Preliminary Communication

ı design for midface distraction

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Midface retrusion is commonly seen in patients with cleft lip and palate, other craniofacial syndromes and maxillofacial trauma. It is now idely understood that the extensive subperiosteal ssection in palatoplasty and alveolar bone grafting ıs a definite contributory role in the occurrence of is deformity. Midface retrusion can be treated either rgically or by slow distraction. The advantage of straction advancement of the maxilla is that there is reduced chance of precipitation of velopharyngeal competence. There is also a reduced likelihood of lapse after distraction advancement than after rgical advancement.

ıe use of distraction osteogenesis for maxillary lvancement was first done by Rachmiel et al in 1993 r advancement of the maxilla in sheep. A preliminary port of the use of rigid external haloframe distractor r maxillary distraction was published by Cohen et al[2] 1997. Molina et a1[3] used rigid external haloframe straction of the maxilla for maxillary advancement 38 patients with maxillary hypoplasia due to cleft ›-palate. All the patients in this study had mixed ıntition. The authors went on to recommend this as e procedure of choice in patients with severe axillary hypoplasia who had mixed dentition. Cedars al[4] used a custom made internal distraction system r maxillary distraction. Hierl et a1[5] used a novel tention system using miniplates and wires for axillary distraction in an edentulous patient with ›st-traumatic midface retrusion.

ırrently no indigenous haloframe rigid external distraction systems are available in our country. The haloframe distractors manufactured abroad are exceedingly expensive. Considering the present situation it is important that an indigenous distraction device be developed which is cheap and easy to use. It is in this setting that an effort was made at our institution to develop an indigenous midface distraction device. This haloframe distractor would have wide applicability in patients with cleft lip and palate, other craniofacial clefting syndromes and patients with craniofacial trauma.

DESIGN

The midface distraction system designed in our institution is a haloframe type rigid external distractor. The parts of this device are:

1. Aluminum haloframe (Figure la)
2. Nylon block (Figure 1d)
3. Perpendicular threaded rods with a Cross pipe joint (Figures 1e & f)
4. Palatoalveolar splint, which is basically a silver arch bar with an acrylic palatal splint. (Figure 2)

The aluminum haloframe (Figure 1a) and is basically a horse shoe shaped aluminum piece with a thickness of 5 mm, the size of which is designed to fit around the head. Aluminum was chosen for this purpose as it is very light (a comparably sized iron or steel frame would be twice as heavy). This haloframe can be conveniently fabricated is a foundry. This haloframe has holes for attaching fixation pins. Though these holes a perforated brass

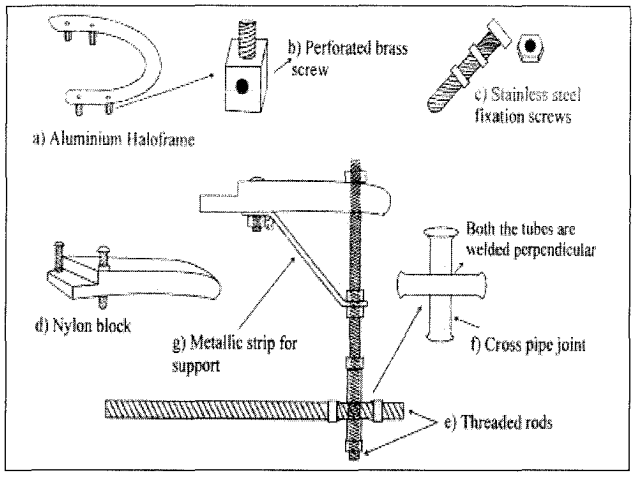

Figure 1: Line diagram illustrating the different parts of the haloframe rigid external midface distractor. The teens have been used purely for simplifying the diagram and the text

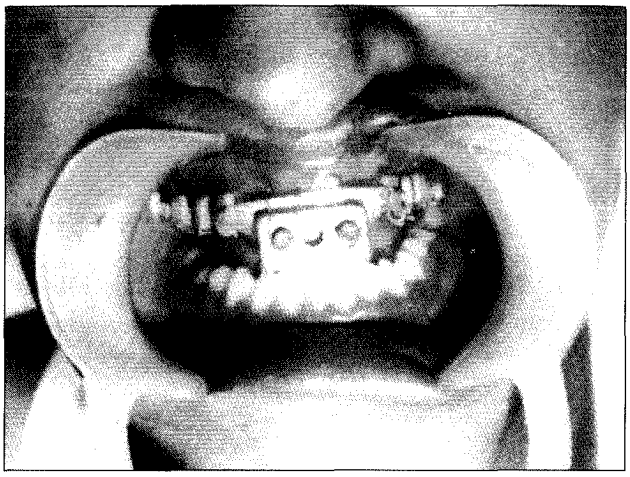

Figure 2: Preoperative photograph of the patient showing the palatoalveolar splint in place. The articulation block (made of brass) with the hole for fitting the threaded rod can be clearly seen as well as the teeth of the silver arch bar

block (Figure 1b) is attached for attachment to fixation screws (Figure 1c). Brass blocks can be easily made at any lathe workshop.

Initially we had fabricated screws from Steinman pins but due to practical problems we switched over to pins fabricated from medical grade stainless steel. The middle portion of this screw is threaded for securing to the haloframe using perforated brass blocks.

A nylon block (Figure 1d) is attached to the anterior position of the haloframe for anchorage of the threaded rods. Nylon is sufficiently inelastic and light for this purpose. A step is created at one end of the nylon block for easy fixation to the haloframe.

A long threaded rod is passed through this nylon block and secured with nuts. An additional metallic strip (Figure 1g) may be used for stabilizing this rod against the angulation stress created during distraction. This threaded rod is articulated to another threaded rod through a cross pipe joint. This horizontal joint is made by welding two small pipes- 3 inches long in a perpendicular arrangement. The horizontal threaded rod has a tapered and threaded end, which fits, into a threaded slot in the palatoalveolar splint.

The palatoalveolar splint has three components
i) Silver arch bar
ii) Acrylic palatal splint
iii) Articulation block into which the horizontal threaded rod was screwed fit.

The arch baris made from silver, as silver is both malleable and strong with a good resistance to fracture. This is made from thick silver wire of a rectangular cross section on to which pieces of the same silver wire are soldered (the teeth of the arch bar). In the anterior end of the arch bar a silver plate with a pair of holes for fixation of the articulation block is soldered.

The articulation block is a brass block, which is fitted on to the arch bar. This block has a threaded hole into which the tapered end of the horizontal threaded rod is fitted (Figure 2).

After this assembly the arch bar is moulded to the shape of the dental model of the patient. Acrylic palatal splint is then fabricated on the dental model. This assembly is put together and is applied the day before the surgery (Figure 2).

The assembly of haloframe, nylon block and the vertical threaded rod is done before the surgery for conservation of time.

OPERATIVE DETAILS

The first step in the surgery is the performance of LeFort I or II osteotomy as per the preoperative planning. After the osteotomy is completed and the mobility of the osteotomized fragment is confirmed

fixation of the haloframe is started with simultaneous closure of the mucosal incision.

Fixation of the haloframe is best done at a plane just below that connecting the frontal and parietal eminences. The fixation should be such that the appliance does not protrude behind the head of the patient (so that the patient is able to sleep). It is better to give skin incisions during fixation of the haloframe. The screws are fixed in a manner similar to that of the Crutchfield device (the Crutchfield device is used for cervical traction in patients with cervical spine trauma) ie the screw should abut on the outer table of the calvaria and not pierce it. Four screws are enough to stably fix the haloframe to the skull. After the stability of the haloframe is confirmed the crosspipe is fitted on the vertical threaded rod followed by the passage of the horizontal threaded rod. No attempt is made to advance the maxilla at this stage (Figure 3).

Following surgery a latency period of about 3 days is given following which distraction may be started after minimal retightening of the screws. The tightness of the screws should be confirmed at regular intervals. During the entire period of distraction osteogenesis the patient can be allowed a soft diet orally. The patient also has to be instructed about maintaining the cleanliness of the palatoalveolar splint.

Thus this midface distraction device can be easily fabricated using easily available materials.

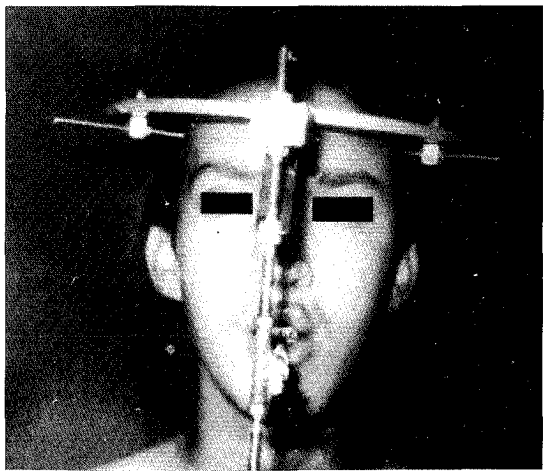

Figure 3: Photograph of the patient after fixation of the haloframe distractor

PATIENT DETAILS

This midface distraction device was used for midface distraction in a 19 year old patient with severe midface retrusion due to cleft maxillary hypoplasia. This patient had been operated in childhood for cleft lip at the age of 1 year and cleft palate at the rate of 3 years. The patient developed progressive midface retrusion with growth. On examination there was midface hypoplasia with a cleft alveolus (two piece maxilla). This patient was taken up for distraction advancement of the maxilla after a proper informed consent. The patient was also properly explained that the distraction device was still very much in a developmental stage. The fixation of the device and LeFort I osteotomy were done as described above. Distraction was commenced 5 days after the surgery. During this period the patient was allowed a soft diet orally. Initially in this patient screws fabricated from Steinman's pins were used but around 2 weeks after surgery the screws became lax necessitating an emergency change of the screws. New screws were fabricated from stainless steel to replace the faulty ones. This presumably has caused a costly lapse in the treatment. The distraction had to be stopped for a period of about 10 days. Following this when the distraction was restarted the advancement gained was much less and the distraction had to be stopped after a period of 10 days. The distraction device was retained in situ for a period of six weeks and then removed.

A total of 8 mm advancement of the maxilla was achieved in this patient. A vertical lengthening of the maxilla of 6mm was achieved. The malocclusion was greatly reduced following the surgery (Figures 4 & 5).

The success of the procedure can probably be augmented by bony fixation in addition to the orthodontic fixation. This can be done using either wire fixation only or wire and miniplate fixation. This was just a preliminary case in the development and understanding of halofiame midface distractor. The device still needs a lot of fine-tuning to make it optimally effective. The indigenous designing of this distraction system can reduce the cost of treatment greatly bringing it within the reach of the common man.

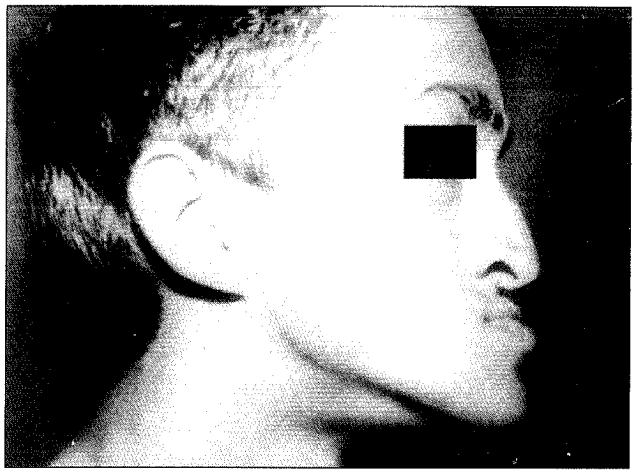

Figure 4: Preoperative photograph of the patient showing severe midface retrusion

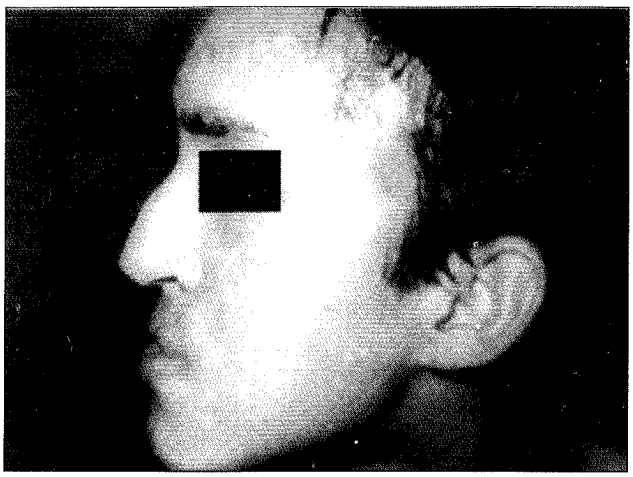

Figure 5: Post distraction photograph showing evidence of midface advancement and midface lengthening

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