

Evolution and effectiveness of infant orthopaedics

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ABSTRACT

Topic- Evolution and effectiveness of infant orthopaedics

Background: The cleft lip and palate is the most common Craniofacial anomalies which cause distortion in nasal morphology and alveolar morphology with wide gap between alveolar segments and palate. This wide palatal cleft gap poses a great challenge for the surgeons to approximate alveolar segments and to close palatal cleft gap. Correcting the palatal cleft and restoring the nasal anatomy is crucial part of cleft lip and palate treatment. In order to restore the function and esthetics, Infant orthopaedics was introduced to reduce alveolar cleft gap and to ease the surgical closure in the palatal cleft. Initially infant orthopaedics was used for moulding of alveolar arches and palate alone, later on nasal moulding was included along with infant orthopaedics as a part of Nasoalveolar moulding procedure. Currently more controversies have arisen regarding the effectiveness of infant orthopaedics in restoring nasal and alveolar morphology. In this review we will study the chronological evolution of infant orthopaedics and its effectiveness in treatment modalities.

REASON: To understand the effectiveness and evolution of infant orthopaedics.

EFFECTIVENESS AND EVOLUTION OF INFANT ORTHOPAEDICS

Introduction

Orofacial clefts comprise a range of congenital facial deformities. The prevalence of the orofacial cleft is reported as one in 500 to 1000 births. (1)The cleft lip and the palate is a most common congenital anomaly with significant variation depending upon the geographical location, racial and ethnic background and socioeconomic status. These cleft can involve lip or bifid uvula to complete unilateral or bilateral cleft of the lips and palate. The malformation of the cleft lip and palate can affect different functions of children such as hearing, breathing, feeding, phonation, aesthetically, psychological, and social adaptations problem. And hence in order to develop the existing conditions and to sort out the early suffering of the infants "Infant orthopaedics" came into the existence.

The surgical treatment of the cleft lip and the palate has been documented since AD 317 and has corrected by cutting and stitching the edges together. However the surgical techniques was advanced from 1800s to 1900s, these techniques set a focus achieving premuscle closure, and a better esthetic results. The infant orthopaedics was started between 6 months to 5 yrs of age. (2)

This review is carried out because the sufferings of the neonates in such conditions was reduced to the maximum in the current years. However it's been the struggle of the many researchers to continuously review the neonates, with those conditions to return back lead the life normally

EVOLUTION OF THE APPLIANCE

1556- Pierre Franco- Gave the first detailed description of indications, surgical techniques, and post operative care of cleft lip(3)

- 1575-Amboise pare- pioneered this technique that bears his name in repairing cleft lip palate.(4)
- 1689- Hoffman design- used facial binding to narrow the cleft and prevented post surgical devices(5)
- 1844- Hulihen design- used adhesive tape binding to narrow the cleft deformity(5)
- 1927- Brownphy design- used silver wire which passed through both the cleft and alveolar segments and progressively lightened to approximate the cleft alveolar segment before the lip repair(5)
- 1930- Blair- skin and fascia was removed at the time widely separated the nasal domes . The primary unilateral nasal dissection technique described (6)
- 1946-Pritchard observed the rate of bone healing was inversely proportional to size of gap(5)
- 1950- Mc. Neil design- used series of acrylic plates to actively mould the alveolar segments into the desired position (5)
- 1952- Tennyson- Developed a technique preserving a structure using Cupid bow.(7)
- 1958- Burston design- modified Mc. Neil technique(8)
- 1967- Rosiestein and Jacobson design- Acrylic obturator that engaged the undercut region in the alveolar segment allowed the passive moulding of the segment(9)
- 1975- Geograide and Latham design- used pin retained active appliance to simultaneously retract the pre-maxilla and expand the posterior segments over a period of several years(5)
- 1983- Robertson design – used passive or active acrylic appliance and external strapping, depending on the presenting clinical condition to reposition The alveolar segment and encourage the self- growth(5)
- 1986- Mc.Comb and salyer- intra nasal horizontal sutures was performed between the dome cartilage for the external (10)
- 1986- Brogan design- used both extra – oral strapping and intra oral appliance (5)
- 1990- Hotz design- used passive orthopaedic appliance with continuous adjustment to guide growth over a prolonged period. This approach delayed until the six month for the lip repair (5)
- 1993- Grayson design- pre surgically moulder the lip, nose , and the alveolus in the infants born with the cleft lip and the cleft palate. This design enhanced the aesthetic outcome(5)
- 1995- De Braise design- used orthopaedic design that the manipulating of the alveolar segment on a continuous basis by selective trimming theory promoting lateral self- growth(5)
- 1999- Millard and Latham- Active orthopaedics, Gingivoperioplasty and lip adhesion achieves main goal of moving the plates to normal positions (11)
- 1999- Habner and Mash – Passive Alveolar moulding appliance-Restoration of soft tissue known to cause force to produce the motion of segments (12)
- 2001- Cutting and Grayson- The combination of presurgical moulding and non surgical columella elongation allow bilateral cleft lip and nose correction in single stage(13)
- 2003- Adirina and Silvera et al- Modified PNAM by orthodontic wire instead of palatal prosthesis with acrylic bulb positioned inside the nose to the apex of the Alar Cartilage (14)
- 2005- Mandona et al- Removed 11 to facilitate the PNAM devices(15)

- 2005- Ajay , K.s. Rao et al- Extended the time period of PNAM from 3-5 months to 4-6 months(16)
- 2006- Adam and carmen et al- Modified PNAM by using Acrylic ball (0.036) instead of Acrylic extension (17)
- 2006-Jet and Lang et al- used soft denture lining instead of clear hard Acrylic resins(18)
- 2010- Abida et al- Modified PNAM by using the orthopaedic ring plate with an acrylic ring around the protruded Premaxilla((19)
- 2010- Chitravelu siva Subramanian et al- Modified PNAM by using TMA wire for nasal stent because of its resilience nature(20)
- 2011 – Quan yu, Xiang gove et al- used digital model to analyse the NAM procedure with the reverse engineering software(21)
- 2011- JANEN Roven- used 3D capture of surface of soft tissue for the documentary purpose (22)
- 2014 –Ranjit Ruseh , swapna puliet et al- Modified PNAM by relieving the inner side of the acrylic, prolabial banding was done and petroleum jelly was applied at the time of insertion (23)
- 2015- Nikhil nagaraj et al- Modified PNAM by using the titanium molybdenum wire for the fabrication of nasal stents for cleft lip and palate(24)
- 2015- YUN fang Chan et al- Modified PNAM by using the simplified lip taping and passive palatal plate(25)
- 2016- Baeuer , schonberger et al- Rapid PNAM- used NAM with the fixation pin, ventilation hole, and fixation point for nasal stents(26)
- 2017- Grayson technique by Shafees Koy and Hussain- Modified PNAM by adding the soft denture reline during every dental visit, nasal stents to swan shaped and kidney shaped nasal bulb beneath the alar dome and beneath the Nostril Rim(27)

RECENT FINDINGS:

The nasal septal and columnar deviations can be improved with a novel device. 3D analysis was done to analyse the progressive temporal and morphological change in the lip and nose which occur with the NAM treatment. Stereo photometry was shown reliable in comparison to manual anthropometry

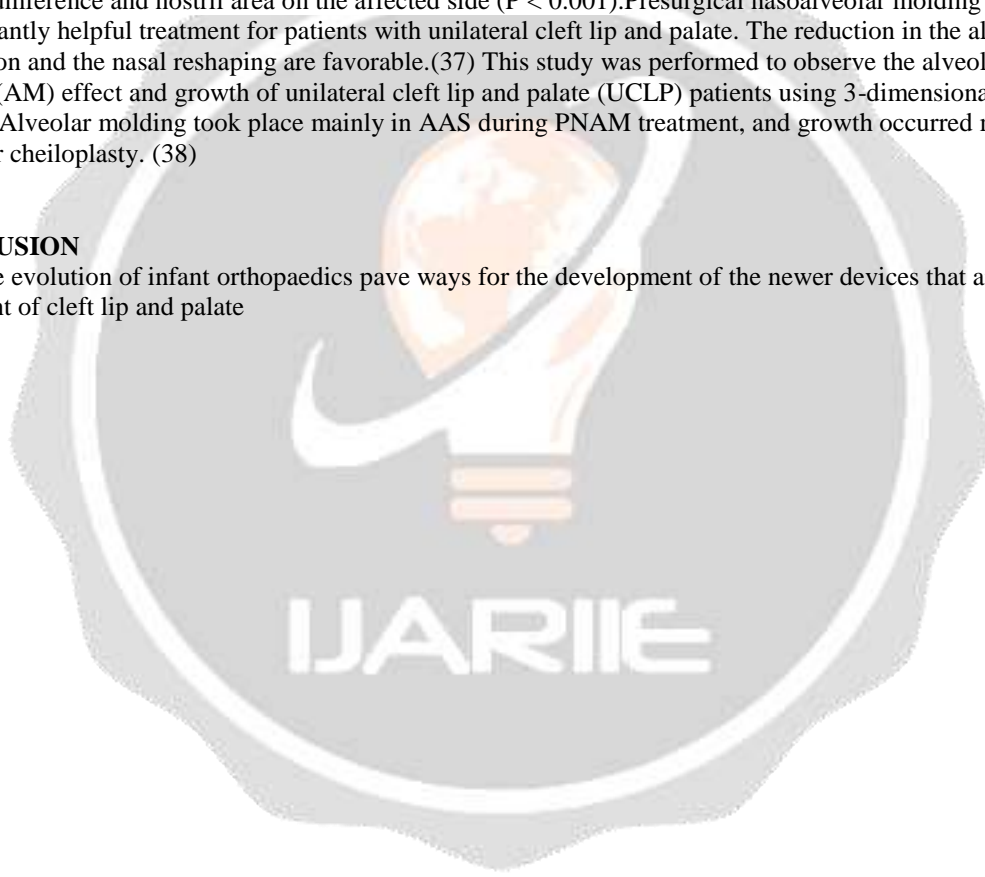
EFFECTIVENESS OF INFANT ORTHOPAEDICS

Gingivoperiosteoplasty (GPP) can avoid secondary alveolar bone graft (ABG) in up to 60% of patients with a cleft. However, preoperative predictors of success have not been characterized. Thus it is reported on the preoperative alveolar segment position most favorable for successful GPP.(28). Computer-aided nasoalveolar molding can effectively reduce the cleft gap, correct the alveolar midline deviation, and retract the projection and outward rotation of the premaxilla segment, and normalize the contour of the alveolus.(29) Nasoalveolar molding improves nasal symmetry and achieves an improvement of all maxillary alveolar dimensions, increasing alveolar rim width, reducing the size of alveolar cleft gap, and improving shape of the maxillary dental arch. As a consequence of reducing the alveolar and nasal deformities before surgery, it is expected that the primary repair will be easier for the surgeon and more successful.(30) The presurgical nasoalveolar molding (PNAM) technique, developed by Grayson, is a new approach to presurgical infant orthopedics. PNAM reduces the severity of the initial cleft alveolar and nasal deformity. Thus, it enables the surgeon and the patient to enjoy the benefits associated with repair of a cleft deformity that is minimal in severity. This article presents a brief insight into PNAM with a case series of three different cases (one unilateral and two bilateral) which underwent PNAM treatment and gave an excellent surgical prognosis.(31) Maxillary alveolar morphology could be improved in UCLP infants treated with computer-aided presurgical nasoalveolar molding. The width of the cleft could be reduced and the maxillary midline corrected effectively. However, the alveolar height decreased significantly after the treatment.(32).For successful primary nasolabial repair of complete cleft deformity of the primary palate, cleft surgeons need special care in reconstructing the sound nasal

floor. Especially when the cleft gap is wide or when any type of nasoalveolar molding therapy was not performed, three-dimensional reconstruction of the nasal floor is critical for a balanced nasal shape. In this study, the author describes an effective method for reconstructing a double-layered nasal floor using two mucosal flaps from both sides of the fissured upper lip. This is a report of six patients with unilateral or bilateral complete cleft of the primary palate with a detailed description of the surgical technique and a literature review.(33) We evaluated the effects of presurgical nasoalveolar molding (NAM) with an orthopedic appliance and compared them with a passive orthopedic method (Hotz plate, HP), focusing on the naris morphology and width of the alveolar and palate cleft gap. The width of the alveolar and palate cleft gap was significantly narrowed in the NAM group, and the cleft gap at the initiation of NAM correlated significantly with the Hausdorff distance after cheiloplasty. We found that NAM improved the form of the naris after primary cheiloplasty and decreased the palate cleft gap more effectively than HP and that the width of the palate cleft gap was correlated with the surgical outcome of the naris.(34) After PNAM treatment and cheiloplasty, the lip profile was obviously improved, cleft gap was reduced, and the height of ala nasi fornix was recovered. PNAM treatment can improve the lip shape and nasal deformity degree of UCLP patient. The cleft gap and upper lip tension are reduced.(35) NAM was effective in reducing the severity of the initial cleft deformity mainly at the anterior portion of the maxillary arch.(36) The decrease of the cleft width, arch length, and alar base width on the cleft side and the deviation of the columella were significant, in addition to the significant increase of the arch circumference and nostril area on the affected side ($P < 0.001$). Presurgical nasoalveolar molding therapy is a significantly helpful treatment for patients with unilateral cleft lip and palate. The reduction in the alveolar cleft region and the nasal reshaping are favorable.(37) This study was performed to observe the alveolar molding (AM) effect and growth of unilateral cleft lip and palate (UCLP) patients using 3-dimensional (3D) analysis. Alveolar molding took place mainly in AAS during PNAM treatment, and growth occurred mainly in PAS after cheiloplasty. (38)

CONCLUSION

Thus the evolution of infant orthopaedics pave ways for the development of the newer devices that aids in the treatment of cleft lip and palate



Items: 20

★ **Did you mean:** [\(\(\(\(\("cleft palate"\[MeSH Terms\]\) OR \(\("cleft lip" OR "cleft lip/alveolus" OR "cleft lip/and or cleft palate" OR "cleft lip/and or palate" OR "cleft lip/and palate" OR "cleft lip/cleft" OR "cleft lip/cleft lip" OR "cleft lip/cleft palate" OR "cleft lip/cleft palate child" OR "cleft lip/cleft palate patients" OR "cleft lip/palate" OR "cleft lip/palate care" OR "cleft lip/palate cases" OR "cleft lip/palate children" OR "cleft lip/palate deformities" OR "cleft lip/palate deformity" OR "cleft lip/palate infants" OR "cleft lip/palate patient" OR "cleft lip/palate patients" OR "cleft lip/palate" OR "cleft lip alveolus palate" OR "cleft lip and/or cleft palate" OR "cleft lip and/or cleft palate," OR "cleft lip and/or palate" OR "cleft lip and cleft palate" OR "cleft lip and or cleft palate" OR "cleft lip and or cleft palate," OR "cleft lip and or palate" OR "cleft lip and palate" OR "cleft lip and palate and" OR "cleft lip and palate and craniofacial" OR "cleft lip and palate and craniofacial centre" OR "cleft lip and palate management" OR "cleft lip and palate orthodontics" OR "cleft lip cleft palate" OR "cleft lip cleft palate child" OR "cleft lip cleft palate clip" OR "cleft lip cleft palate deformities" OR "cleft lip cleft palate patients" OR "cleft lip cleft palate problem"\)\)\)\) OR \(\("unilateral cleft lip and palate" OR "unilateral cleft lip and palate outcomes" OR "unilateral cleft lip and palate patients" OR "unilateral cleft lip and palate uclp" OR "unilateral cleft lip cleft palate" OR "unilateral cleft lip cleft palate patients" OR "unilateral cleft lip infants" OR "unilateral cleft lip palate" OR "unilateral cleft lip palate children" OR "unilateral cleft lip patient" OR "unilateral cleft lip, alveolus, and palate" OR "unilateral cleft lip, palate" OR "unilateral cleft of lip and palate" OR "unilateral cleft palate" OR "unilateral cleft palate infants" OR "unilateral cleft palate patients" OR "unilateral cleft palate subjects" OR "unilateral cleft palates" OR "unilateral cleft patients"\)\)\)\) OR \(\(\(\("bilateral cleft lip and palate" OR "bilateral cleft lip cleft palate" OR "bilateral cleft lip cleft palate patients" OR "bilateral cleft lip palate" OR "bilateral cleft lip palate patients" OR "bilateral cleft palate" OR "bilateral cleft palate patient" OR "bilateral cleft palate patients" OR "bilateral cleft patient" OR "bilateral cleft patients" OR "bilateral cleft subjects" OR "bilateral clefts"\)\)\)\) AND \(\(\(\("infant orthopaedics" OR "infant orthopedic appliances" OR "infant orthopedics"\)\) OR \(\("hotz appliance" OR "hotz orthopedic plate" OR "hotz s plate" OR "hotz type orthopedic plate"\)\) OR \(\("nasoalveolar molding" OR "nasoalveolar molding appliance" OR "nasoalveolar molding plate" OR "nasoalveolar molding technique" OR "nasoalveolar molding techniques" OR "nasoalveolar moulding" OR "nasoalveolar orthopedic molding"\)\) OR \(\("grayson nam device" OR "grayson nasoalveolar molding" OR "grayson technique"\)\) OR \(\("latham technique" OR "latham type" OR "latham's appliance"\)\)\)\) AND \(\(\(\("alveolar morphology" OR "alveolar morphometrics"\)\) OR \(\("alveolar width" OR "alveolar width measurements" OR "alveolar widths"\)\) OR alveolar **length**\) OR \(\("cleft gap" OR "cleft group" OR "cleft index" OR "cleft individuals" OR "cleft infants" OR "cleft length" OR "cleft lengths"\)\)\)\) \(37 items\)](#)

Fig 1- OUR KEY WORDS INCLUDED THESE CONCEPTS

References

1. Abyholm F, Bergland O, Semb G. Secondary bone grafting of alveolar clefts: a surgical orthodontic treatment enabling a nonprosthodontic rehabilitation
2. Comprehensive care of cleft lip and palate children at Ziirich University: A preliminary report. 1946(volume-70), American journal of orthodontics
3. Ellis H-Pierre Franco: master surgeon in the 16 th century, al.Br J Hosp Med (lond).2011

4. AN Williams, MRCP - Proper to the duty of a surgeon: Amboise and sixteenth century paediatric surgery - journal of Royal society of Medicine
5. Rahul Goyal, Lakshmi M.S - Presurgical Nasoalveolar moulding (PNAM): A quantum step in discovering little smiles Journal of Evolution of medical and dental science 2014; volume 3, Issue 50, October 06
6. Mulliken, J B. Correction of the bilateral cleft lip and nasal cleft (Cormit): Evolution of a surgical concept. J. 29: 540, 1992.
7. Bruror RO - The Tennison lip repair revisited. plastic Reconstr surg. 1983 May; 71(5): 633-42
8. Burston - A technique of the orientation of serial histological sections. J anat volume 300(450-465) 1957
9. Chugh A, Dahiya D, Thukral H, Verma S, Ahlawat A, et al. (2016) Different Designs of Feeding Aids for Cleft Palatal Defects. J Health Edu Res Dev 4: 180. J Health Edu Res Dev 4: 180.
10. Mahmoud F. El. bestar and Omar Monsour M.D - cleft lip and nasal deformity: A primary repair - Egypt. J. Plast Reconstruc. surg. vol. 28, No., January 15-21, 2004
11. Millard, D.R., jr. - Closure of bilateral cleft lip and elongation of columella by two operations in infancy. Plast. Reconstr. surg. 47; 324, 1971
12. Murthy PS, Deshmukh S, Bhagyalakshmi A, Srilatha K. Pre surgical nasoalveolar moulding: Changing paradigms in early cleft lip and palate rehabilitation. J Int Oral Health 2013; 5: 70-80
13. Cutting, Grayson - correction of Nasal cartilage C. Cleft Lip. In T Recs, Plast reconstr 867-76
14. Adriana, Goyal, sukshe et al, Three dimensional technology for recording cleft lip and palate with facial clefts - clinic of plastic surgery April 2004 volume 31, Issue 2, page 141-148
15. Y, Grayson B, Barillas I, Cutting C. Program and Abstracts of the 59th Annual Session of the American Cleft Palate-Craniofacial Association. Seattle: American Cleft Palate-Craniofacial Association; 2002. The Effect of Gingivoperiosteoplasty on the Outcome of Secondary Alveolar Bone Graft; p. 51.
16. Ajay, Baraja, sharma - Presurgical Nasoalveolar molding - A clinical study - Journal of maxillofacial and oral surgery >ausgabe 3/2011 volume - 653-75
17. Adam and Carman, - Presurgical Nasoalveolar moulding therapy for the treatment of bilateral cleft lip and palate - A preliminary study - Cleft lip and palate journal, May 2006, vol. 43 no. 3
18. Jet, Lang et al, - usage of dentures lining in infant orthopaedics - journal of Craniofac surgery - vol 4 143; 45
19. Abida firdose, nasan Heston bang, -, Nasoalveolar molding of bilateral cleft of the lip and palate infants with orthopaedic ring plate -, vol-2009(6)
20. Chitravelu siva Subramanian, Devisupriya, Nagalingam, -, A modified Presurgical orthopaedic device in the treatment of unilateral cleft lip and palate, Eur J Dent 2016 jul-sept; 103(3) 436-438,
21. Quang yu DDS, MDS, Xiang Gong DDS, MDS, Gou min wang, DDS, MDSPH. Ph.D, Zhe. Yuan, DDS, MDS, YU fen kiang DDS, MDS et al - A Novel technique for Presurgical Nasoalveolar moulding using the computer aided Reverse Engineering and Rapid prototyping (J Craniofac. surgery 2011; 22 142-146)
22. Janna Roven, Swapna puri, Shrikanth, Ganesh Pawar, Vivek Ramdas. - 3D captures of the results of Alveolar Morphology post-NAM journal of pedodontics vol-475-87
23. Mandve, et al., Presurgical Alveolar remodelling - An experience in the journey of cleft lip and palate, clinical cosmetical and investigational Dentistry - Journal of orthopaedics 2015-7; 8

24. Nikhil Nagaraj, Muralidhara Nagarguna, Anil Kumar, Narayan Gandhekar, Kulamdasami Gopala krishnan et al, - Double loop technique using Titanium molybdenum alloy wire for Fabrication of nasal stunts, The cleft- palate craniofacial journal 52(2) .246-249 March 2015
25. Chen Y-F, Liao Y-F, A Modified Nasoalveolar Molding Technique for Correction of Unilateral Cleft Nose Deformity, Journal of Cranio-Maxillofacial Surgery (2015), volume 298(67-76).
26. Bauer - Rapid Nam; generative manufacturing's approach of Nasoalveolar molding devices for Presurgical cleft lip and palate treatment. Journal of Biomed tech(Berl) .2017 Aug 28: 62(4) 407-414
27. Shafees Koya, Sandeep Shetty, Akhter Husain, and Mustafa Khader (2016) Presurgical Nasoalveolar Molding Therapy Using Figueroa's NAM Technique in Unilateral Cleft Lip and Palate Patients: A Preliminary Study. Journal of Clinical Pediatric Dentistry: 2016, Vol. 40, No. 5, pp. 410-416
28. Essen, Bekisz, Gibson, Cutting CB, Flores RL et al.- Preoperative Alveolar segment position as a predictor of successful in patient with cleft lip and palate, Plast recon surgery ,2017 dec.15., 10.1097 4321
29. Gong Zhao, Zheng J, YU Quo -, A digital assessment of the maxillary deformities correction in infant with bilateral cleft lip and palate using computer aided PNAM-J.craniofacial ,surg 2017 sept ;28(6)
30. Ruiz Esclong, Martinez, Fenrnandez, Cortes sandAz, Munoz, Velasco,- Nasoalveolar molding therapy for The treatment of unilateral cleft lip and improves nasal symmetry and maxillary dimensions. J Craniofac surgery ,2016, nov 27(8); 1976-1982
31. Atkgupe PR, Karina YM, Yagavai C, NAik, Deepak, Maganti, Krishna et. al, - Presurgical Nasoalveolar molding :A boon to facilitate the surgery of infants with cleft lip and palate, contemp- cli dent 2016 Oct-dec 7(4);569-573
32. Zhongua yu, Gong, yang, Shen, pan G, Chen R- Effects of the Presurgical Nasoalveolar moulding by computer aided technique-Zhongua kou Qiang ya cue Dec ;50(12) 710-4(Chinese article)
33. Park YW, Kwangju KJ, Kim MK,- double layered reconstruction of the nasal floor in a complete cleft deformity by using superfluous lip tissue, Maxillofac Plast reconstruction surg, 2015 oct 13;37(1) .ecollection 2015 dec.
34. Sasaki Togashi, S, karube R, Yangawa T, Nakane S, Tabuchi, Ishbani, shniya yagamata Adachi k et. al, - Presurgical Nasoalveolar moulding orthopaedic treatment improves the outcome of primary chelioplasty of unilateral complete cleft lip and palate by naris morphology, J. Craniofac surgery 2012; Nov 23(6)-1569-601
35. Li SN, YANG TT, Qui HL, Mi, YJ, Gong XM, - The changes of palate cleft gap of complete unilateral cleft Lip and palate before and after Presurgical orthopaedic and chelioplasty -Hua xi Kou Quiang Yi Xue za Zhi ,2011 jun 29(3);276-8(Chinese article)
36. Sabarinath VP, Thombare P, Hazarey PV, Radhakrishnan V, Agrekar S,-, changes In maxillary alveolar morphology with Nasoalveolar molding J. Clinic paediatric winter, 35(2) 207-12
37. Kecik D, Enacar A. - Effects of Nasoalveolar moulding therapy on nasal and alveolar morphology in unilateral cleft lip and palate- J Craniofac surg, 2009 nov ;20(6):2075-80
38. Baek SH, SOA WS – Difference in Alveolar moulding and growth in the cleft segments- 3-dimensional analysis of unilateral cleft lip and palate patients – oral surg oral med, oral pathoi, endod, 2006 Aug 102(2):160-8 ePub 2006 mar 30