traumatic to the teeth. In order to avoid dental injury, acrylic mouthguards often are made.[25]

Clinical History

A female Vietnamese child was unable to open her mouth more than 3 mm or chew properly following a single febrile seizure at age one year (Figure 1). The symptom persisted and at age five her father brought her to the pedodontic clinic at LSU School of Dentistry; her chief complaint was inability to open her mouth and chew food. She could tolerate extraoral radiographs only.

The child was well nourished but small (height and weight less than 3rd percentile), her face was convex,

[a] Proplast–Vitek Corp; Houston, TX.

FIGURE 1. The child's maximum oral opening before surgery was 3 mm.

asymmetrical with mandibular retrognathia and probable micrognathia (Figures 2 & 3). She was unable to protrude her mandible, which deviated to the right upon opening.

Intraoral examination revealed a 7 mm midline deviation, a bilateral, distal-step terminal plane, crowded primary teeth, right posterior crossbite, 7 mm overjet, carious teeth, and mildly inflamed gingiva. Her interincisal opening was forcible to 5 mm without pain.

Radiographs showed bilateral deep antegonial notches, enlarged coronoid processes, a proximity of the right condyle to the temporal bone, and a short right ramus. Radiographic evidence of a right condylar fracture was obscured by the healing and remodeling.

The first priority was to refer her to an oral and maxillofacial surgeon for consultation. Tomography confirmed the diagnosis of bony ankylosis of the right TMJ, but fibrous ankylosis of the left TMJ could not be ruled out.

After oral surgery consultation, dental prophylaxis of the buccal surfaces of the teeth, and topical application of fluoride, study model alginate impressions were made with a scaled-down metal impression tray. (By reducing the tray's thickness to 1-2 mm and maintaining its width to approximately that of a child's dental arch, it could be inserted into the child's mouth.) A surgical stabilization splint was fabricated to hold the mandible in an anterior and inferior position to encourage and direct symmetrical maxillary and mandibular growth.

The stabilization splint was constructed by mounting study casts on an articulator using a face bow and an interocclusal record of the condyles in centric relation. The facial midline was marked on the maxillary cast and the anatomic midline was marked on the mandibular cast. The mandibular anatomic midline was aligned with the maxillary facial midline by completing the intended surgery on the mandibular cast. A rope of uncured autopolymerizing resin was made in the shape of the dental arch and the material was compressed between the maxillary and mandibular teeth by closing the articulator. The excess resin was removed during polymerization. After polymerization the cast was returned to the articulator. The splint was ground selectively with acrylic burs and excess material was removed to establish balanced contacts in centric relation for all opposing support cusps and incisal edges. The facial and palatal surfaces but not the occlusal surfaces were polished.

A stabilization splint should be well fitted, cover the occlusal and incisal edges of all the teeth in the arch, contact all opposing support cusps in retruded position, be smooth, and have minimum bulk.

The child was hospitalized for corrective surgical osteotomy, a costrochondral rib graft to reconstruct the right TMJ, and a left vertical oblique ramus osteotomy. The Pediatric Surgery Service was consulted to excise the rib segments to be grafted into the mandible.

In the operating room two five-inch long segments of rib including 1 cm of cartilage with periosteal attachment were taken from the fourth and fifth ribs. Bilateral coronoidectomies were performed. The splint was placed into the mouth using intermaxillary fixation with arch bars. One rib was placed into the right

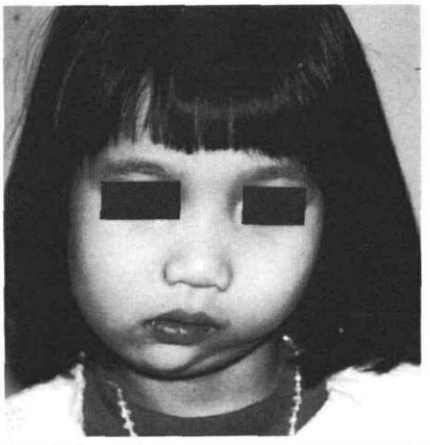

FIGURE 2. (*left*) Micrognathia, microstomia, and a severe midline deviation were pretreatment manifestations of ankylosis.

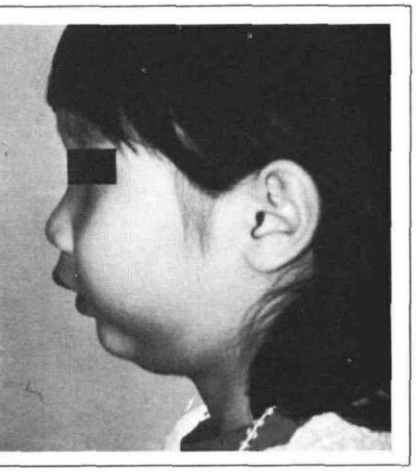

FIGURE 3. (*right*) Profile reveals micrognathia and microstomia.

TMJ region. The second rib was divided into small chips which were placed to act as the corticancellous segment of the graft, allowing the mandible to be advanced. The costochondral portion of the rib was placed next to the head of the condyle and four wires were passed through the mandibular ramus to ligate the ribs to the mandible.

The surgical treatment increased the vertical opening from 3 to 22 mm (Figure 4). After two and one-half weeks, the child was taken out of fixation. The splint which had been ligated to the patient's mandible was trimmed on the occlusal surface 1-2 mm every two weeks for 4 months until the maxillary teeth almost contacted the mandibular teeth. The child changed from a pureed to a full diet. During this time, the patient received physiotherapy and was fitted with nocturnal interarch elastics to control occlusion. After removal of the splint and arch bars, definitive dental care and home preventive instruction began.

The increased vertical dimension made restorative care possible. Carious lesions had not progressed substantially even though treatment was postponed for approximately four months.

One year later, the child's weight had increased to 47 pounds (45th percentile) and her height to 43 inches (20th percentile). The interincisal opening was 20 mm. Protrusive and right and left lateral excursive movements were observed. She also benefited from a more esthetic fact (Figures 5 & 6). Accounting for dental compensations, she continued to have 40% overbite, a 12 mm midline deviation, a bilateral, mesial-step terminal plane relationship, and anterior and left posterior crossbites.

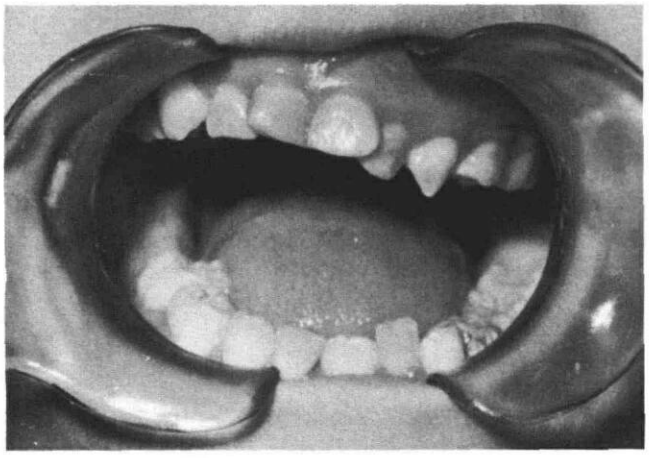

FIGURE 4. The child's maximum oral opening after surgery was 22 mm.

Conclusion

When TMJ ankylosis is recognized, the pediatric dentist should coordinate treatment immediately with the oral and maxillofacial surgeon and effect early surgical release of the mandible from the temporal bone. Any delay of corrective surgery will cause an increasing loss of function, diminished mandibular growth, and disfigurement. Since ankylosis curtails growth, the child's face can be deformed severely by adolescence. The earlier the successful treatment the less severe are the effects.[10]

Releasing the condyle can be accomplished by several surgical techniques, immediately improving function. However, the surgical procedure which both improves function and stimulates growth is the surgery of choice for the immature child. Grafting a segment of rib between the condyle and temporal bone satisfies both needs.

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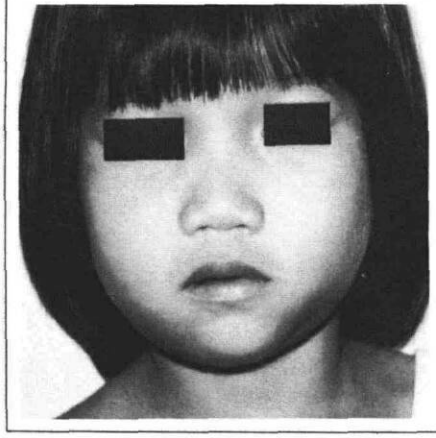

FIGURE 5. (*left*) One year postoperatively, facial harmony is much improved.

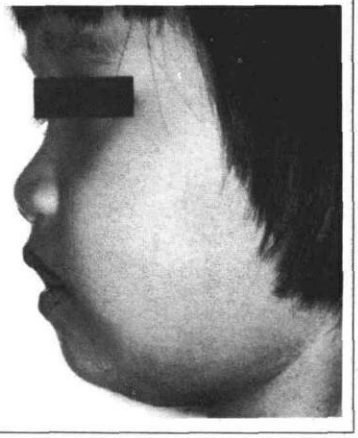

FIGURE 6. (*right*) One-year postoperative view reveals an improved facial profile.

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Quotable quote: when a child steals

The first time a parent catches his child stealing he wonders whether it's a stage the child is going through. "No, it's not natural," says Erma Beck, Chicago public school psychologist, who has counseled hundreds of school children and their families, often in matters dealing with theft. "Even minimal stealing by your child has to be confronted and stopped."

If not a part of the child's development, why, then, do kids steal? Experts feel that the desire for attention is the primary reason, other than necessity, that causes a child to steal something. Related to this desire for attention are a compulsive need for revenge and the desire to demonstrate a skill.

The importance of the parents' role in correcting their child is a point on which experts agree. According to Frank C. Jordan, Jr., "Parental intervention is the most important variable in stopping childhood theft. If you find that your child is guilty, make sure that he makes some reparation, either through community service, paying for the item, or abiding by a particular set of restrictions."

"Some kids think stealing is a joke because nothing happens to them," comments California policeman Ron Allen. "They are released to their parents and they are out again that night. This makes them feel that their parents don't care."

Andrews LB: When a child steals.
Parents, June, 1984.