PARADIGM OF CLEFT ORTHODONTICS

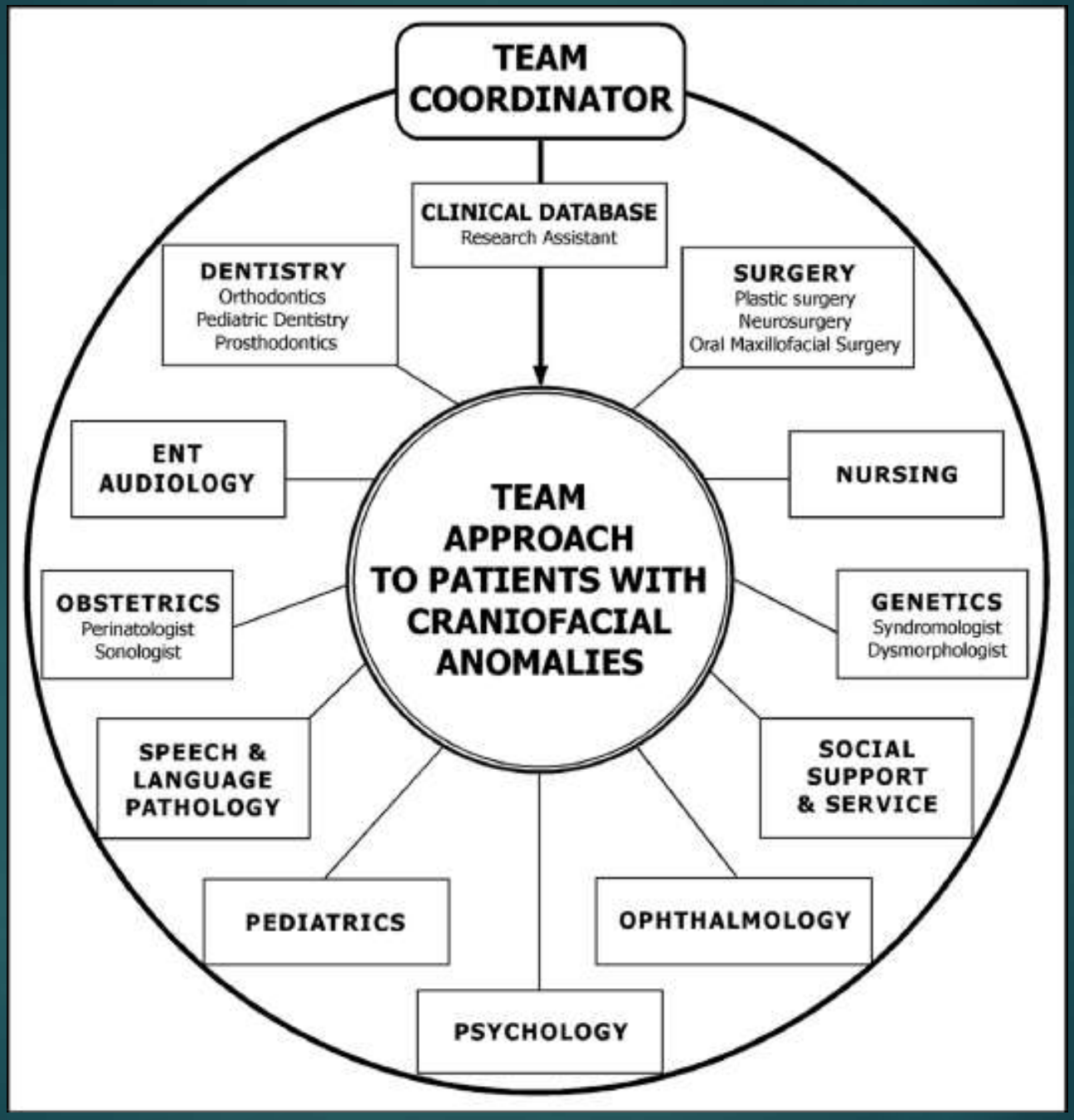
DR PUNEET BATRA

BDS, MDS, MORTH RCS (EDINBURGH), FFD ORTH RCS (IRELAND), DNB, PGDHM, PGDMLS, FPFA, FWFO, FACDE, FICD, MNAMS

PROFESSOR AND HEAD IN ORTHODONTICS

VICE PRINCIPAL

INSTITUTE OF DENTAL STUDIES AND TECHNOLOGIES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Norway: Oslo Protocol

GOLD STANDARD

- *The Oslo protocol*
  Pre-surgical orthopaedics have never been performed in Oslo.
- The surgical protocol was as follows:
  - patients with UCLP had lip closure (**Millard technique**) and hard palate closure using a single layer vomer flap at 3 months of age.
  - Patients with BCLP had lip (**straight line technique**) and hard palate closure with a single layer vomer flap done in two stages, one side was closed at 3 months and the other at about 4–6 weeks later.
  - The posterior palate was closed at 18 months using a modified **von Langenbeck technique**.
  - All patients have had alveolar bone grafting in the mixed dentition.
  - Secondary surgery was undertaken on an individual basis.

LESSONS FROM EUROCLEFT 1992

- Primary bone grafting not useful
- Pre-surgical orthopedics controversial
- Feeding plates not useful
- Primary surgery critical
- Balance between speech and growth needs to be struck

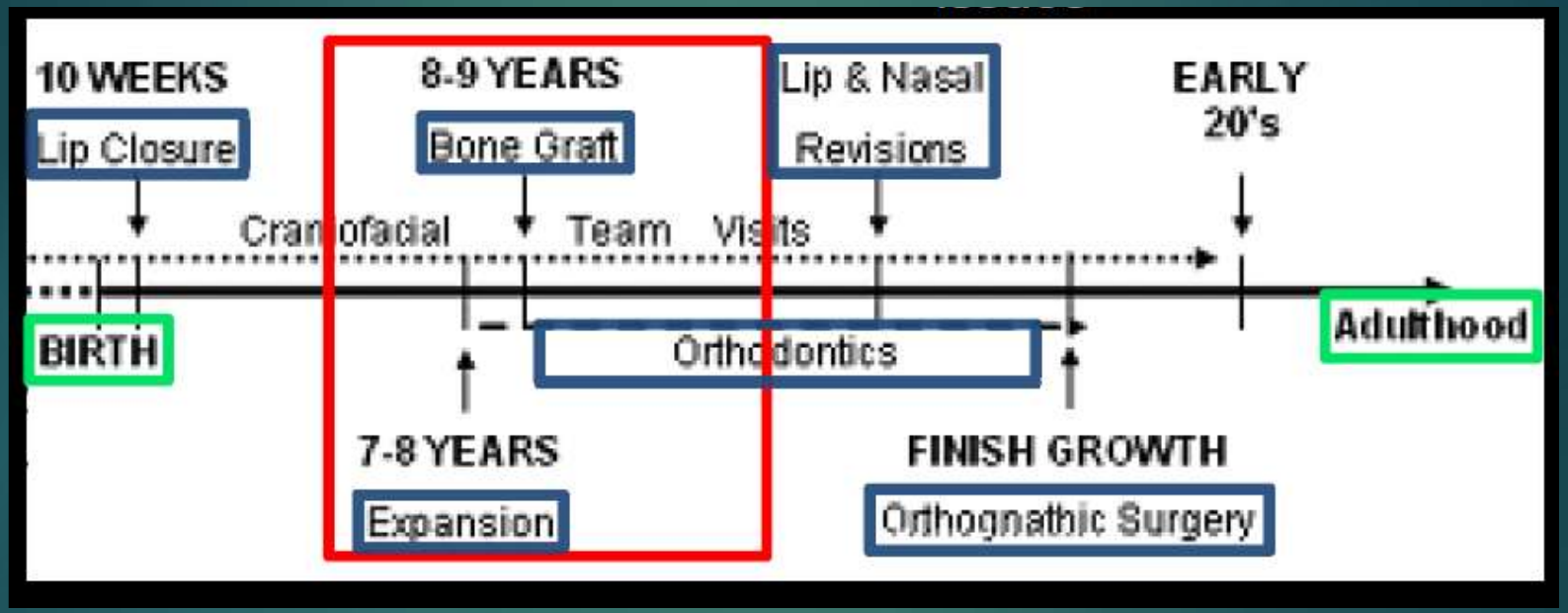
drpuneetbatra@gmil.com

GOOD PRIMARY SURGERY

- Eurocleft
- Eurocleft Project 1996-2000
- Eurocran
- Scandcleft
- AmeriCleft

drpuneetbatra@gmil.com

Cleft Orthodontics



drpuneetbatra@gmail.com

Q: Should Feeding plates be used to assist in early feeding???

Reid J. A review of feeding interventions for infants with cleft palate. CPCJ 2004;41(3):268-278

drpuneetbatra@gmil.com

Presurgical Infant Orthopaedics (PNAM)

drpuneetbatra@gmil.com

Q :Types of Appliances for NAM ?

Types	Name
1. Active	Lathan device, dynamic maxillary appliance (DMA)
2. Passive External strapping	McNeil and McNeil-type appliances; Grayson appliance and nasoalveolar molding (NAM)
Without external strapping	Zurich appliance

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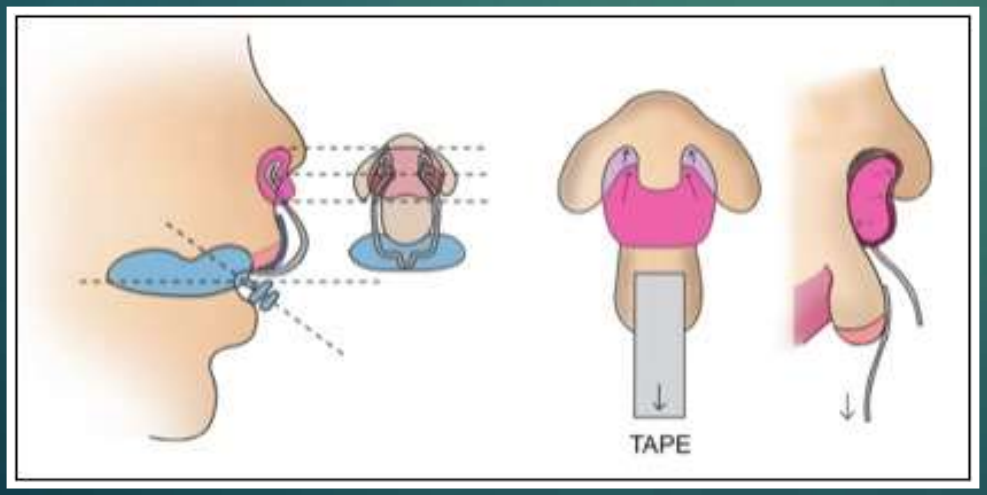
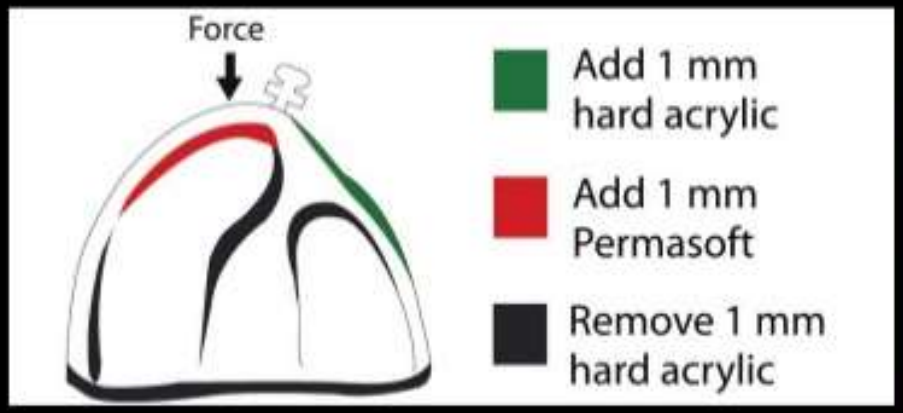
Grayson technique

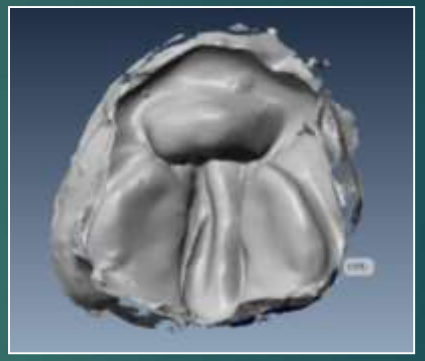


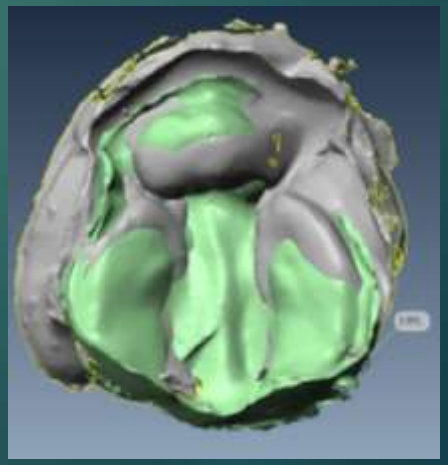
Appliance adjustments



- Diagrammatic representation of the subtractions and additions made to NAM device in unilateral cleft.

NASOALVEOLAR MOLDING BCLP





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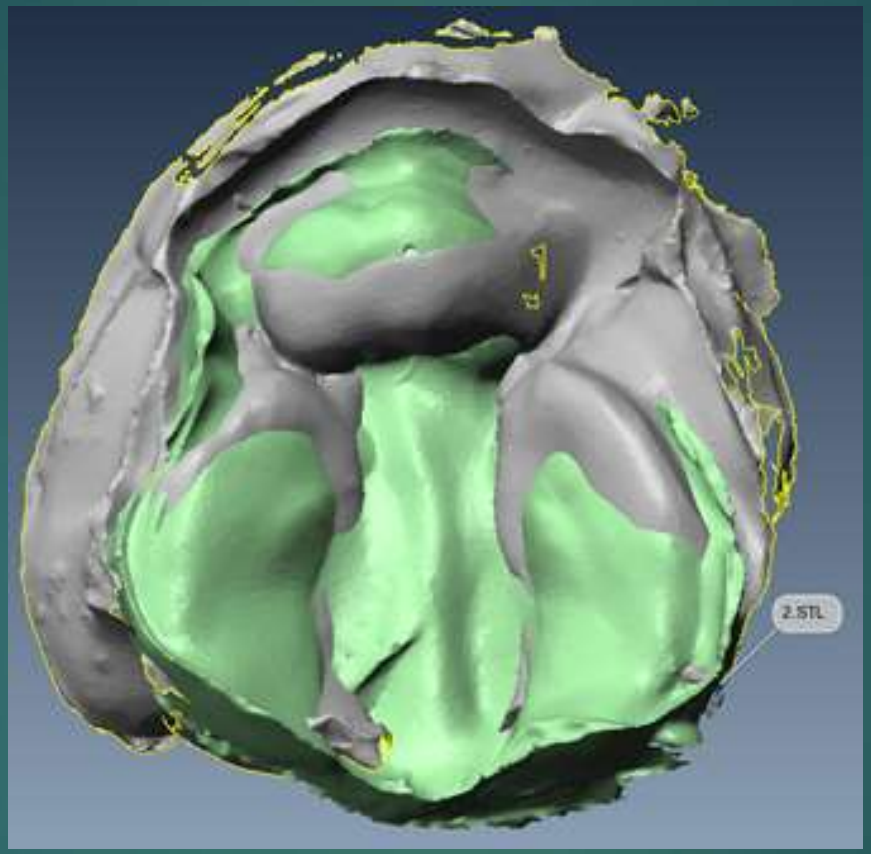
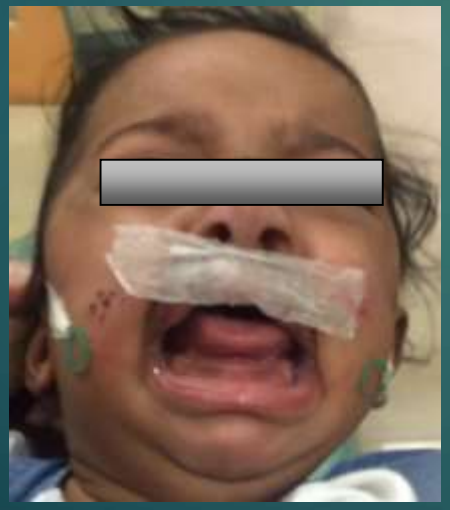
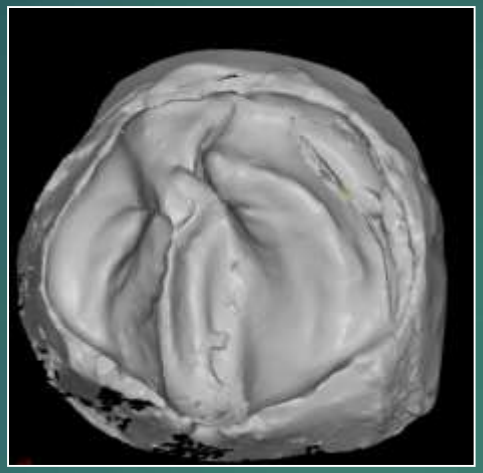
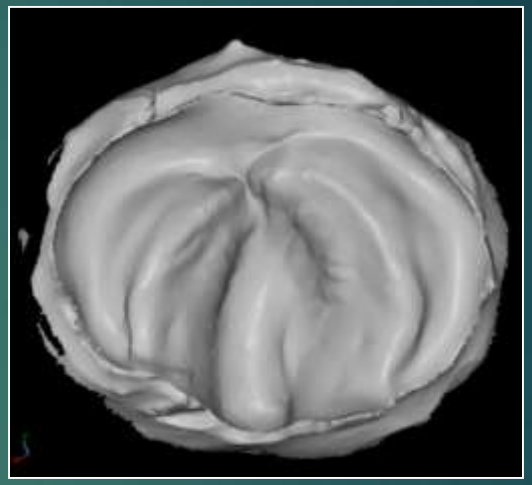

2.STL

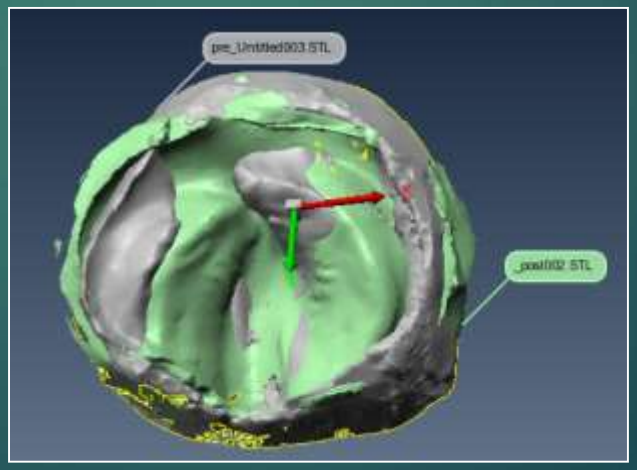
BCLP



NASOALVEOLAR MOLDING UCLP

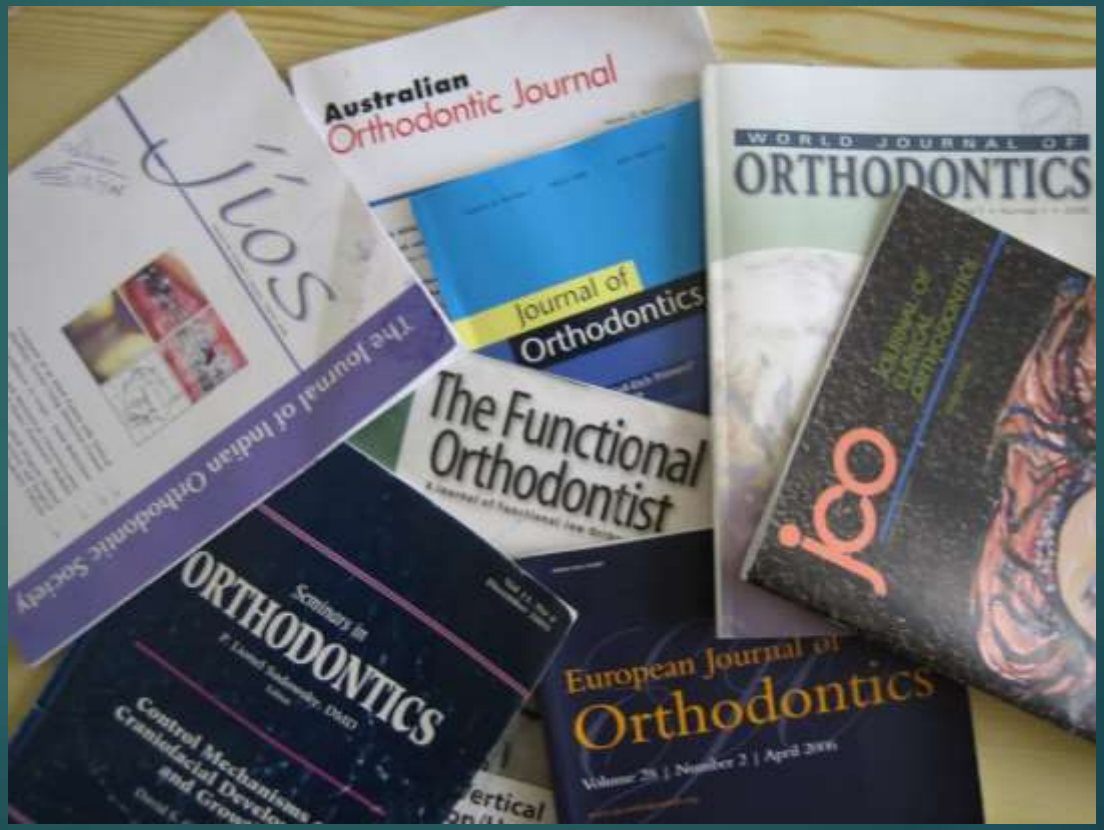






drpuneetbatra@gmil.com

Q: Is presurgical orthopedics useful???



drpuneetbatra@gmil.com

Current status of presurgical infant orthopaedic treatment for cleft lip and palate patients: A critical review

P. Priyanka Niranjane, R. H. Kamble, S. Pallavi Diagavane, S. Sunita Shrivastav, Puneet Batra1, S. D. Vasudevan, Pushkar Patil2

Indian Journal of Plastic Surgery 2014 Vol 47 Issue 3: 293-302

Q: Will a nasal elevator only suffice???

DYNA CLEFT…. Cleft Palate Craniofac J. 2013 Sep;50(5):548-54

drpuneetbatra@gmil.com

Q : Is molding required every week?

Batra P et al. Ind J Cleft Lip Palate & Craniofac Anomal 2015

- PNAM therapy effects (Grayson and Yen Modification single step NAM technique).
- Same treatment outcome in term of alveolar molding, but single step technique reduces patient's visits.

Journal of Cleft Lip Palate and Craniofacial Anomalies

drpuneetbatra@gmil.com

ALIGNER NAM


13th Week


14th Week


11th Week


15th Week Post
Treatment

POST-TREATMENT

POST-TREATMENT

Treatment from early mixed dentition to eruption of permanent teeth

Assessment of growth

Q: How can we assess facial growth and results ???

drpuneetbatra@gmil.com

GOSLON Yardstick

(Mars et al. 1987).

The GOSLON Yardstick rates the UCLP dental study models into 5 Groups .

- Group 1 (excellent growth)
- Group 2 (good growth) requiring simple or no orthodontic treatment.
- Group 3 (adequate growth) requiring complex orthodontic treatment to correct the malocclusion.
- Group 4 (poor growth)
- Group 5 (very poor growth) requiring orthognathic surgery

drpuneetbatra@gmil.com

Group 1

Group 2

Group 3

Group 4

Group 5

GOSLON

11/08/2017
drpuneetbatra@gmil.com
drpuneetbatra@gmil.com

BAURU YARDSTICK for assessing Bilateral results

a. Score 1 & 2

b. Score 2

c. Score 3

d. Score 4

e. Score 5

drpuneetbatra@gmil.com

Treatment from early mixed dentition to eruption of permanent teeth

Bone graft preparation

Q:How to orthodontically prepare the arch for ABG?

- Timing of treatment closely related to timing of planned bone graft.. either before lateral incisor erupts, or before canine erupts. When root of tooth is 1/3 to ½ developed.

- Orthodontic treatment involves expansion to develop favourable arch form, alignment ..care not to move roots into cleft defect..

drpuneetbatra@gmil.com

Collapsed arches

Expansion

Batra P, Duggal R, Parkash H. Efficacy of Nitinol Expanders in cleft and non-cleft patients. J Ind Orthod Soc 2003;36:130-4.

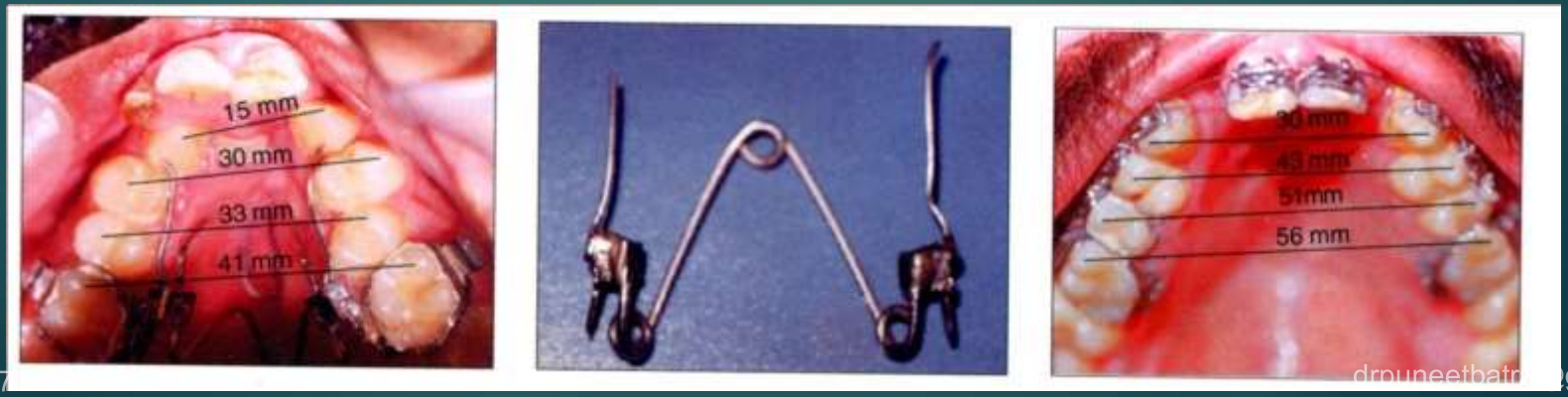
drpuneetbatra@gmil.com

NiTi Palatal Expander




Quadhelix


Modified expander



drpuneetbatra@gmil.com

Q: What are the objectives of ABG ???

Objectives	*Reference*
The provision of bone in the cleft through which teeth can erupt or be moved orthodontically	Amanat and Langdon, 1991
Stabilization of the maxillary arch, particularly in bilateral clefts	Boyne and Sands, 1972
Obliteration of oronasal fistulae	Abyholm et al., 1981
The provision of bone support to the alar base of the nose and therefore improved nasal symmetry	Kokkinos et al., 1997
It allows the placement of implants and thus reduces the necessity for other prostheses	Vurdi et al., 1991

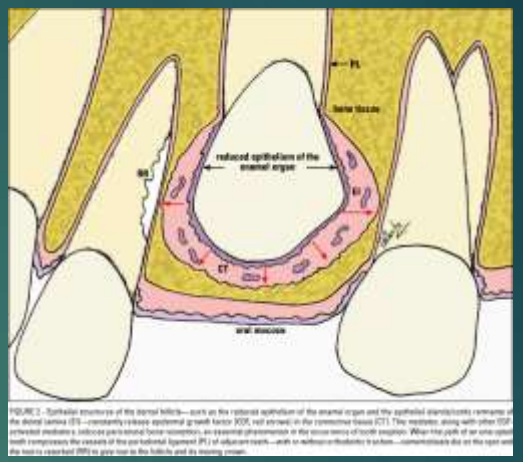
drpuneetbatra@gmil.com

Preoperative Cleft Defect

Postoperative Bone Graft

drpuneetbatra@gmil.com

drpuneetbatra@gmil.com



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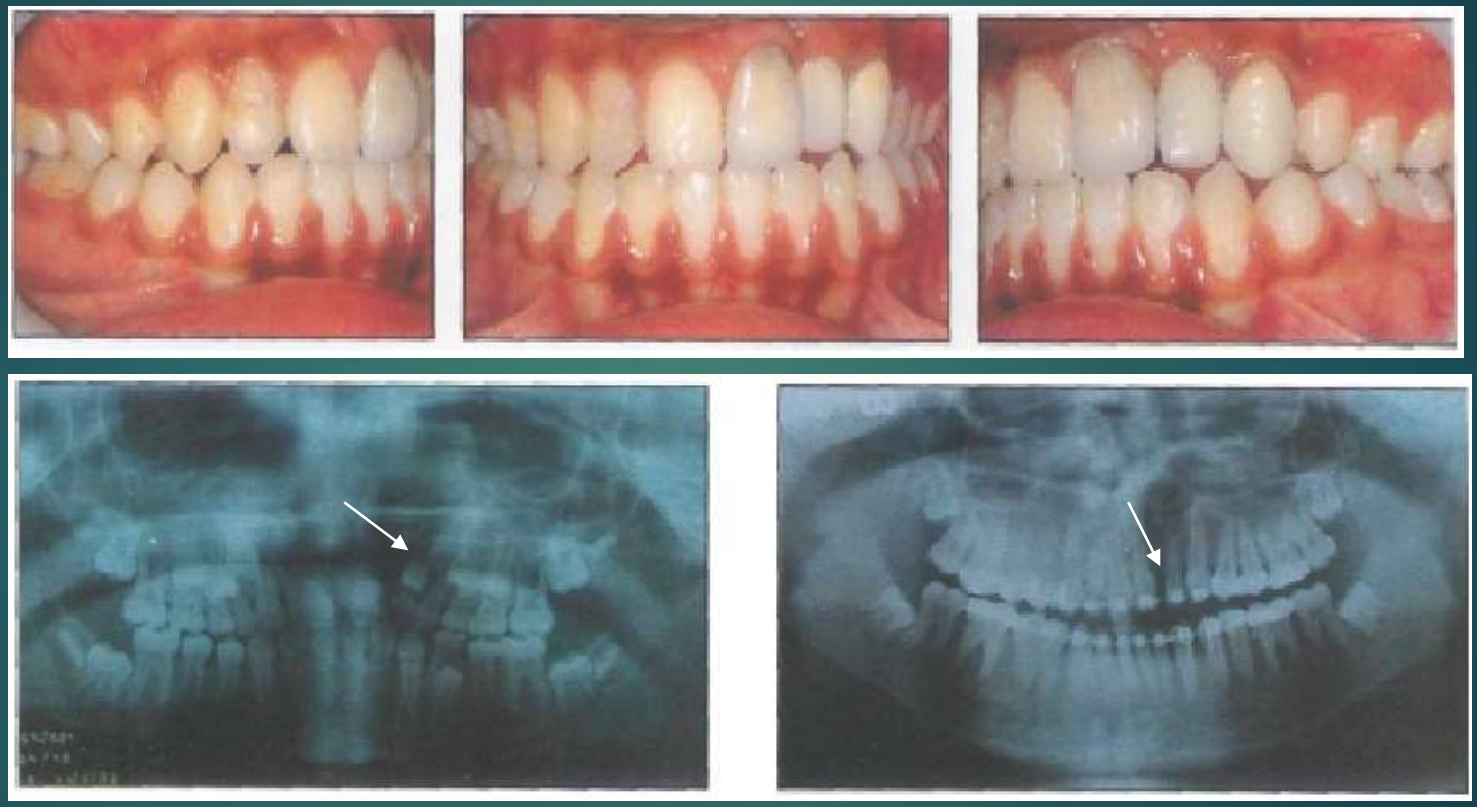
Batra P, Duggal R, Parkash H. Secondary bone grafting in a patient with cleft lip and palate and eruption of tooth through the graft. J Ind Soc Pedo Prev Dent 2004;22(1):8-12.

drpuneetbatra@gmil.com

Successful bone graft



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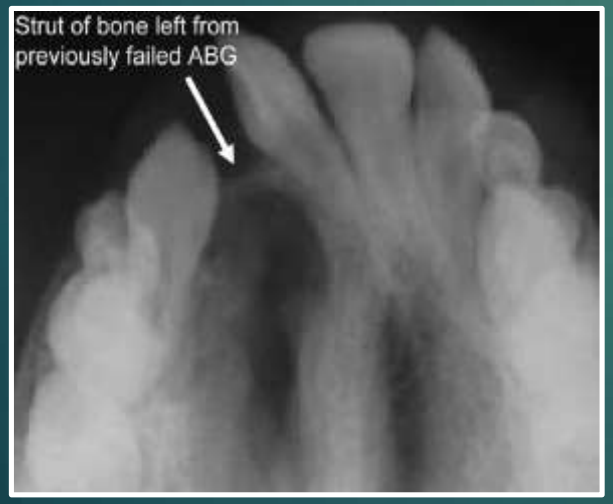
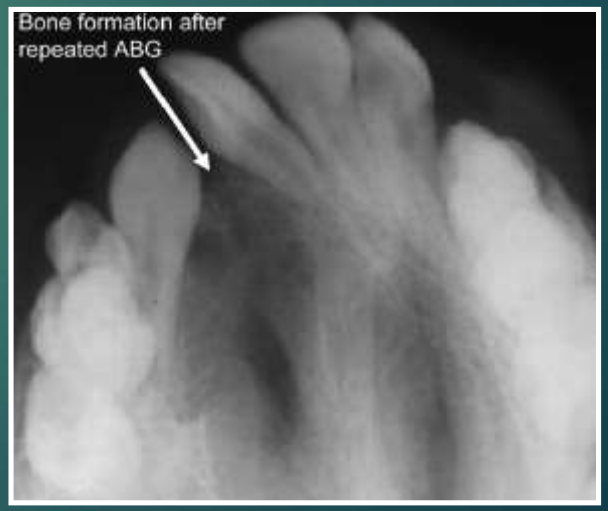
Q: How to evaluate alveolar bone graft success ??





drpuneetbatra@gmil.com

Scales used to evaluate bone graft:

1. Bergland Scale
2. Kindelan Scale
3. Chelsea Scale
4. SWAG (A Standardized Way of Assessing Grafts)
5. CBCT evaluation

drpuneetbatra@gmil.com

Elimination of the Residual Alveolar Cleft by Secondary Bone Grafting and Subsequent Orthodontic Treatment

OLAV BERGLAND, PROFESSOR, DR. ODONT.
GUNVOR SEMB, D.D.S.
FRANK E. ÅBYHOLM, M.D., D.D.S., PROFESSOR, DR. MED.

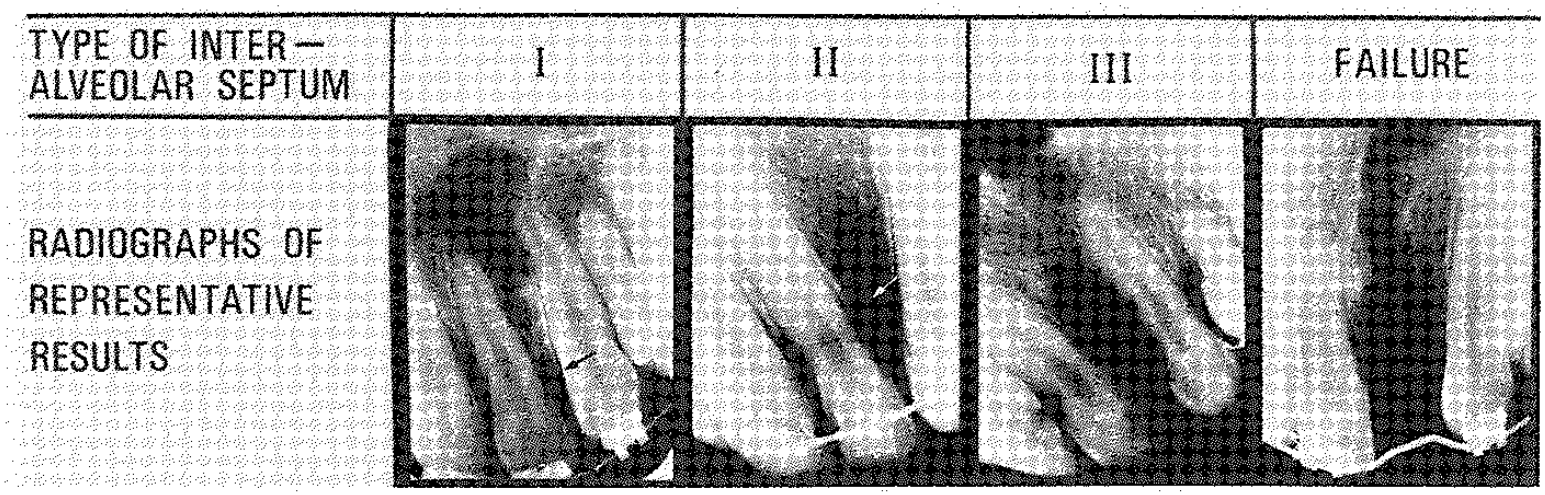


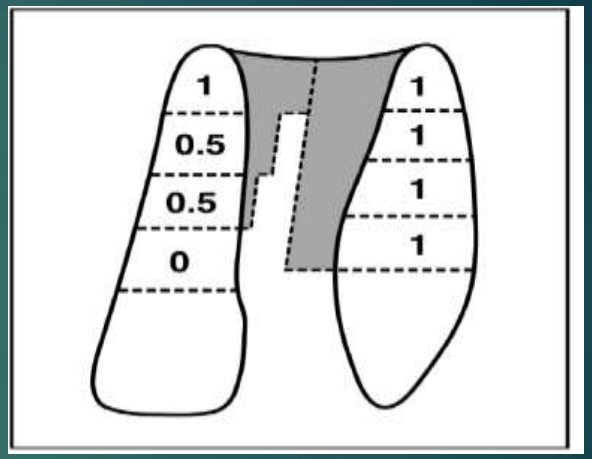
FIGURE 6 The basis for the semiquantitative evaluation of the height of the interalveolar septum achieved: Type I: height approximately normal, Type II: height at least ¾ of normal height, Type III: height less than ¾ of normal height, Failure: no continuous bony bridge across the cleft achieved.

Cleft Palate Journal, July 1986, Vol. 23 No. 3

drpuneetbatra@gmil.com

A New Scale to Assess Radiographic Success of Secondary Alveolar Bone Grafts

H. WITHEROW, S. COX, E. JONES, R. CARR, N. WATERHOUSE

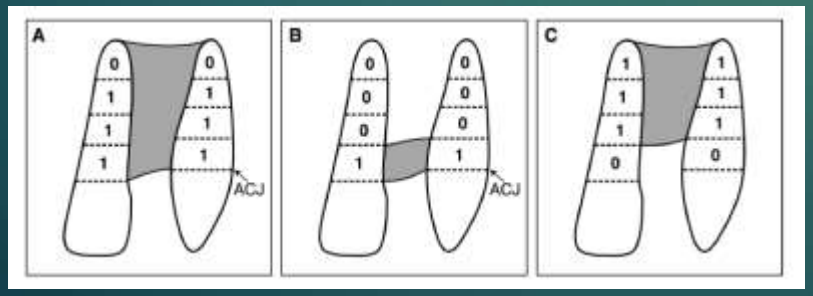


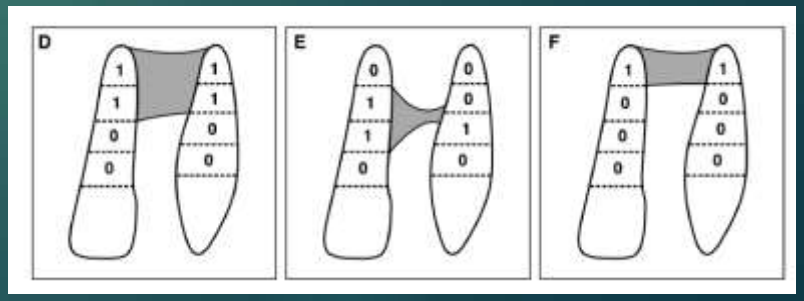
Stage 1

In the first stage the observer divides the cleft vertically and also divides the roots of the adjacent teeth into fourths.

Stage 2

The second stage involves assigning a letter grade to the cleft, from A to F, that reflects the position of the bone.





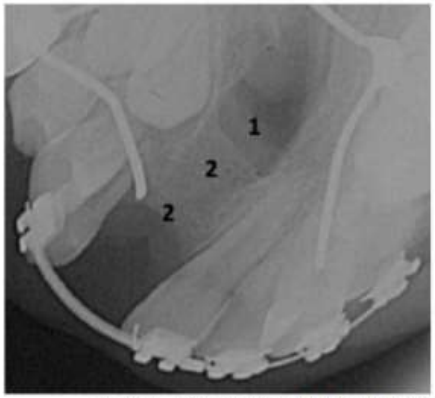
drpuneetbatra@gmil.com

SWAG SCALE

- Americleft Project : **"A Standardized Way of Assessing Grafts"** (SWAG)

Table 2. Americleft SWAG Scale Scores (Russell et al., 2011)

Score	Description
0	No bone bridge. Permanent tooth roots or crown exposed in cleft margin.
1	No bone bridge. No permanent tooth roots or crown exposed.
2	Bone bridge present in one of the cleft thirds (avg. 1/3 entire cleft site filled but less than ½); permanent tooth root or crown exposed in both other unbridged thirds
3	Bone bridge present: avg 1/3 cleft site filled but less than ½; permanent tooth root or crown exposure in one of the remaining unbridged thirds; no permanent tooth root or crown exposure in the other unbridged third.
4	Bone bridge present: avg. 1/3 cleft site filled but less than ½; no permanent tooth root or crown exposure in the other unbridged thirds OR Bone bridge present in two of the cleft thirds: avg. 2/3 cleft site filled (more than ½ filled); permanent tooth root of crown exposure in the other unbridged third
5	Bone bridge present in two of the cleft thirds: avg 2/3 cleft site filled (more than ½ filled); no permanent tooth root or crown exposure in the remaining unbridged third
6	Complete bone fill-in: definitely more than 2/3 cleft site filled, including up to and beyond actual or projected root apices.



Apical 1/3	1
Middle 1/3	2
Coronal 1/3	2
Total Score	**5**

Figure 1. Example of SWAG Scale Method with Scoring

drpuneetbatra@gmil.com

CBCT Evaluation

- The amount of bone density and extent of periodontal attachment can impact the overall success of the graft and are impossible to assess on radiographs

- **Feichtinger M et al** CPCJ 2007: bone resorption in the transversal dimension is clearly underestimated with conventional two-dimensional radiographs.

- **Hamada Y et al 2005:** The Dental 3D-CT images clearly showed precise three-dimensional (3D) morphology of the bone bridge, 3D relationships between the bone bridge and the roots of cleft-adjacent teeth, and their periodontal condition

drpuneetbatra@gmil.com

Impacted Canine

drpuneetbatra@gmil.com

Treatment from early mixed dentition to eruption of permanent teeth

Maxillary Protraction

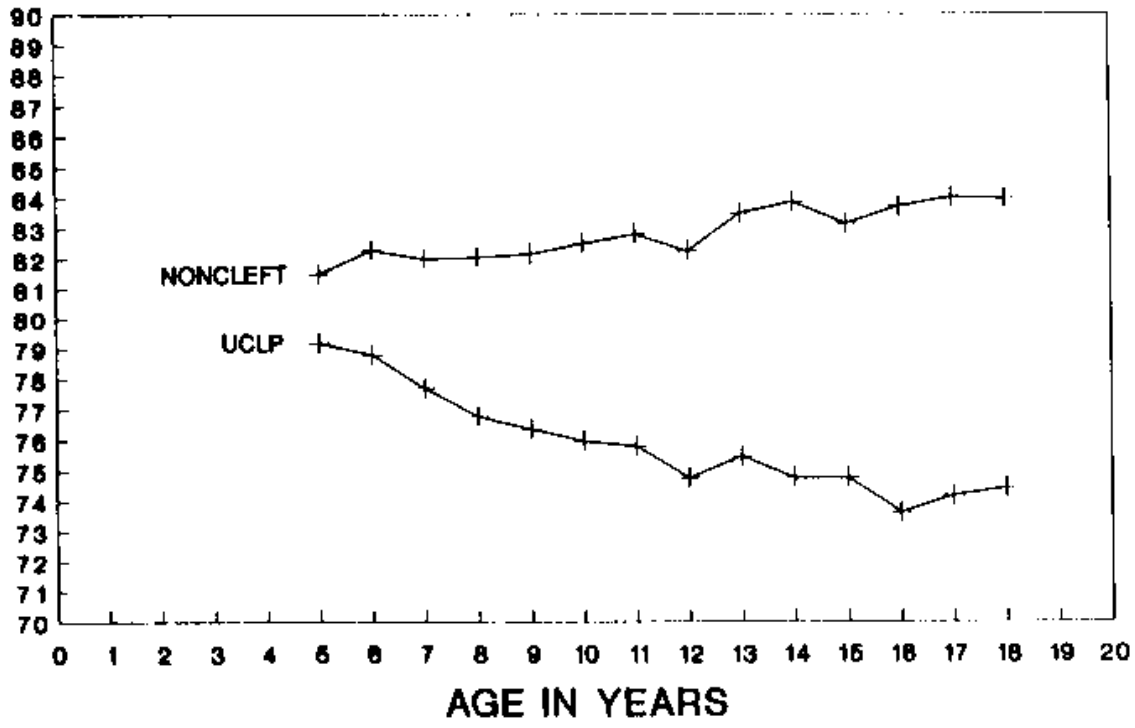


FIGURE 1 Maxillary prominence (s-n-ss). UCLP compared to noncleft subjects. (From Semb, 1991.)

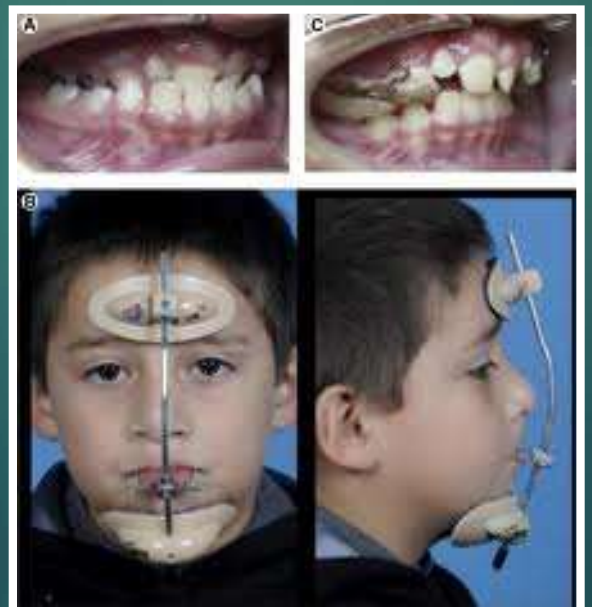
Maxillary retrusion becomes more apparent with time. Differences in growth potential between a center whose surgery is relatively atraumatic will be readily detected as age increases

Q : Is maxillary protraction required in all cases ??

Maxillary Protraction: Different Effects on Facial Morphology in Unilateral and Bilateral Cleft Lip and Palate Patients

ROLF S. TINDLUND, D.D.S.
PER RYGH, D.D.S., DR. ODONT.

Cleft Palate–Craniofacial Journal, March 1993, Vol. 30 No. 2



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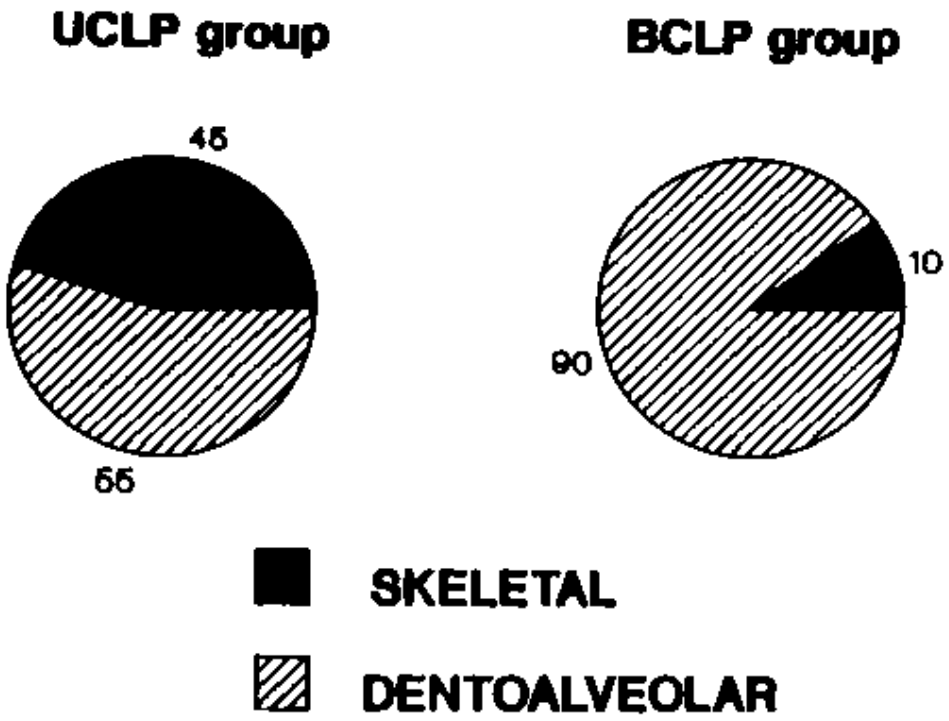

FIGURE 7 Diagrammatic presentation of the maxillary skeletal (black sector) and dentoalveolar (striped sector) effects achieved by protraction treatment. *A*, in the UCLP group and *B*, in the BCLP group.

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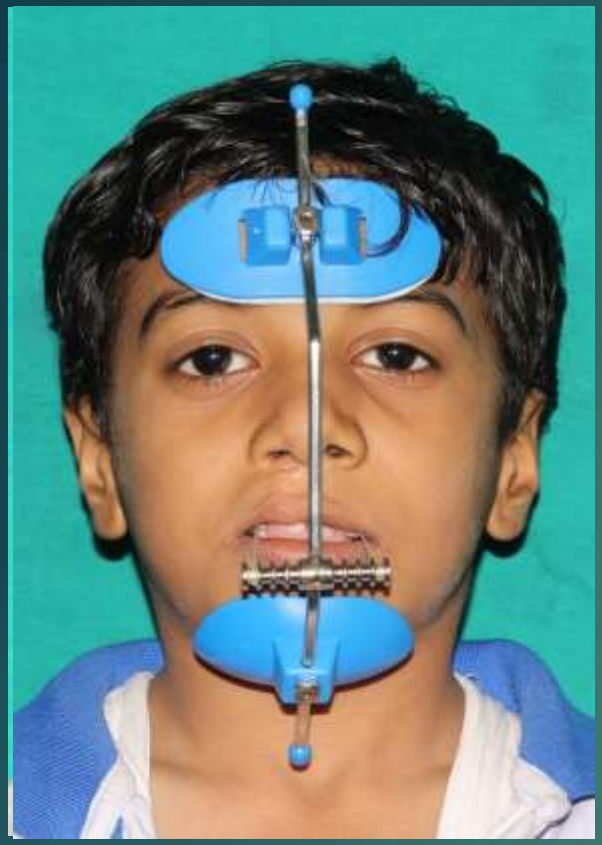
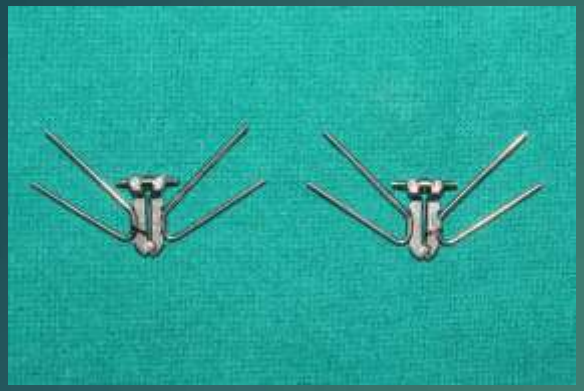
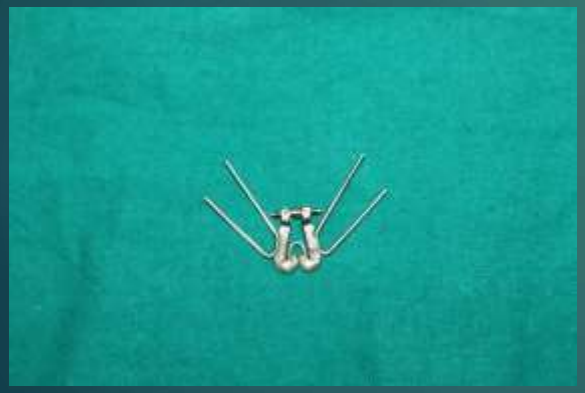
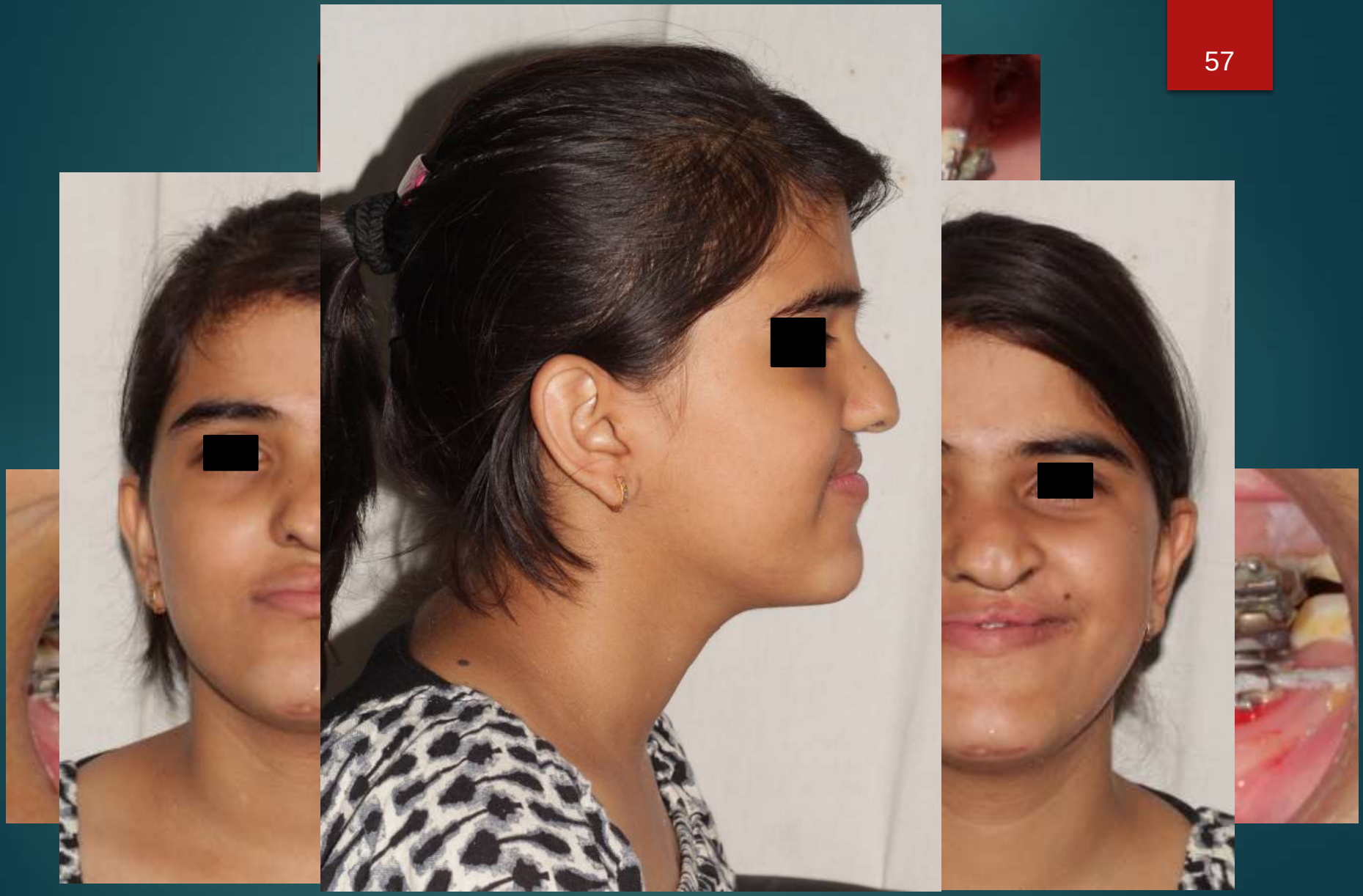
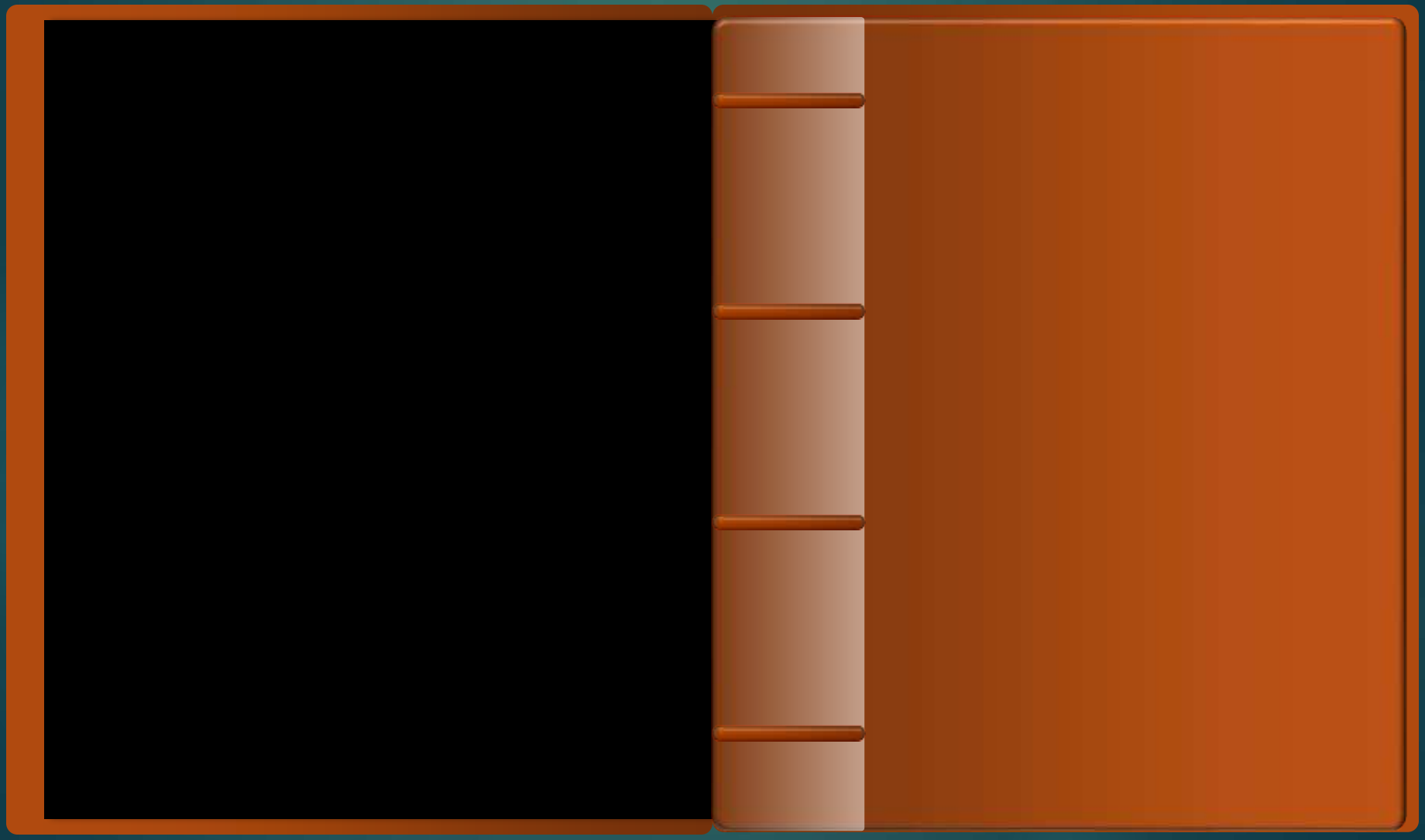


MODIFIED MEAZZINI APPLIANCE FOR ALT-RAMEC









MULTIPLE SUPERNUMERARIES

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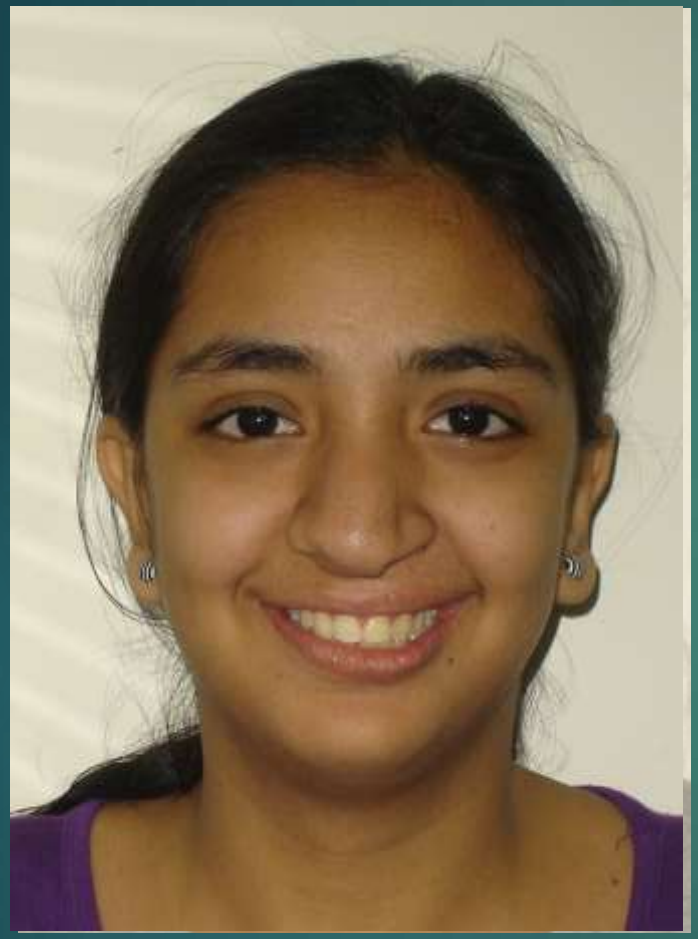
ATYPICAL EXTRACTION

drpuneetbatra@gmil.com



Q: The dilemma of tooth movement in grafted bone ?

1) SPACE CLOSURE
2) SPACE MAINTENANCE
   - Adhesive Bridge
   - Auto transplantation
   - Implant

drpuneetbatra@gmil.com

Space Closure

Table 1. Review of studies that have evaluated the impact of alveolar bone grafting on orthodontic space closure across a grafted site

Primary Author	Participants & Assessment	Comment
Turvey 1984[19]	- 24 randomly selected cleft patients post BG. (15 UCLP, 9 BCLP) mean age for BG 11.7 years (y) - clinical evaluation	- 12 of 24 (50%) had orthodontic space closure
Bergland 1986[5]	- 41 BCLP, 82 BG sites, grafting age range 8-17y	- 41 of 43 (95%) closed if BG before canine eruption
Bergland 1986[6]		
Enermark 1987[13]		
Dempf 2002[21]		
Schultze-Mosgau 2003[22]	(mean age 8-11y) - 59 BG before canine eruption	- orthodontic space closure in 55 of 68 grafts (78%) - less bone resorbtion with gap closure
Oosterkamp 2010[23]	- 27 BCLP's with 1 missing lateral - assess aesthetics, mandibular function. Clinical assessment	- 17/27 (63%) with closure - no difference for aesthetics - space closure group scored better for function
Seike 2012[24]	- 41 patients with 49 BG's	- 26 of 49 (53%) achieved orthodontic space closure

Success rates for total space closure in some studies have been as high as 90% and more and in most others vary between 50-75% success.

This may require challenging orthodontic mechanics in cases where the patients has a Class III skeletal growth tendency and an attempt is made to maintain the upper dental centre line.

drpuneetbatra@gmil.com











drpuneetbatra@gmil.com

Space Maintainance

1) Adhesive Bridgework

- Modern restorative techniques have advanced significantly from the era of the fixed-fixed prosthesis requiring significant tooth reduction. Reduced caries rates in the cleft population and modern adhesive techniques have resulted in resin retained bridgework being the first choice for restoration in the adolescent.
- Despite multiple searches there appeared to be no studies suggesting the long term success of this type of bridgework compared to the non-cleft population.

drpuneetbatra@gmil.com

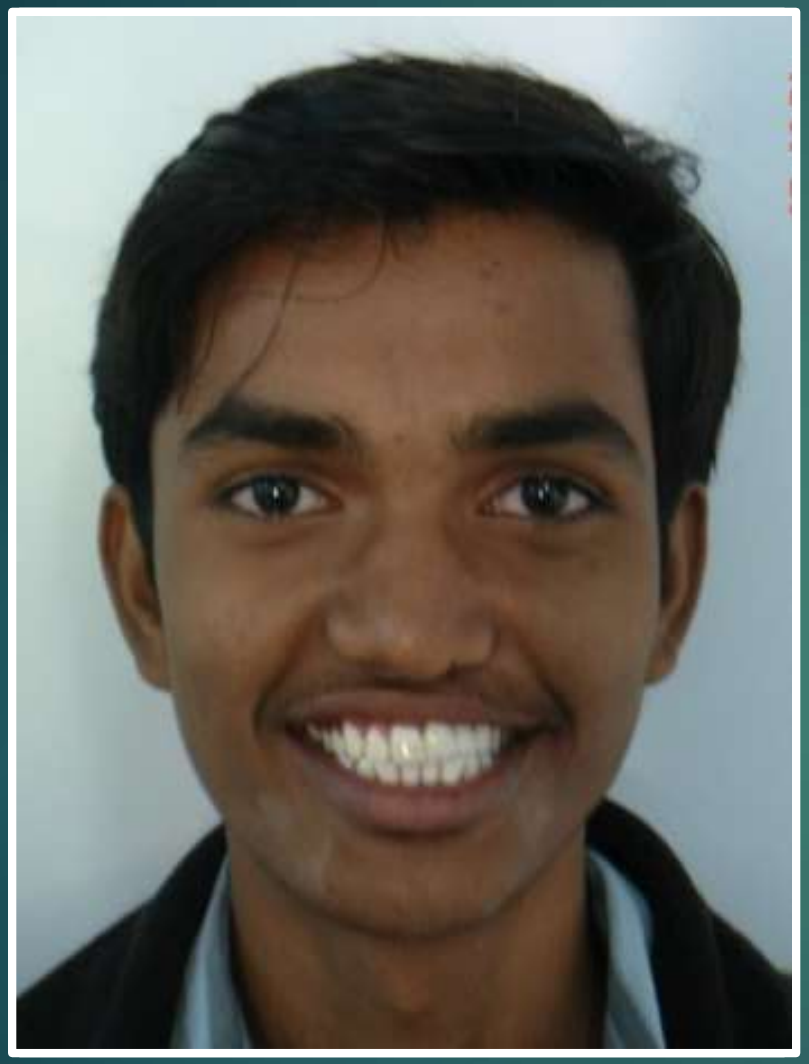









drpuneetbatra@gmil.com



2) Tooth auto-transplantation

Table 2. Review of studies looking at success of transplanting teeth into sites that recieved an alveolar bone graft

Primary Author	Participants/teeth	Comment
Hillerup 1987[26]	- 4 patients with UCLP - 4-20 months (mo) post-graft - observation time 1-4 years (y)	- all successful with signs clinical and radiological healing
Hamamoto 1998[27]	- 2 patients, 1 CLA & 1 UCLP - and histological specimens from BG site	- graft is still undergoing remodelling at 6mo & better to perform the transplant at this stage - the teeth can be moved orthodontically 3mo post-transplant
Czochrowska 2002[28]	- 5 consecutive pts. with two incisors on the cleft side missing - three had previously been BG - transplant age range 10-13y 4-26mo post graft	- 100% survival - gingival index and pocket depth as control teeth
De Muynck 2004[29]	- 1 pati	
Tanimoto 2010[30]	- 2 pati - pt. 1, - pt. 2,	
Aizenbud 2013[31]	- 4 patients transplanted with maxillary second premolars	- 12-48mo follow up - orthodontic movement after 6mo

The most common tooth for transplantation is the lower premolar.

Operator technique-sensitive, but if successful the functional tooth will maintain the bone.

drpuneetbatra@gmil.com

Tooth auto-transplantation- when… ???

- The optimum time for auto-transplantation appears to be 6- 12 months post-secondary alveolar graft when the graft is still remodeling.
- If the auto-transplant is done at the same time as the alveolar graft, this has been shown to lead to increased resorbtion in simulated alveolar clefts.
- Orthodontic movement can commence usually after 3 months and is likely to be completed uneventfully..

drpuneetbatra@gmil.com

3) Implants

- Recent studies suggest that the long-term success of these implants is good and the implant acts as a functional stimulus to maintain the bone but a significant number of the implants required further grafting (tertiary).






drpuneetbatra@gmil.com

Implant

drpuneetbatra@gmil.com

Orthodontics in Permanent Dentition after growth cessation

Q: How presurgical orthodontic treatment is different?

- In CLP patients, the upper incisors are uprighted, and labial tipping is required instead.
- The lower incisors of CLP patients need to be flared labially as is the case in typical skeletal Class III patients to release the dental compensation.

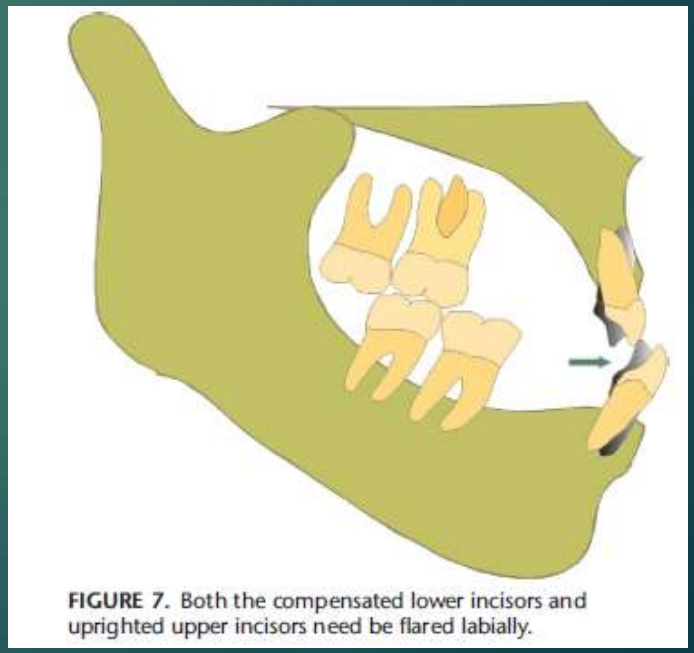
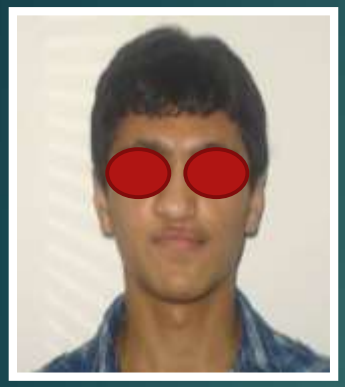


FIGURE 7. Both the compensated lower incisors and uprighted upper incisors need be flared labially.

drpuneetbatra@gmil.com

ORTHOGNATHIC SURGERY











drpuneetbatra@gmil.com

Continuous maxilla good for orthognathic procedure or distraction





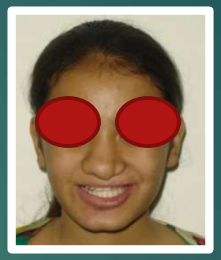




drpuneetbatra@gmil.com

Segmental Osteotomy







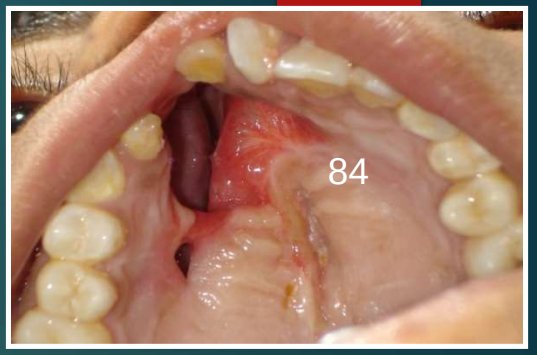







drpuneetbatra@gmil.com

UCLP Indigenously designed distractor



drpuneetbatra@gmil.com

BCLP Bilateral Distraction Expansion screw from Leone

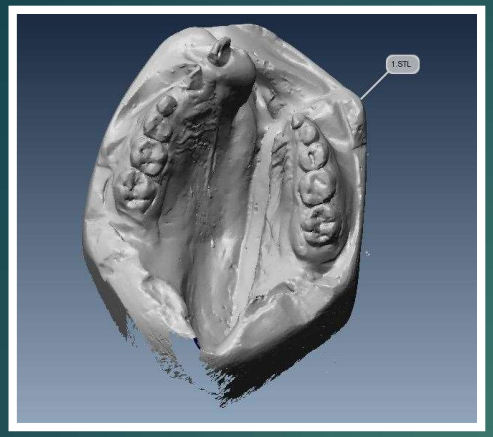
drpuneetbatra@gmil.com

ANTERIOR MAXILLARY DISTRACTION

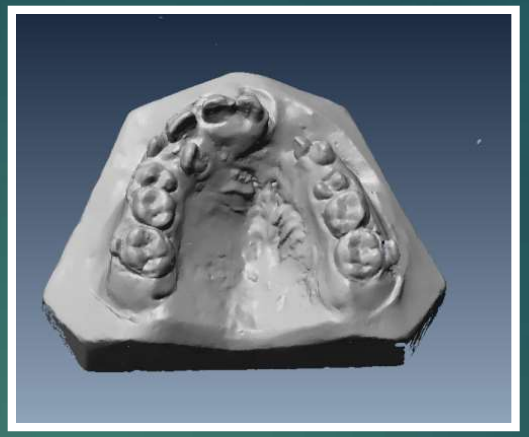
ALL IN ONE

drpuneetbatra@gmil.com

drpuneetbatra@gmil.com



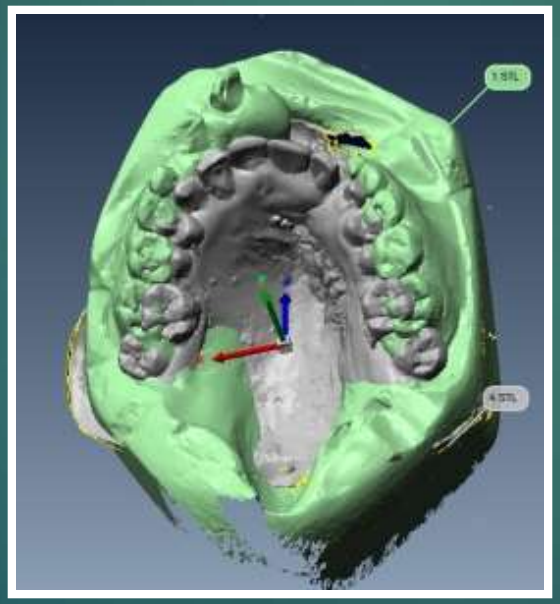
Pre treatment

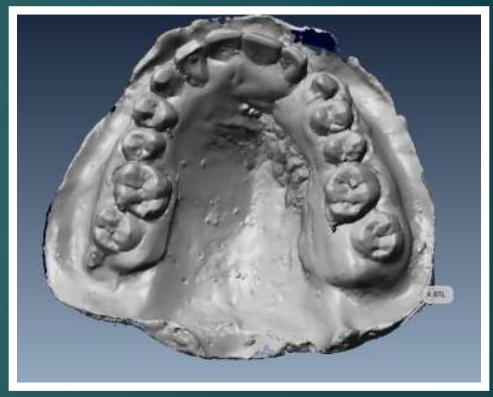


After lip Repair

Pre distraction

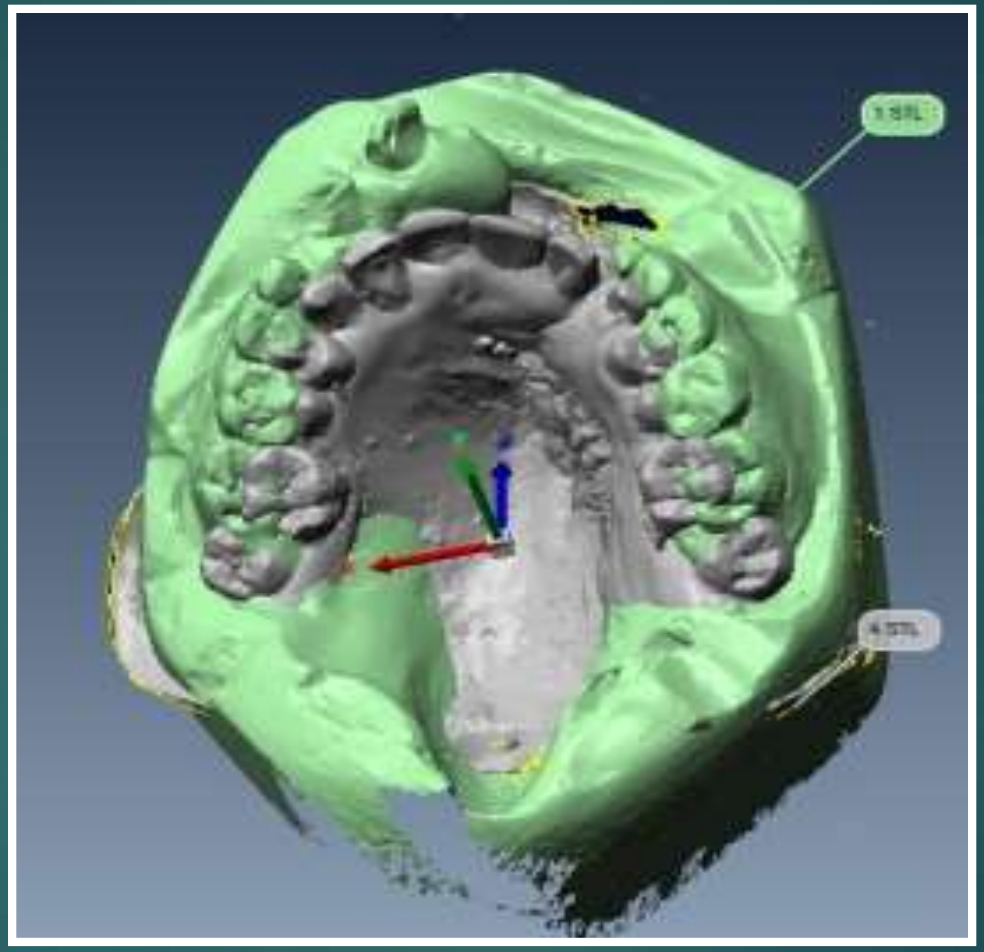
UCLP INDIGENOUSLY DESIGNED DISTRACTOR





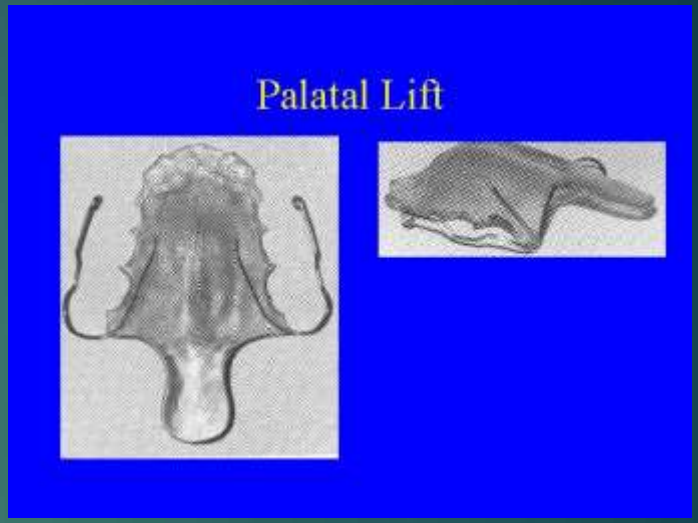
Post distraction

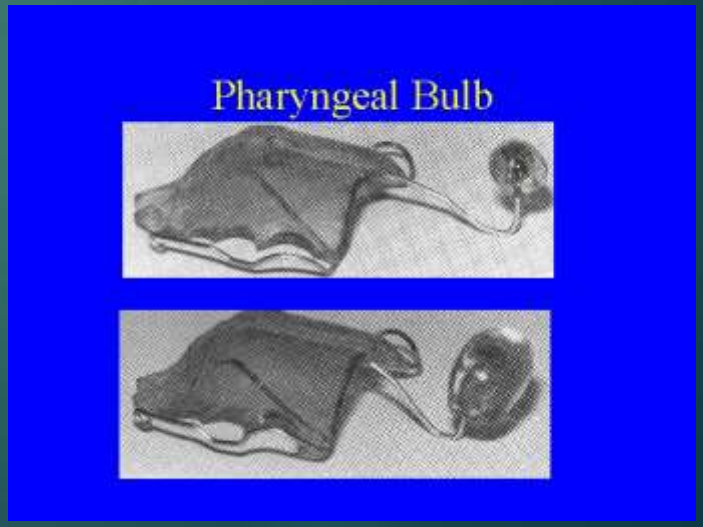
drpuneetbatra@gmail.com
drpuneetbatra@gmil.com



Speech

- Nasal endoscopy
- Lateral video fluoroscopy
- Speech assessment
  - Palate re-repair versus Pharyngoplasty





OVERDENTURES


a. Case 1: Frontal facial view with overdentur


Figure 6b. Case 1: Intraoral view with overdenture in situ (mirror image of left side).

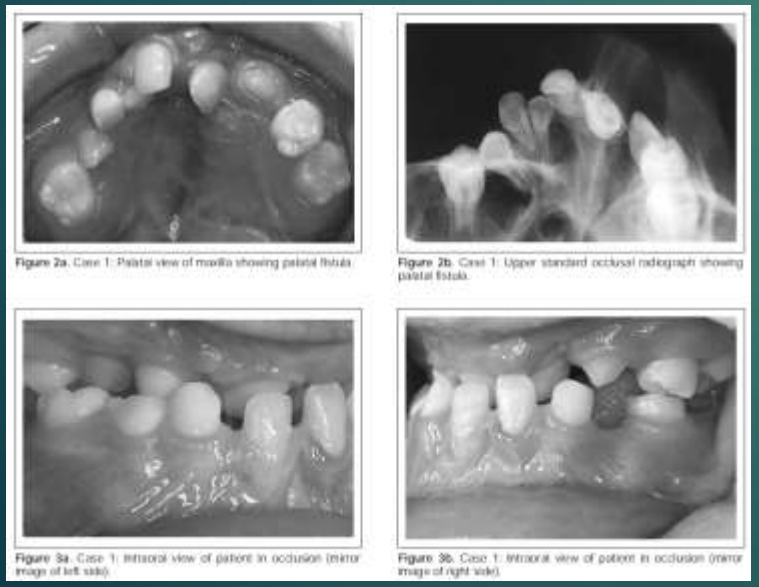


Figure 2a. Case 1: Palatal view of maxilla showing palatal fistula.

Figure 2b. Case 1: Upper standard occlusal radiograph showing palatal fistula.

Figure 3a. Case 1: Intraoral view of patient in occlusion (mirror image of left side).

Figure 3b. Case 1: Intraoral view of patient in occlusion (mirror image of right side).

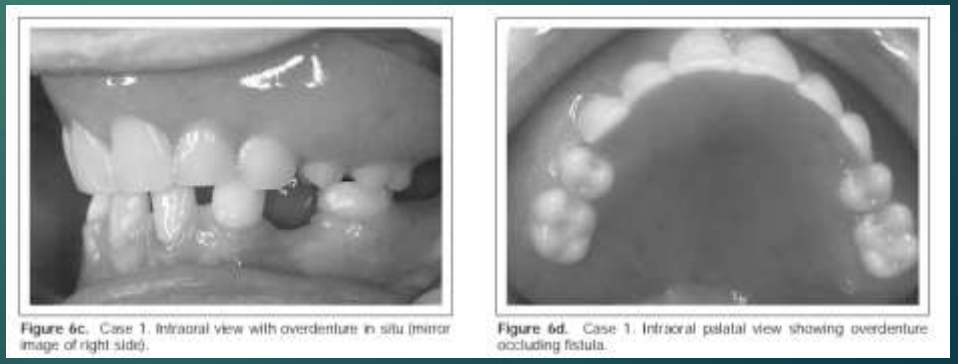


Figure 6c. Case 1: Intraoral view with overdenture in situ (mirror image of right side).

Figure 6d. Case 1: Intraoral palatal view showing overdenture occluding fistula.

In Summary

- Oro facial clefts require a interdisciplinary approach
- Treatment extends over many years and risks exhausting patient cooperation
- Need to keep the patients best interests in mind.

drpuneetbatra@gmil.com

Thank You

drpuneetbatra@gmil.com