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Mandibular growth and mouth opening after two different surgeries in TMJ ankylosis: A one-decade assessment

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Abstract:
Parpose: the long-term outcome and clinical results of gaparthro plasty used for the treatment of condylar ankylosis of the mandible in children with application of postoperative activator appliances and costochondral rib graft are evaluated and compared.
Materials and Methods: A nonrandomized, retrospective clinical study of 10 cases of condylar ankylosis (18 Joints) of the mandible surgically treated during a 12 year period from 1990 to 2002 was performed.Four patients were treated by condylectomy and interpositional Flap and Six patients were treated by condylectomy and immediate costachondral rib grafts.
The First group underwent long-term postoperative therapy using removable activator appliances. Casts, radiagraphs, photographs, computed tomography (CT) Scans, were Used post surgically to evaluate rib graft, condylar growth and function, occlusion, and Facial and condylar symmetry.
Results: Symmetry, arch coordination, correction of occlusal canting, mandibular deviation, facial growth , and prevention of reandkylosis were obtained and better controlled in those cases that cnderwent long-tern or thodontic activator therapy post operatively and were followed closely.
Conclusions: Children with long-standing condylar ankylosis of the mandible and its resultant facial asymmetry and occlusal canting (Secondry to a non functional jaint and Maxillary compensation) treated with condylectomy and interpositional flap treated more favorably when activators were used postsurgically. The patients that failed to comply with or continue activator therapy postsurgically developed complications relating to mandibular deviation , occlusal dysharmony, asymmetry and rankylosis of the temporo mandibular joint (TMJ).
Keywords: TMJ, Costocharndral Graft , gap Arthroplasty Mouth opening
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Ankylosis is most commonly associated with trauma (%31 to 98% of cases) , local or systemic infection (10% to 49%) , systemic disease (10%) , or neoplasm. Ankylosis of the TMJ is one of the most serious complications of condylar fracture. In the cases of trauma , it is hypothesized that intraarticalar hematoma, with scarring and excessive bone formation , leads to hypomobility. Infection of the TMJ is most commonly the result of contiguous spread from otitis media or mastoiditis but may also result from hematogenous spread, including tuberculosis, genorrhea, and scarlet fever. Systemic causes of TMJ ankylosis include ankylosing spindylitis , rheumatoid arthritis, and psoriasis. Ankylosis can be calssified on the basis of degree of limitation (partial or complete) , location of the union (intracapsular versus extracapsular), and type of tissue involved (fibrosis , osseous , or fibro- osseous). The end result is sever limitation in the range of mandibular motion , which may interfere with speech, oral hygiene, and proper preparation of a food bolus for digestion and maintenance of nutrition. As the mandible develops , three growth centers are able to produce

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enlargement this comolex bony structure , the condyles , the surface of the ramus, and the alveolus.

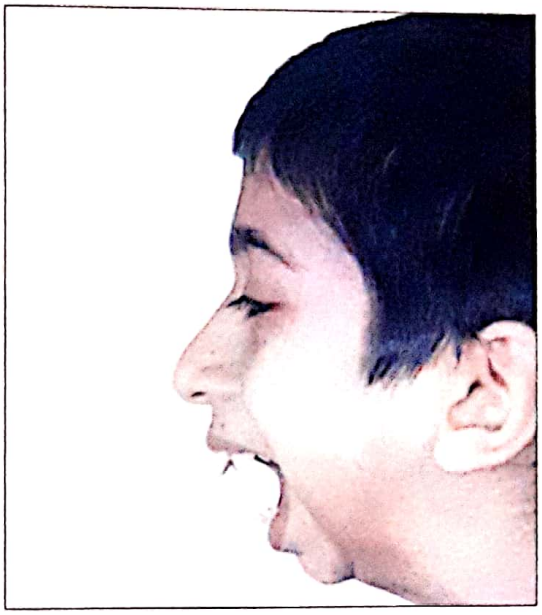
Inilially , it was believed that the mandible was pushed down and forward by growth at the condylar growth center. This concept has not been borne out by clinical research, in that the condylar cartilage in vitro possesses little indepen dent growth potential and produces only a fraction of the growth pressure of epiphyseal cartilage. In addition , removal of the condylar cartilage in experimental animals has shown little effect on growth.

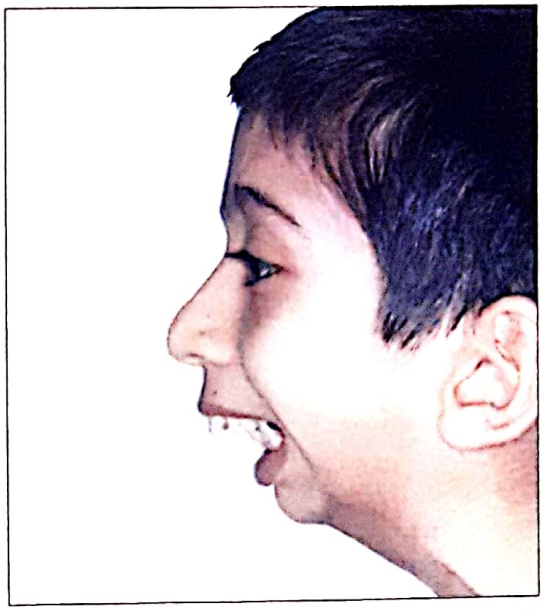
With the introduction of the " functional matrix" theory by Moss in 1968, a new under standing of mandibular growth was born. This theory, simply stated, suggests that the mandible rather than being pushed down and forward - is pulled there as a result of changes in the growing soft Tissue envelope , or " functional matrix" surrounding it [2] . There fore, growth at the condylar center is secondry and compensatory to these primary changes. Ankylosis prevents the anterior and inferior distraction of the mandible by its soft thissue envelope (as stated in the " functional matrix" theory). The opposite condyle, in unilateral cases, deposits appositional bone along its posterior and superior aspects. This process result in a shortened ramus on the ipsilateral side and a normal or elongated ramus in the contralateral side facial asymmetry and deviation of the chin midline toward the affected side are the result. There is a potential for significant growth disturbance in the growing patients. [3,4]

Methods & Materials

This nonrandomized, retrospective study, which covered the period between 1990 and 2002 involved a review of the records , charts , radiographs, computed tomography (CT) scans and photographs of 10 children (18 joints) who had TMJ ankylosis and were treated with Gap arthroplasty with interpositional flap and arthroplasty with immediate costochondral rib grafts at the Department of Oral and Maxillofacial surgery at our Medical center.

There were four boys and six girls , ranging from 2 to 12 years of age, with amean age of 6.7 gears. The presenting signs and symptoms in these patients included unilateral or bilateral condylar ankylosis , limited mouth opening, inability to protrude the mandible, lack of mandibular function, facial asymmetry , chin deviation, canting of the occlusal plane, retrognathism, and open bite. A history of facial trauma of varying types preceding development of the condition was obtained in 9 of the patients, and in one patient the ankylosis was congenital without definite cause. Eight patients had bilateral and Two had unilateral ankylosis. Assessment of patients was directed toward determining the cause of the facial deformity , the extent of joint damage, the adequacy of mandibular function, and evaluation of the skeletal deformity. Treatment planning before surgery included clinical and photographic records of facial and dental relationships, midlines, ver-





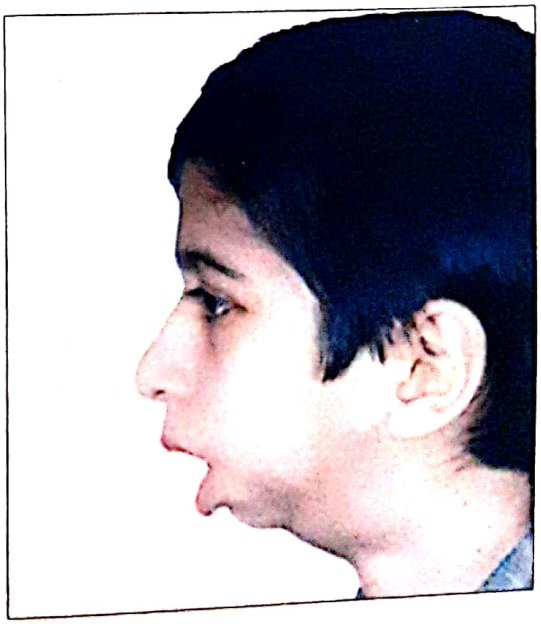


Diagram.1.

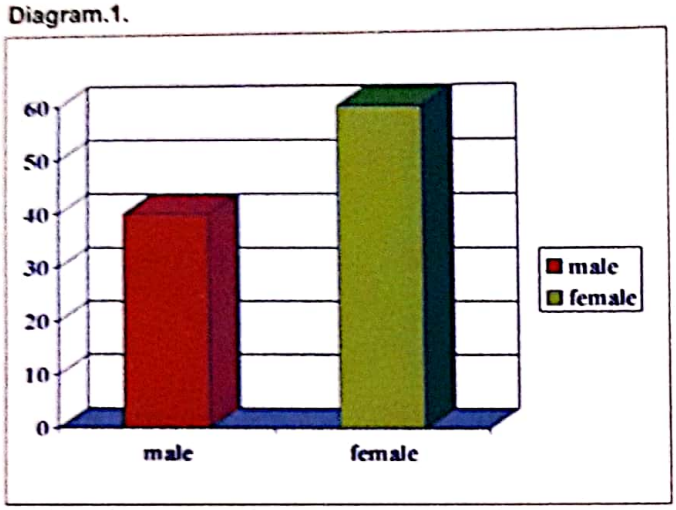
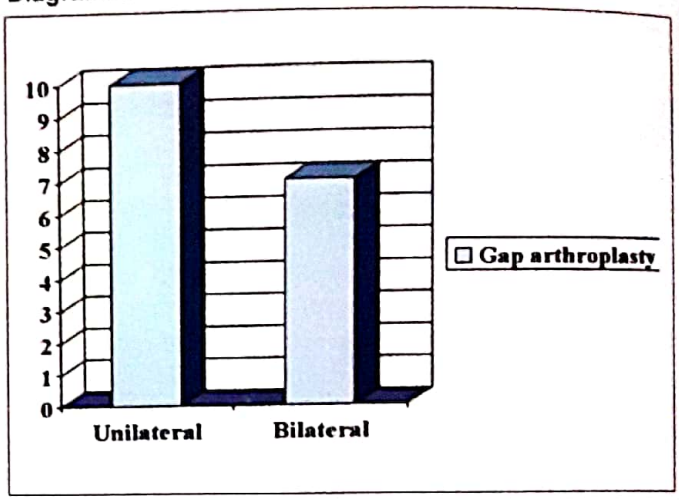


Diagram.2.



tical discerpancies in the mandibular ramus and angles, presence of an open bite , and discrepancies in the anterior _ posterior and transverse facial planes , and especially the occlusal plane, which was assessed for transverse tilting and occlusoal slanting. Radiographs and CT scans were evaluated for the extent of callous formation , condylar deformity , and length of the mandibular body and rami on the right and left sides.

The radiographs were also used for purposes of tracing and determining bilateral discerpances contributing to the skeletal asymmetry such as ramus height , as well as assessment of amount of deviation of the dental and skeletal midlines relative to the midsagital plane.

Operative procedure

After fiberoptic nasoendotracheal intubation and routine preparation and draping, a preauricular incision with a 10cm temporal extension was made. Sharp dissection was continued to the superficial temporalis fascia. After retraction of the flap, the superficial temporalis fascia was incised at a 45 degree angle, stating at the root of the zygomatic arch and the temporal fat pad (as described by Alkayat and Bramely) until the shiny deep temporalis fascia was reached.

Then the periosteum was incised on the most medial superior aspect of the arch , starting from the root of the zygomatic arch and coming forward. This flap of the superficial temporalis fascia, periosteum, and temporal fat pad thus reflected contained the zygomatic and temporal branches of the facail nerve, which cross over the zygomatic arch between 0.8 and 2.5 cm anterior to the external acoustic meatus and lie within this connective tissue , which represents the fusion of the superficial temporalis fascia with the periosteum [5]

After access to the bony callous , step one in this approach consist of aggressive resection of the bony or fibrous ankylotic segment. Recurrent ankylosis is most commonly caused by incomplete removal of the bony or fibrous mass , especially from the medial aspect of the joint. A preoperative computed tomography scan is helpful to delineate the boundaries of the ankylotic segment.

In some cases of TMJ Ankylosis following a condylar Fracture , the proximal stump is identified medial and anterior to the joint and is fused to the posterior maxilla. Step two consists of dissection and stripping of he temporalis , masseter , and medial pterygoid muscles, scar release from the ramus, and ipsilateral cornoidectomy. Longstanding ankylosis may result in temporalis muscle atrophy and fibrosis. Ipsilateral coronoidectomy has been recommended to facilitate intraoperative interincisal opening. Following step two , the Mouth opening Is evaluated. It should be at least 35 mm without force , and in unilateral cases , the opening should be accompanied by translation of the opposite normal condyle. If this is not achieved, the third step consists of contralateral coronoidectomy and stripping of the masseter, medial pterigoid , and temporalis muscles.

Diagram.3.

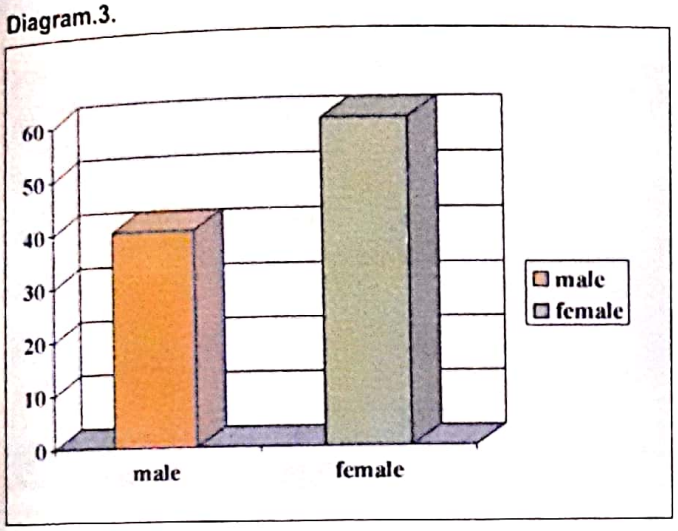
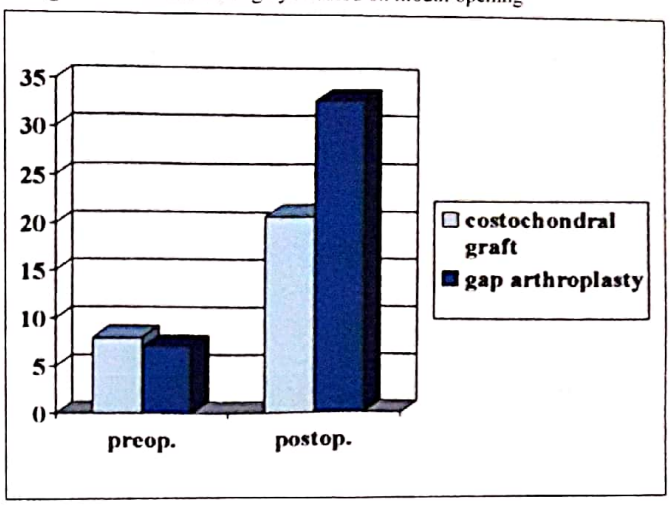


Diagram.4. Effect of Surgery Method on mouth opening



Exploration of the contralateral TMJ may be required when preopretive evaluation reveals decreased joint space or condylar irregularity on the contralateral side. In step four , a new joint lining is constructed. In gaparthroplasty cases, temporalis muscle and Fascia, as and axial pedicled flap, has been used as an interpositional tissue. [6,7]

In costochondral graft cases, if and intact disk is identified during the procedure, it is maintained to line the glenoid fossa. In these cases, step five and six consist of reconstruction of the condyle with a CCG and rigid fixation of the graft. In both groups , next step is early mobilization and aggressive physiotherapy.

In costochondral graft cases, after release of MMF (usually 3 to 10 days) , patients begin a soft diet and jaw-opening exercises. In both group exercises consist of active range of motion , lateral excursive motion, and passive range of motion by manual finger stretching in front of mirror. During the next 3 to 4 weeks, the diet is advanced to a solid consistency. Our physical therapy program consists of heat, massage, ultra sonography, gum chewing, range of motion exercises, and in gaparthroplasty cases the use of jaw motion device. After discharge , the patients were seen weekly for he first few weeks postoperatively and then at 1 month intervals. In gaparthroplasty group at each visit 1 to 2 mm of acrylic was removed from the superior inner part of the acrylic functional appliance on the ipsilateral side, using acrylic burs to allow for eruption of the teeth on that side and gradual maxillary compenstation for the occlusal canting to occur. Chin deviation was also addressed by adjustment of the appliance in such a way that the patient would close the jaw in midline. The activator appliance was retained until correction of the deformity and restoration of symmetry and occlusion. During this period, new appliances need to be constructed as growth progresses. In bilateral cases, the same procedure was used except that acrylic was removed bilaterally from the posterosuperior inner potions of appliance to allow the eruption of the posterior teeth bilaterally. The patients are followed closely until completion of growth (postpuberty) and then periodically because after completion of growth there is usually less chance for development of future occlusal or facial disharmony.

Results

In 10 cases of TMJ ankylosis , 8 cases were treated bilaterally and two were treated unilatereally. Four cases (three bilateral and one unilateral treated case) underwent effective activator appliance therapy postoperative six cases (five bilateral and one unilateral) treated with costochondral graft. The clinical criteria used for postoperative evaluation of he patients included assessment of mouth opening, evaluation of the occlusion , occlusal slanting, and facial symmetry. Paraclinical evaluations included CT scaning and plain radiographs to determine included CT scaning and plain radiographs to determine graft take, joint form, function, and

Fig .1.

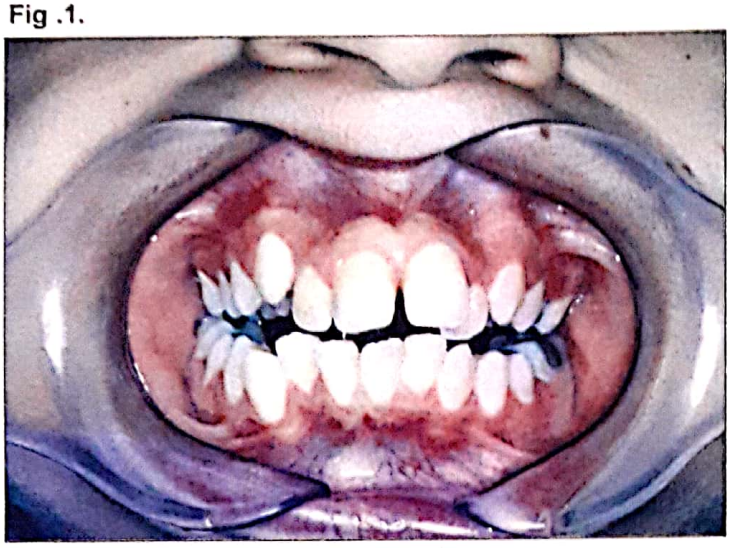
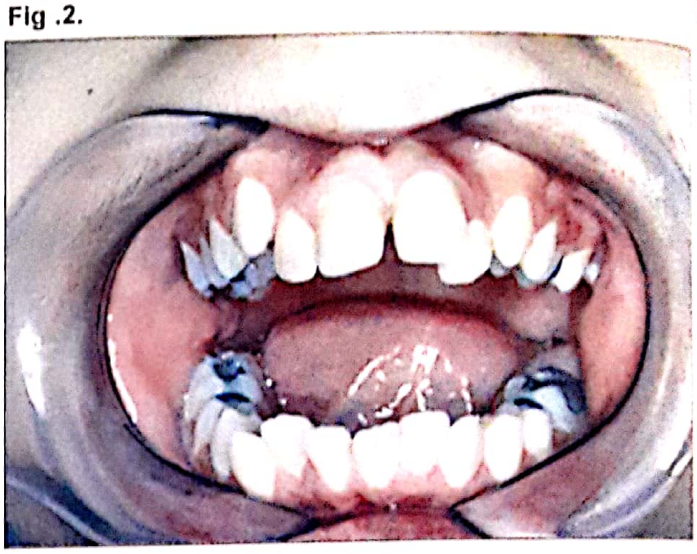


Fig .2.



symmetry. In all cases that were treated postsurgically with activator appliances and we were able to follow-up to date it was possible to obtain a more than satisfactory occlusion and acceptable facial symmetry and mandibular function.

Occlusal canting and dental midline relationships were also corrected in this group. The six patients who did not undergo appliance therapy postoperatively developed mechanisms affecting growth are unknown, the role of activator appliances in effectively guiding and stimulating mandibular growth, coordinating the arches , and correcting chin deviaton is well known [18]. Our Results is that , gaparthroplasty with functional activator postopervatively as better outcome than costochondral grafts in cases of TMJ ankylosis In this study has been showed that mandibular growth is better in gaparthroplasty group. This accords well with the soft tissue functional matrix theory that suggests the role of the soft tissue in mandibular growth and also suggests the functional matrix is more important than the condylar growth center when considering mandibular growth , such a study would address the precise role of activator appliances and help the profession decide wether it is the activator alone that produces favorable results and prevents reankylosis , or if other factors are involved.

Sufficient mandibular growth on the grafted side , problems of occlusion, mandibular deviation, over growth and reankylosis.(Fig 1-2, Diagram 1-4)

Discussion

The method chosen for treatment of TMJ ankylosis must not only provide a functional joint but also help restore facial summetry. In children there is an additional requirement of allowing facial growth to proceed normally. [4,8,9,10]

Several study have shown that in children costochondral graft have the potential to grow , however , this factor alone does not mean that growth will always proceed normally. Growth of these grafts is unpredictable, ranging from resorption to overgrowth necessitating secondry surgical procedures (12-15). Unfortunately, uncontrolled and often excessive growth was also noted in these cases.

Authors such as Heffez and Doju, Kent , and others too reported unsatisfactory results with costohondral autografts. Fundamental research on the growth potential at the normal mandibular condyle suggest that the velocity of this growth is governed by a combination of intrinsic (cell derived) and local extrinsic (enviroment modified) factors, (16-18) The clinical findings in our cases support the fact that external factors such as activators and jaw function may indeed influence and guide mandibular growth after gaparhroplasty, and that these appliances may play a role in allowing favorable results to be obtained. Despite the fact that the extrinsic mechanisms affecting growth are unknown, the role of activator appliances in effectively guiding and stimulating mandibular growth, coordinationg the arches, and correcting chin deviation is well known[18]. Our Results is that, gaparthroplasty with functional activator postoperative has better outcame than costochondral graft in cases of TMJ ankylosis in this study had been shown that mandibular growth is better in gaparthroplasty group.

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