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# MICROGNATHISM OR HYPOPLASIA OF MANDIBLE –A REVIEW

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## ABSTRACT

**Background:** Micrognathia is a frequent congenital deformity in our country and its treatment needs very high experience and highly qualified Orthognatic surgeon. **Objective:** to discuss the diferent methods in treatment of Mandibular Hypoplasia. **Materials and Methods:** A huge survey in the literature and 3 databases was done and all of the methods and their efficacies were studied and compared. The keywords were micrognathia, Mandibular hypoplasia, treatment, Osteotomy, Distraction Osteotomy. We reviewed all of the patents related to Distraction Osteogenesis. **Results**: During 6 months more than 2303 papers were found and some of them that were not relevant were omitted. Then those with strong evidence were selected, 32 papers. Discussion and conclusion: All of the methods for treatment of Mandibular hypoplasia were studied and were discussed here. The best treatment for micrognathia are Bilateral saggital splitting and Bilateral Distraction Oseogenesis method. Distaction osteogenesis with a flexible drive assembly (PCT/IB 2013/054225) is also a new method for having better results.Both are effective and reliable procedures for hypoplasia of Mandible and the results are comparable with older methods.

**KEYWORDS:** Micrognathia, Hypoplasia, Mandible, Distraction, Osteogenesis.

## INTRODUCTION

Hypoplasia of mandible is a common disorder and to evaluate and review the results of different treatments we conducted the present study. Mandibular aplasia is defined as incomplete development of the mandibular process of the first brachial arch. Its prevalence is less than 1:70,000. It is usually associated with low-set ears, transposition of the viscera, congenital heart defects, and rib abnormalities. Micrognathism, also called micrognathia, strawberry chin, hypognathia or hypogthathism, is a condition where the jaw is undersized. It is also sometimes called "Mandibular hypoplasia" It is common in infants, but is usually self-corrected during growth, due to the jaws' increasing in size. It may be a cause of abnormal tooth alignment and in severe cases can hamper feeding. Hypoplasia of Mandible would result in protruding of tongue, difficulty in mastication and oral hygiene, difficulty in sleep and snoring and deformity in neck and chin muscles. 1 Aesthetic deformity and unpleasant figure are also an issue in these patients. Purpose of this review article was to evaluate the different methods of treatment and recommend some the best ones with the best results and few complications according to our experience and literature review.[1,2]

## MATERIALS AND METHODS

During more than 6 months from March 2015 to Sep. 2015 we surveyed the literature for all of the papers about micrognathia. All English papers were reviewed. We used micrognathia, Mandibular hypoplasia, treatment, Osteotomy , Distraction Osteotomy and lower face deformity as keywords and "AND" to search the literature in databases pubmed, EMBASCO and Chocrane. All of the papers that were relevant included and those with strong evidence selected (inclusion criteria). The different methods with etiology, results and complications compared. Those that were case series or had not enough evidence were omitted (exclusion criteria). Flow diagram: Search 3 databases=>, All original research and review papers =>, English papers =>, case series excluded.

## RESULTS

The keywords were micrognathia, Mandibular hypoplasia, treatment, Osteotomy, Distraction Osteotomy.

We found 2303 papers and those that were relevant were 966 papers.

We chosed 32 papers that had strong evidence.

And the Etiology, results and complications were compared.

Also we compare their results with our experience and conclusion had been made in areas of interest.

The etiology of Mandibular hypoplasia in 91% cases were congenital and 32% had a relative with hypoplasia.

Mandibular osteotomy, mandibular body lengthening, mandibular ramus lengthening with bone graft, mandibular L-osteotomy and reverse L-osteotomy, Sagittal splitting osteotomy and distraction osteogenesis have been done for treating the mandibular hypoplasia. Mandibular lengthening had more than 18% relapse. 25% complications and graft failure.

L-osteotomy had 9-11% relapse and sagittal splitting 2-3 relapse and 2-4% complication.

Distraction osteogenesis had 0.5-1% relapse and 2-5% complications.

## DISCUSSION

Several terms have been used to denote a small lower jaw. From a literal sense, each has a slightly different meaning, but the terms are frequently used interchangeably. From its Greek derivation, the word micrognathia signifies a small jaw.

Mandibular hypoplasia results in a small mandible due to failure of growth and development. Retrognathia is used to describe a jaw that is posteriorly displaced but not necessarily smaller in size. And the use of the term mandibular atresia is not accepted anymore.[1,2]

## ETIOLOGY

Mandibular micrognathia can be classified according to its etiology as congenital, Developmental, or acquired. One of the most frequent causes of congenital mandibular hypoplasia is maldevelopment of the first and second branchial arches.[1,2]

### *Variation of Mandibular Hypoplasia and Associated Functional Disturbances*

Deficiencies in the length and width of any part of the lower jaw characterize mandibular hypoplasia. The degree of involvement of each section varies; unilateral and bilateral deformities occur. When the deformity is bilateral, it is called generalized micrognathia. It contains retruded lower jaw, retruded chin and small chin, hypertrophy of chin muscles or lower lip muscles, flattening of cervico-madibular angle, protruding of tongue and in small infants even obstruction in mouth passage, class II malocclusion, bad hygeince in mouth and teeth.[1,2,3]

### *Early Surgical-Orthodontic Planning*

Early consultation with the orthodontist eliminates later misunderstandings. One should particularly avoid and advise against untimely orthodontic therapy, which modifies the malformed mandible and greatly complicates subsequent surgical treatment.[2]

### *Preoperative planning*

Diagnosis and planning of surgical examination of the patient. A number of laboratory records are required to formulate a surgical strategy: photographs, cephalometric and panoramic roentgenograms, and dental study models. More complicated deformities may call for additional tests such as CT scan.[2, 3]

### *Elongation Osteotomies of Body of Mandible*

*General Considerations* Although in the vast majority of cases, the sagittal splitting procedure of the ramus is preferred to lengthen the mandible, there are special indication for the infrequently used body osteotomies. The line of osteotomy and its location in the body of the mandible vary according to the deformity and the status of the dentition.

Gaps in the dental arch due to missing teeth offer a convenient site for the line of osteotomy, because possible injury to the adjacent teeth is avoided. Various types of osteotomy are available. 4.

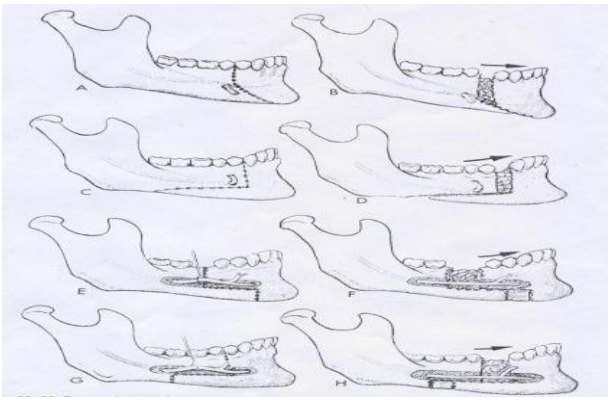

**Fig. 1: several types of osteotomy for elongation of mandible**

### *Maintenance of contact of bony fragments*

The L-osteotomy, the step osteotomy or sagittal splitting of the mandibular body are preferable to the straight vertical osteotomy because they provide an increased area of contact between the fragments. Maintenance of contact between the fragments is ensured by the fixation appliance and direct interosseous wiring or plate and screws. The contact between the bone fragments has to be adequate.

Otherwise bone grafts are placed in the line of osteotomy to facilitate consolidation.[5,6,7,8,9,10]

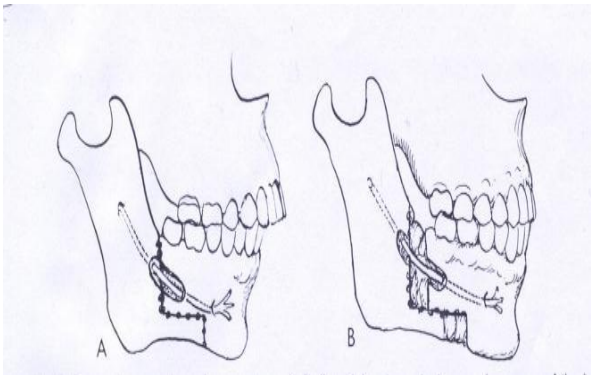


**Fig 2: L-osteotomy in body**

***Preservation of inferior alveolar neurovascular bundle***

The inferior alveolar nerve divides into two terminal branches, the mental and incisive nerves. The mental nerve exits from the mental foramen and divides into three branches that provide the sensory innervation to the skin of the lower lip and chin .the other terminal branch, the incisive nerve, is an anterior extension of the nerve within the mandible.[11]

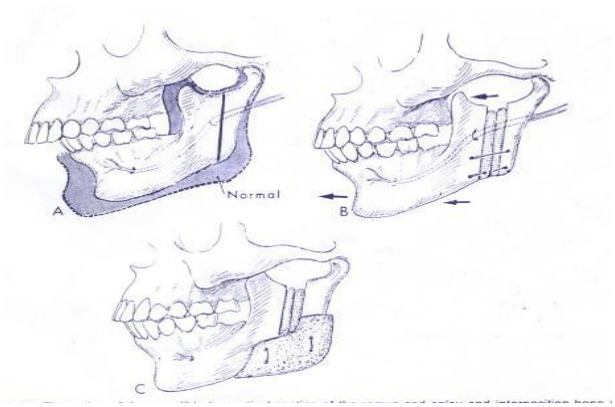


**Fig. 3: Ramus osteotomy**

***Preservation of soft Tissue coverage***

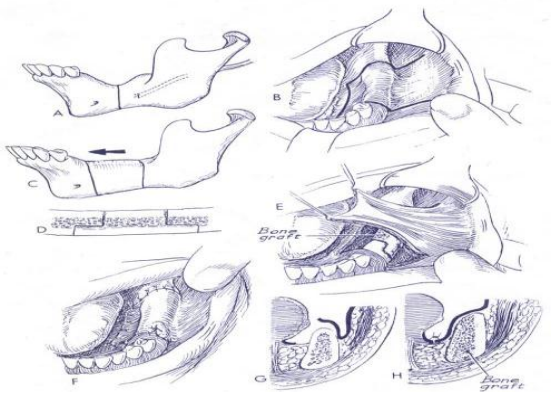


**Fig. 4: soft tissue coverage and bone graft**

The best technique of exposure is the degloving procedure. Excellent exposure of a major portion of the body is obtained and preservation of the mental nerves is facilitated. The labiobuccal vestibular incision, made well above the buccal sulcus and continued backward over the inner aspect of the cheek, provides enough tissue to cover the bones in the average elongation osteotomy and is better than the gingival incision.[12]]

***Techniques for lengthening mandibular body***

A step osteotomy can be used to lengthen the shortened body of the mandible. horizontal portion would maintain the bone contact. This method was employed by von eiselsberg (1906) to lengthen the body of the mandible and by blair (1907) to correct an open bite.[7,8,9]

***Interdental osteotomy***

The vertical part of the step osteotomy can be done between the alveolar bone, between two adjacent teeth caring not to injur the dental roots. Thus there is no need for extraction of the teeth. Intraoral periapical dental and panoramic roentgenograms give a clear picture of the position of the roots of the teeth and the amount of intervening alveolar bone. Additional space, if needed, can be created by the orthodontist.[9]

***Mandibular Hypoplasia Associated with Maxillary Dentoalveolar Protrusion***

The problem of correction is discussed with the patients and parents early in age, 4-6 years of age. If mandibular hypoplasia is severe and the soft tissues over the mental symphysis are tight and unyielding. The anterior maxillary dentoalveolar part had moved forward and downward, resulting in an exagerated over jet and overbit.[13,14]

***Bone Grafting Associated with Elongation Osteotomy:***

Iliac bone grafts, consisting mostly of cancellous bone, are used as flat pieces of bone graft and cover the lines of osteotomy and fill the gaps of the mandibular advancement. Calvarial bone grafts can also be used but lack the big necessary volume.[15,16]

***Other Elongation Osteotomies of Mandibular Body***

The oblique osteotomy through the body of the mandible was described by blair (1907) and kazanjian (1939). This technique is useful in the edentulous mandible when the inferior alveolar nerve has been destroyed by trauma, disease, or ablative procedures.

***Advantage and Disadvantages of Body Elongation Osteotony:*** The main indication for a body elongation osteotomy is the needed to correct mandibular arch together with the length. Such as a mandible that has unequal unsymmetric body length and distorted dental arch contour.[5,6,7,8]

***Operations on Mandibular Ramus to Increase Projection of Mandible***

Horizontal osteotomies through the ramus above the inferior alveolar foramen to lengthen the mandible were used by lane (1905) and blair (1907). But they have complications such as lack of good bony contact, trauma to inferior alveolar nerve and difficulty of operation in the back part of the mouth.[5,6,7,8,9,10,17]

***Increasing Vertical Dimension of Ramus***

Sometimes, as in craniofacial microsomia, it is indicated to increase the vertical dimension of a hypoplastic ramus. The procedure is not an easy one, as the powerful masseter and medial pterygoid muscles respond to being stretched and will have a compress effect on the bones. Relapse is a definite possibility.[18,19]

***Advantages and Disadvantages of Vertical Osteotomy of Ramus***

The vertical section procedure of the ramus is simple. Exposure is satisfactory, the osteotomy is easy to perform, and adequate advancement can be achieved. In contrast to body elongation techniques, the vertical osteotomy of the ramus presents minimal risk to the inferior alveolar nerve, edentulous areas are not produced in the dental arch and soft tissue coverage of the osteotomy is good.[20]

***Elongation of Mandible by Sagittal Section of Ramus***

The sagittal splitting technique of ramus is the most popular method used to increase the anteroposterior dimension of the mandible. A wide surface of contact between the fragments is provided, and thus the bone graft is not required and it is easy to fix. The basic technique is similar to that used in the treatment of mandibular prognathism with some important differences.[21, 22]

***Advantages and Disadvantages of Sagittal Section of Ramus:*** The intraoral approach is an advantage. Gaps are not produced in the dental arch. The wide surface of bone contact afforded after advancement of the segments is the main advantage. Bone grafts are not needed to maintain bone contact. Consolidation of the fragments is rapid, stable and nonunion is rare. Rigid fixation techniques can be used too.[21,22]

***Osteotomy of Ramus and Body of Mandible for Elongation of Mandible***

A C shaped osteotomy of the mandibular ramus was described by Caldwell, Hayward, and Lister (1968). It is called L-osteotomy, but the cut more resembles a C line. The design of the osteotomy begins with a superior horizontal section placed above the level of the mandibular foramen and it goes down the body of ramus.

***Advantages and Disadvantage of C-Osteotomy***

The advantage of the C-osteotomy is that it provides sufficient bone contact so that a bone graft is not needed. The body sagittal split modification further increases the surface of osseous contact. When the sagittal splitting technique is not possible in small ramus, this technique can be used.[5,6,7,8]

***Choice of Technique for Elongation and Advancement of Mandible:*** There are many techniques for correction of small mandible. Each has advantages and disadvantagesits. But, in most of the cases, the sagittal splitting ramal osteotomy is the procedure of choice and all other new modalities should be compare with it.

During first consultation and during analyzing, the surgeon must think that where is the deficiency, in which part of Mandible - ? Then the best procedure of choice can be found.[5,6,7,8,9,10]

***Age at Operation:*** A major problem that remains controversial is the age at which the corrective procedure should be performed in the developmental type of mandibular hypoplasia. Temporomandibular ankylosis should be relieved as soon as possible. With the presently available means of fixation, an osteotomy to increase the size and anteroposterior osteotomy to increase the size and anteroposterior dimension of the ramus can technically be performed at an early age.But there may be some problem with growing centers of the bone and child may have some deficiency in future. So in these day, Distraction Osteogenesis is becoming popular. this method can be done at the early phases of age even before 4 years ols. The procedure has not reverse effects on growth of the child and growth of the Mandible.

The method would end easily and in fast velocity to the complete result and complete correction of the deformity. The bone will grow normally after the Distraction and there would be no limitations for its grow . Some of the devices with flexible drive apparatus have better options in treating the elongation and rotational deformities of the mandible (PCT/IB 2013/054225).[23]

Several studies comp[ared the result of Saggital osteotomy with Distraction Osteogenesis, it is found that it is safe and with comparable results and without any major complications.[24,25,26,27,28,29,30,31,32,33]

*Postoperative Relapse:* Postoperative regression of the advanced segment of the mandible is a major problem. Cephalometric studies have provided valuable information in this matter. Poulton and Ware (1973) observed patients treated by the sagittal splitting procedure of the ramus over a three year period. Serial cephalograms documented 50 to 80 per cent skeletal relapse during the period of study.But in Distraction Osteogenesis the relapse is very minimal, less than 10%.[21, 22]

***Suprahyoid Musculature:*** The anterior belly of the digastric, the mylohyoid, and the geniohyoid muscles have a strong rotatory downward and backward pull on the anterior fragment (clockwise rotation). The stretching of the muscles, as the advancement is made, would result to a much forceful muscle pull to the bone fragments.22

***External Mandibular Supporting Appliances***

Regression of the advanced mandibular segment can also be minimized by the help of external mandibular supporting devices. Poulton and Ware (1973) employed a pitkin cervical collar to help neutralize the relapsing

forces. The line of force applied by the collar, however, does not completely counteract the pull of the suprahyoid muscles.[34]

***External Traction Devices:*** An external apparatus that exerts traction on the mandible can be used to neutralize the pull of the suprahyoid musculature. However, these are difficult to use and the patient may have some problem to wear them during the work time or school time. They were used mainly in the past for body osteotomy procedures and are now completely abandoned.[35]

***Soft Tissue Deficiency:*** A hypoplastic mandible not only has a deficient skeleton but is often surrounded by a deficient, tight, soft tissue envelope that resists the forces of skeletal advancement. Wide elevation and undermining of the soft tissue around the osteotomy site may be helpful. Vertical parallel incisions through the periosteum assist in overcoming the restrictive force of the periosteal capsule and in allowing for a better expansion of covdering soft tissue.[12]

***Sphenomandibular Ligament:*** The Sphenomandibular ligament is a fibrous band extending from the angular spine of the sphenoid bone to the lingual of the mandibular ramus. In vertical and sagittal osteotomies of the ramus, the lingual remains on the advanced segment of the mandible. And it has a backward force on the advanced parts.[36]

***Other Techniques to Prevent Relapse:*** Overcorrection has been advocated for the treatment of mandibular hypoplasia it is also recommended in Distraction Osteogenesis of mandible. An acrylic occlusal splint is required to modify the dental intercuspal interferences. A posterior open bite part is also needed in the design of the wafer (Poulton and Ware, 1973).

***Secondary Operations:*** If a relapse occurs, a secondary procedure is usually mandatory in order to have a satisfactory result. Further procedures may be required, such as an advancement osseous genioplasty of Bimax. surgery.[37,38,39]

***Contour Restoration in Mandibular Micrognoathia***
After the mandible has been elongated and advanced to correct the malocclusion, additional measures to improve the facial contour are often needed.Such as filler injection or fat cell injection to add volume to the soft tissue of the face and Mandible.

***LATEROGNATHISM: LATERAL DEVIATION OF MANDIBLE***
A truly symmetric face does not exist. When carefully studies, the right and left halves of the average face show some degree of asymmetry. As the skeletal portion of the mandible deviates to one side beyond the average range, facial asymmetry becomes clinically pronounced and mandibular laterognathism is produced: the mental symphysis is lateral to the midsagittal plane of the face.And there may be some deviation in mouth of nose and other part of face. Lateral bite also is frequently present.[40]

***Etiology***
Trauma plays an important role in the etiology of lateral deviation of the mandible. Unilateral underdevelopment is often the result of injury to one condyle in early part of life. Laterognathism is also of congenital origin, i.e., the deformity characteristic of the malformation of the first and second branchial arches.

***Preoperative Planning***
Asymmetry of the face is usually readily detected on clinical examination and photographs. Determination of the defective side of the face may not be so easy: occasionally, the unaffected side may appear to be the deficient part. The position of the chin is used as a rough clinical guide.

***CONDYLAR HYPOPLASIA***
Altered condylar growth is seen in many congenital malformations, but trauma is probably responsible for the most of them. Injury to the condylar cartilage from delivery forceps at birth, a fall, other trauma, or sepsis in early childhood can lead to arrested growth. The degree of growth impairment is greater when the injury occurs early in life.[40]

***Altered Muscular Activity and Condylar Injury***
The condylar growth center shows some form of activity until at least the 21st year and is generally the most active part in the growing mandible. When it is traumatized, there is a definite deceleration in growth due to the inhibitory effect on the proliferation of the cartilage and ossification, particularly during the preschool years.

## CONCLUSION
Although there are several methods in treatment of mandibular Hypoplasia, the best treatment still are Bilateral Saggital Osteotomy OR Bilateral Distaction Osteogenesis.

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Nothing to disclose.

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