SPACE MAINTAINERS

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LEARNING OBJECTIVES

QUESTIONS

ESSAY

- Cause and effect of space loss & role of space maintainer in management of malocclusion (25 mark)
- Space management in developing dentition (50 mark)

SHORT NOTE

- Bonded space maintainer
- Space regainer
- Selection criteria for space maintainer
- Distal shoe space maintainer
- Lingual arch space maintainer

MANAGEMENT OF DEVELOPING OCCLUSION(McDonald, pg no 415)

1. Development of Occlusion
2. Space management early loss of teeth
3. Oral habit
4. Ant cross bite
5. Post cross bite
6. Eruption guidance 6, 31to 41, 43 to 45 & 23 to 25
7. Obstructive sleep apnoea
8. Comprehensive orthodontics

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- Journal of Indian Society of Pedodontics and preventive Dentistry**Year Year** : 2014 | **Volume** : 32 | **Issue** : 2 | **Page** : 111-116 Garg, samadi, Jaiswal
- Journal of Indian Society of Pedodontics and preventive Dentistry**Year Year** : nov 2012 | **Volume** : 32 | Dhinds a A.1, Pandit I. K.2
- IJPD volume 19 Issue 3
- Journal of Clinical Dental Research /2013 Year : 2013 | Month : 10 | Volume : 7 | Issue : 10 | Page : 2402 - 2405Vikas Setia[1], Inder Kumar Pandit[2], Nikhil Srivastava[3], Neeraj Gugnani[4], Harveen Kaur Sekhon[5]
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CONTENTS

INTRODUCTION

Management of premature tooth loss in the primary dentition requires careful thought by the clinician because the consequences of proper or improper space management may influence dental development well into adolescence.

- **Cavalcanti al** studied the prevalence of early loss of primary molars in schoolchildren in the city of Campina Grande, PB, Brazil.
- The results showed that **24.9 percent** of the sample had loss of primary molars, but no differences were observed between genders (P>0.05).
- There was larger loss prevalence among the **9 year-olds (27.2%)** and the most commonly missing teeth were the **lower primary molars (74.3%).**

- The term **'space maintenance'** was given by **Brauer (1941).**
- The term **'space control'** was suggested by **Gainsforth (1955).**

DEFINITIONS

PREVENTIVE ORTHODONTICS:

Action taken to preserve the integrity of what appears to be normal occlusion at a specific time.

GRABER (1966)

SPACE SUPERVISION:

When the judgement of the dentist determines the individual patients occlusion will have a better chance of obtaining optimum development through supervised intervention of the transitional dentition than without the clinician directed intervention.

MOYERS(1976)

SPACE MAINTENANCE

Process of maintaining a space in a given arch previously occupied by a tooth or a group of teeth

J.C BRAUER

SPACE MAINTAINER:

Fixed or removable appliance to preserve the space created by the premature loss of a primary tooth or a group of teeth

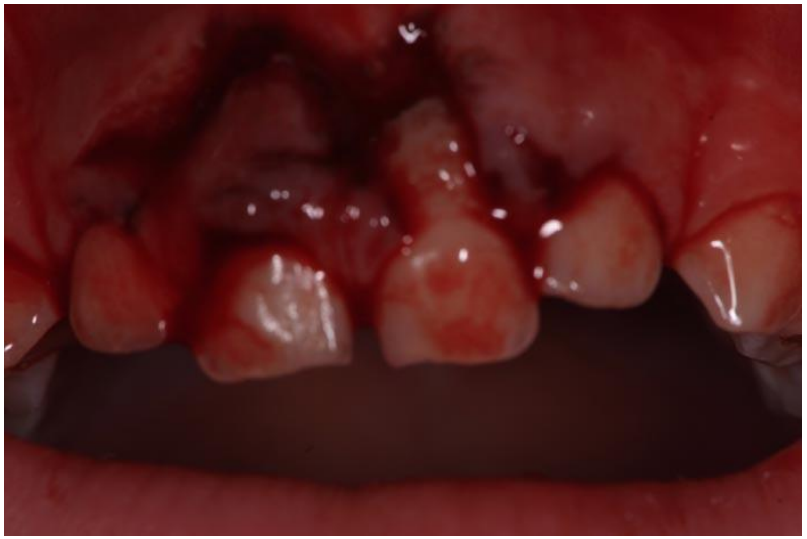
BOUCHER

SPACE MAINTAINERS

These are orthodontics appliance used to prevent loss of arch length.

MARTINEZ AND ELSBACH

CAUSES OF PREMATURE LOSS OF TEETH



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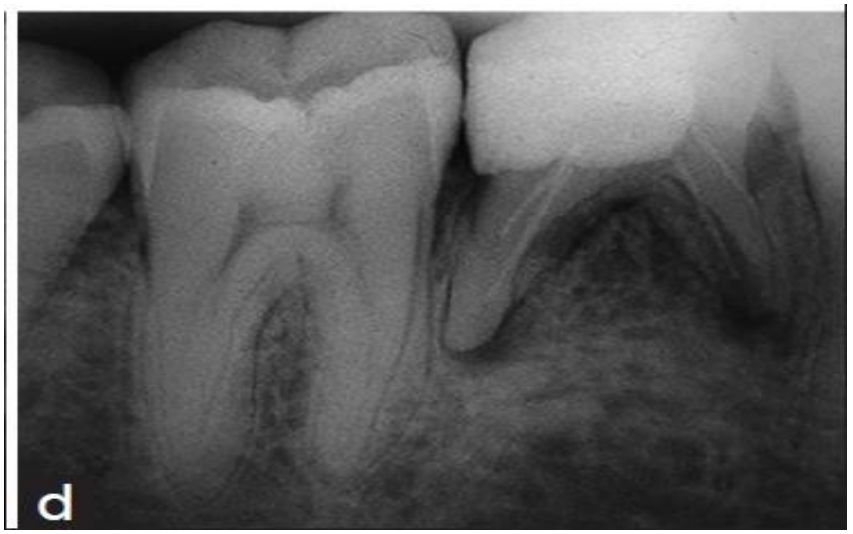
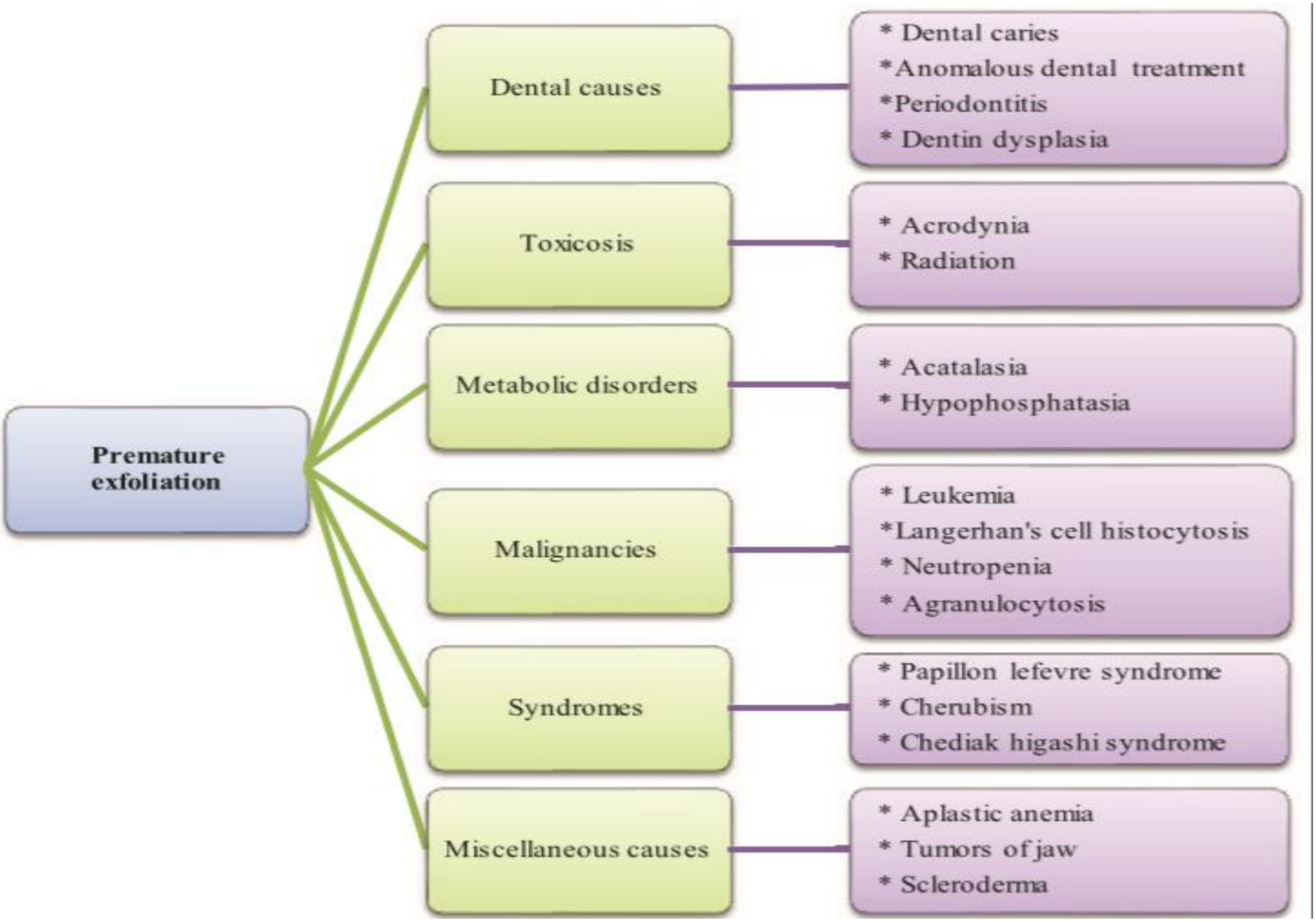


FAILED ENDODONTIC TREATMENT

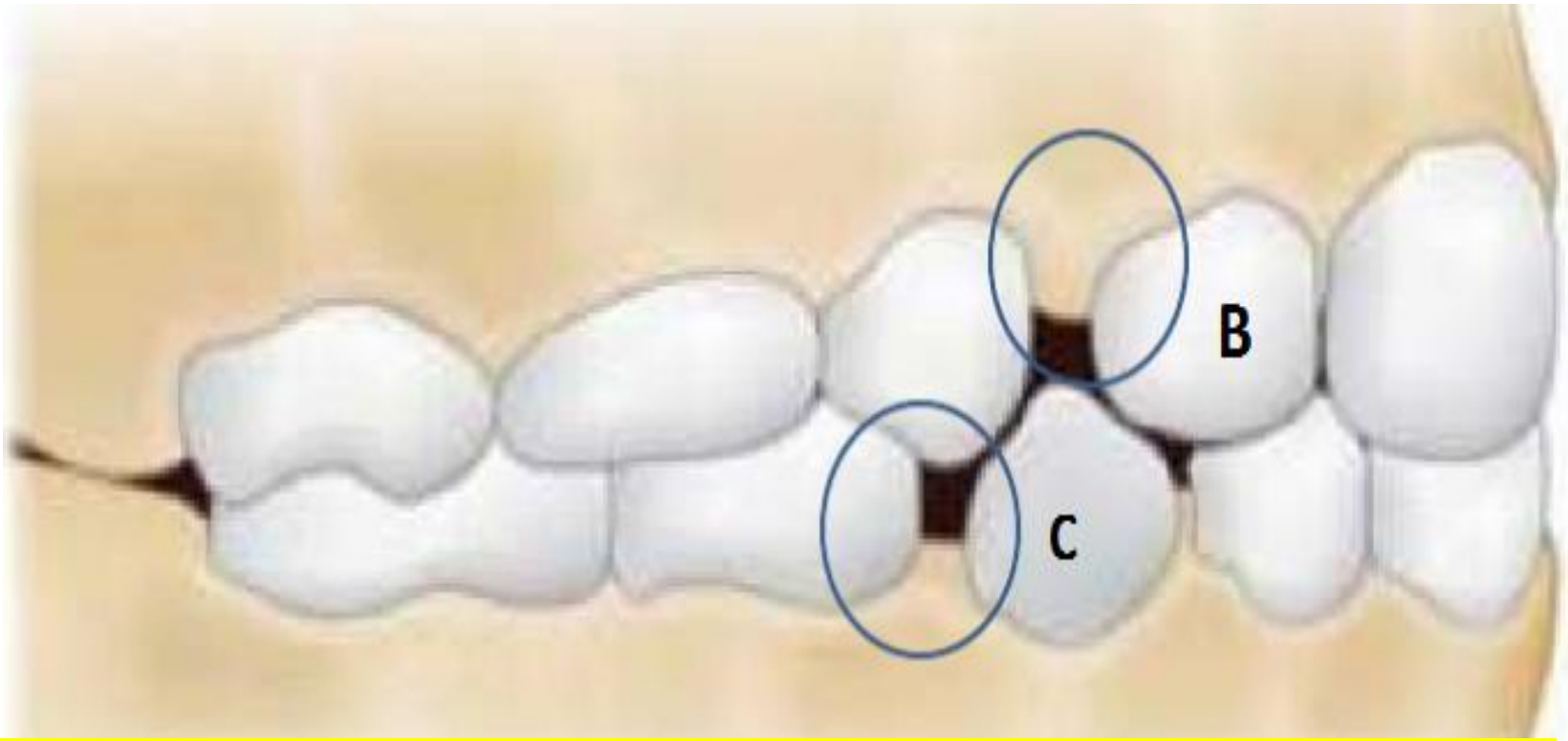

Premature exfoliation
Dental causes
* Dental caries
*Anomalous dental treatment
*Periodontitis
* Dentin dysplasia
Toxicosis
* Acrodynia
* Radiation
Metabolic disorders
* Acatalasia
* Hypophosphatasia
Malignancies
* Leukemia
*Langerhan's cell histocytosis
* Neutropenia
* Agranulocytosis
Syndromes
* Papillon lefevre syndrome
* Cherubism
* Chediak higashi syndrome
Miscellaneous causes
* Aplastic anemia
* Tumors of jaw
* Scleroderma

HISTORY

Davenport and Hutchinson (1880)	Space loss from early loss of primary teeth
Lourie (1904)	Invented lingual arch
JC Brauer (1941)	Coined the term space maintainer
Willets (1932)	Reported first distal shoe space maintainer
Roche (1942)	Roche's distal shoe space maintainer
Nance (1947)	Nance palatal arch appliance
Stefan JM, Miller JB and Johnson R (1971)	Esthetic functional space maintainer
Goshgarian R (1972)	Goshgarian appliance
Palmer (1979)	Bonded space maintainer
Gellin (1990)	Reverse band and loop space maintainer

OBJECTIVES OF SPACE MAINTAINERS

- Preservation of primate space



Dean JA, editor. McDonald and Avery's Dentistry for the Child and Adolescent-E-book. Elsevier Health Sciences; 2015 Aug 10.

- Preservation of integrity of dental arches
- Preservation of normal occlusal planes
- In case of anterior space management –aids in esthetics and phonetics

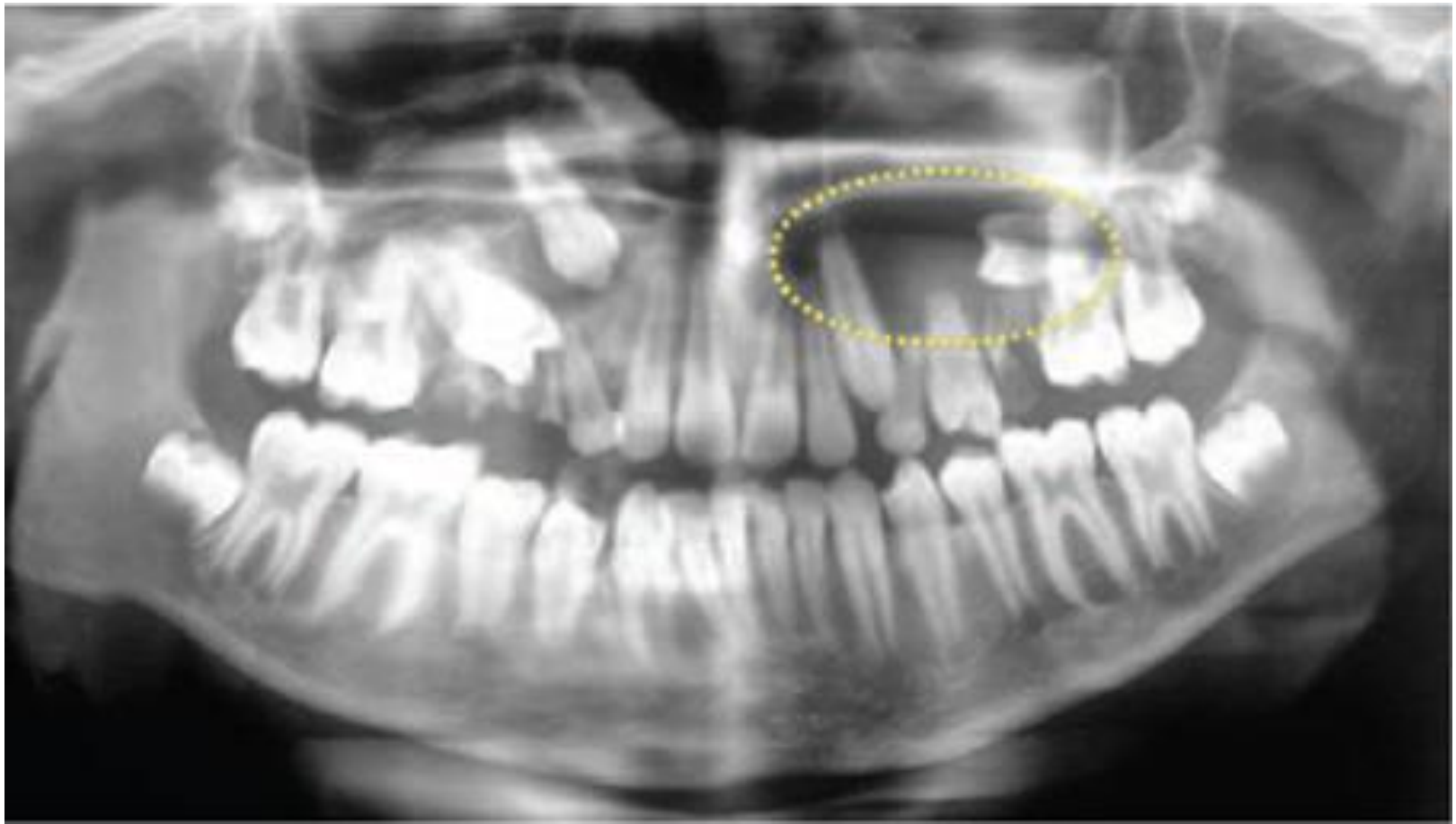
CHANGES SEEN AFTER PREMATURE LOSS OF UNILAT OR BILAT MAND MOLAR

BUCCAL SEGMENT:

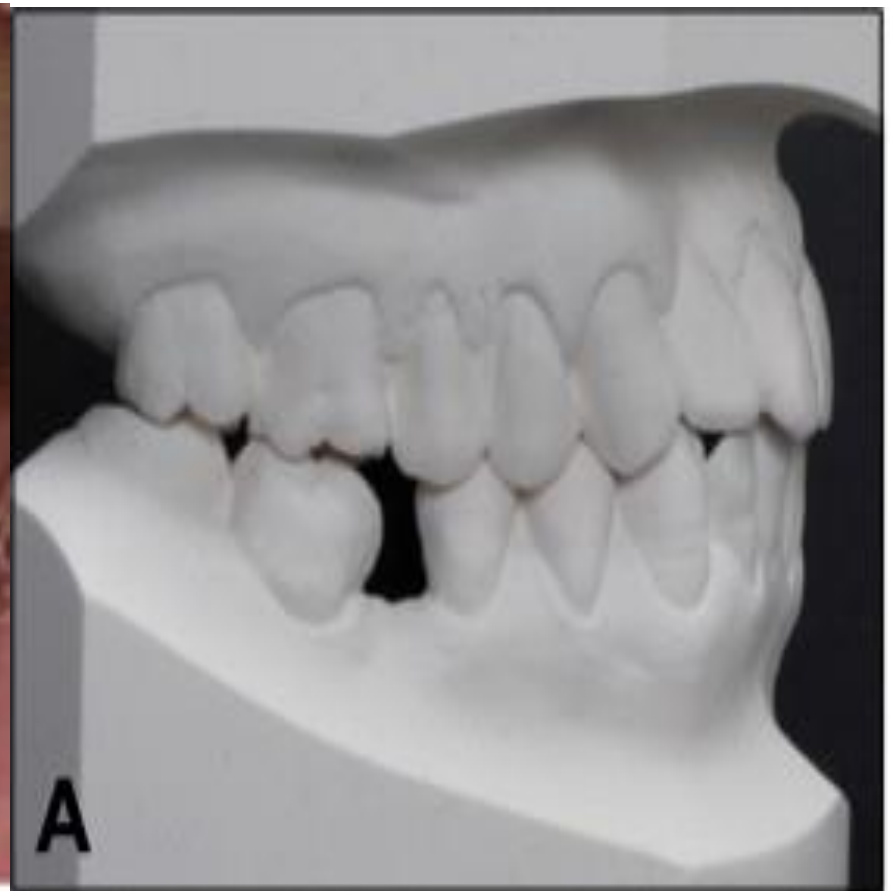
- Abnormally high tongue position coupled with a strong mentalist and buccinators muscle
- Ist primary molar area: collapse of lower dental arch and distal drifting of anterior segment.
- Potential of space loss is more during the time of permanent first molar eruption
- 2nd primary molar area: no buttress to resist so condition is even worse

Max 1st primary molar: The maxillary 1st permanent molar erupts distally and begins a rotation to swing forward once the cusp tips appear through the tissue at the eruption site
Then contacts the second deciduous molar in a less direct eruptive force.

- Maxillary permanent molar erupts distally and then swings forward to contact the second deciduous molar.
- If the latter is missing and no space appliance is placed, it is common for the maxillary 1st permanent molar crown to continue to swing mesially, until it come in contact with 1st molar thus blocking out the second premolar



- Mandibular 1st permanent molar strongly depends on the presence of second deciduous molar distal crown surface for eruptive guidance.
- If the deciduous 2nd molar is lost during permanent molar eruption the latter will continue its mesial eruption pathway to produce a severe space loss and tipped position



ANTERIOR SEGMENT

Primary canine area:

- Unilateral: midline shift occurs/ deviate to side of loss
- lingual tipping of permanent incisors/force of orbicularis oris and its associated muscles.

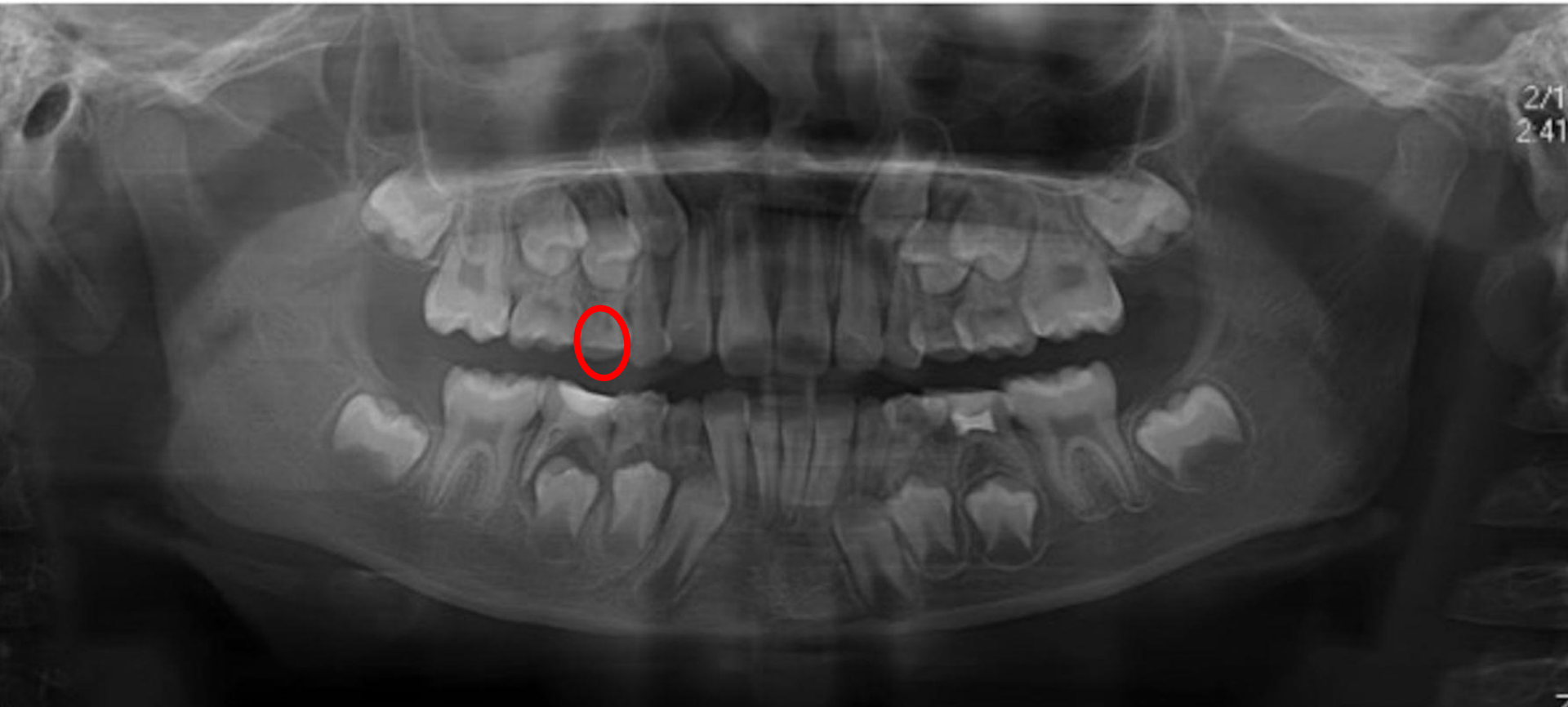
Primary incisor area

- But if there is still time for the permanent incisors to erupt, a space maintainer must be given for speech development, esthetics and prevention of social trauma for child.

LOSS OF INDIVIDUAL TEETH

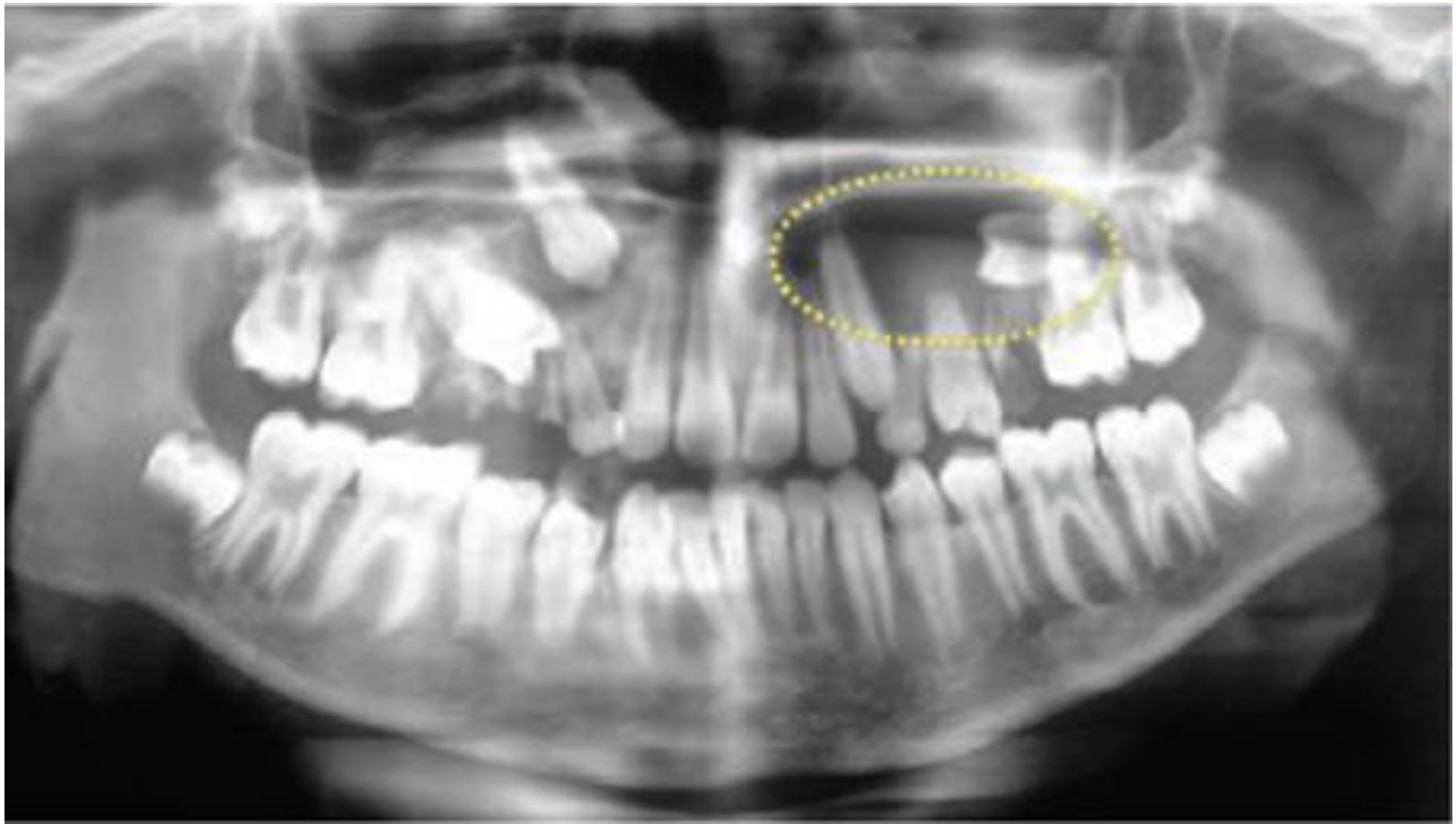
- ❑ **Loss of maxillary primary first molar**
- ❑ Distal drift of primary canines

- 6 and E shift mesially, with the amount depending on the duration on of absence and age at loss
- Erupting first bicuspid is guided along the mesial surface of E



❑Loss of maxillary deciduous 2nd molar

- Early loss of the upper E, second bicuspid is generally impacted
- 6 shift mesially, C & D shift distally
- 4 generally erupt earlier into the site maintained by the D, with distal drifting
- The resultant lack of space between the 6 and 4 causes impaction of the second bicuspid



❑ Loss of mandibular deciduous molar

Similar for all three situations, i.E. Loss of primary 1st molar, 2nd molar or both

1. **Loss of D** - 6 and E drift mesially
2. **Loss of E** - - 6 drift mesially
3. **Loss of D & E** – 6 drift mesially, C drift distally, impaction of premolars and midline shift

TABLE 1: Space maintenance in the primary dentition

Missing primary tooth	Suggested treatment	Reason
Maxillary incisor	No space maintenance required	No consequence. Exception if incisor(s) is/ are lost prior to primary canine eruption, space closure may be observed
Maxillary canine	Band and loop space maintainer	Decrease possibility of midline shift
Maxillary first molar	Band/crown and loop space maintainer	Prevents loss of arch dimension
Maxillary second molar	Distal shoe space maintainer	Guides first permanent molar into proper position Prevents loss in arch dimension
Mandibular canine	Band and loop space maintainer	Decreases possibility of midline shift
Mandibular first molar	Band and loop space maintainer	Prevents loss of arch dimension

TABLE 2: Space maintenance in mixed dentition

Missing primary tooth	Suggested treatment	Reason
Maxillary lateral incisor	Extract antimere	Decrease possibility of midline shift
Maxillary canine	Prior to eruption of permanent lateral incisor(s): removable space maintainer After eruption of permanent lateral incisor(s): extract antimere	Guides permanent lateral incisor into proper position Decreases possibility of midline shift
Maxillary first molar	Prior to eruption of permanent lateral incisor(s): band/crown loop space maintainer After eruption of permanent lateral incisor(s): band/crown loop space maintainer	Requires only minor adjustment to afford normal positioning of permanent incisors Prevents loss in arch dimension
Maxillary second molar	Nance appliance Extract antimere	Prevents loss in arch dimension Decreases possibility of midline shift
Mandibular lateral incisor	Prior to eruption of permanent lateral incisor(s): removable space maintainer After eruption of permanent lateral incisor(s): lingual arch space maintainer	Requires only minor adjustment to afford normal positioning of permanent incisors Prevents lingual tipping of permanent incisors
Mandibular canine	Prior to eruption of permanent lateral incisor(s): band/crown loop space maintainer After eruption of permanent lateral incisor(s): lingual arch space maintainer	Prevents loss in arch dimension Does not interfere with the eruption of permanent incisors

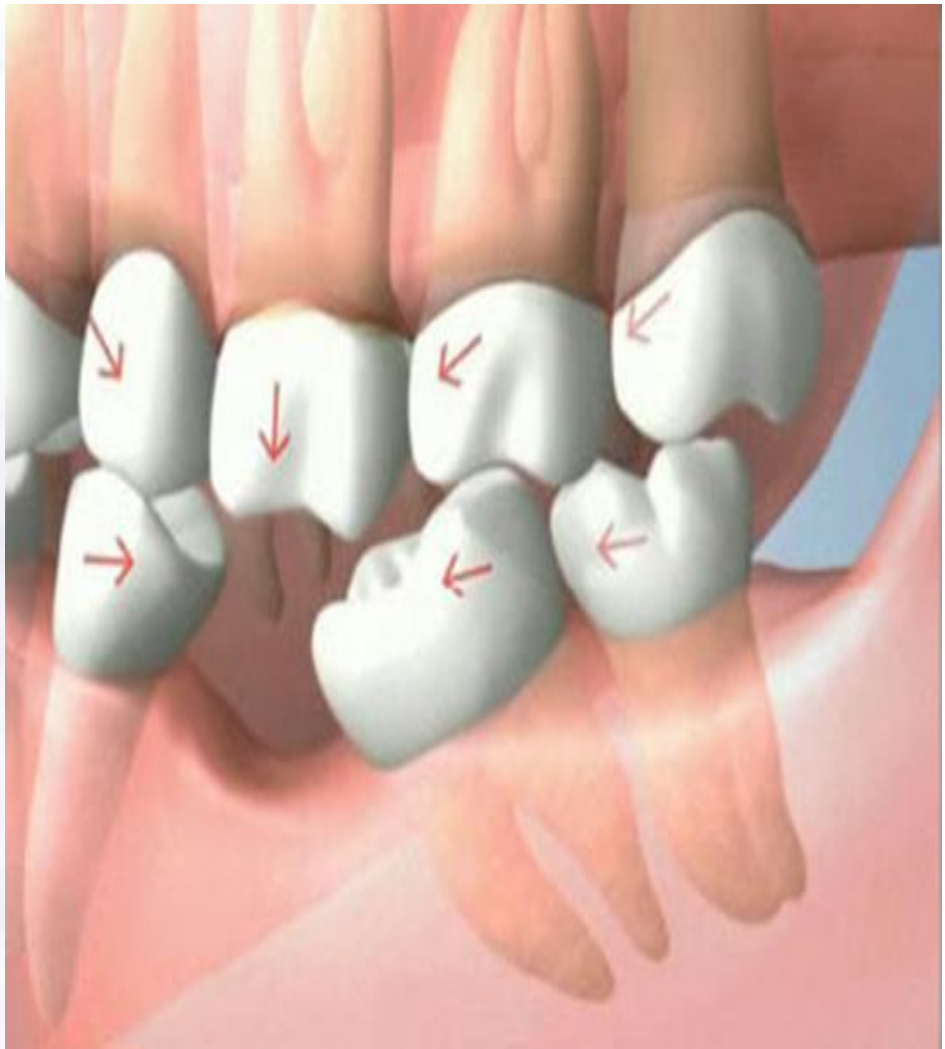
Clinical Disposition Guidelines for Various Dental Arch Space Conditions Resulting from Overall Mixed Dentition Space Appraisal

Overall Appraisal	mm	Clinical Disposition
Large space excess	Greater than +3	Long-term planning
Space excess	Less than +3 to 0	No action; observation
Equivalency	0	Careful observation
Deficiency	Less than -3 to 0	Lower lingual holding arch
Moderate deficiency	-3 to -6	Space regaining or arch expansion
Large deficiency	Greater than -6	Space regaining, arch expansion, or extraction

FACTORS TO BE CONSIDERED IN THE ASSESSMENT OF LOSS OF PRIMARY TEETH TO ARCH DEVELOPMENT

1. INCIDENCE OF SPACE LOSS

Early primary molar loss shows decrease in arch length



2. TIME ELAPSED SINCE LOSS OF TEETH

- Maximum space loss takes **place within the first 6 months**

- Tendency is more to occur in the maxillary than mandibular arch

  - If space closure has already occurred, space regainers given
  - To avoid these, best method is to fabricate appliance before extraction of primary tooth. (**Dean,McDonald)**

  - **98% closure of spaces present >14 months**
    - **Seipel et al, 1946**
  - **99% 7 98% closure of spaces occur for spaces present > than a year**
    - **Seward, 1965 ;Breakspear, 1961**

Dean JA, editor. McDonald and Avery's Dentistry for the Child and Adolescent-E-book. Elsevier Health Sciences; 2015 Aug 10.

3. STAGE OF DEVELOPMENT/ DENTAL AGE OF THE PATIENT

- If teeth actively erupting adjacent to the prematurely lost tooth then maximum chances of space loss
- Calculated according to the **methods of gustafson & koch or gron & moorees**

- In general, more space loss is likely to occur if teeth are actively erupting.
- **Significant space loss** is most influenced by the stage of eruption of the 6, with the high chance if a primary molar is lost just before or during eruption of the 6.
- Amount of space closure is **less if the 6** are fully erupted into occlusion at the time of primary tooth loss.
- **D lost prematurely and the 2 is in an active state of eruption.** The eruption of the 2 may result in distal movement of the C and encroachment on space availabl, accompanied by midline shift toward the area of the loss.
- In mandibular arch, a lingual "collapse" of the anterior segment occur, with a resulting increased overbite.
- **A e lost at 5 years of age** requires different abutment considerations than one lost during the mixed dentition when first permanent molars have erupted. Teeth actively erupting adjacent to the edentulous area have a greater effect on the amount of space lost than do fully erupted teeth.
- **Early loss of d during the time of active eruption of the 6**, a strong forward force will be exerted on the e that causes it to tip into the space required for eruption of the 4. Resulting in midline shift and retrusion of the anterior segment

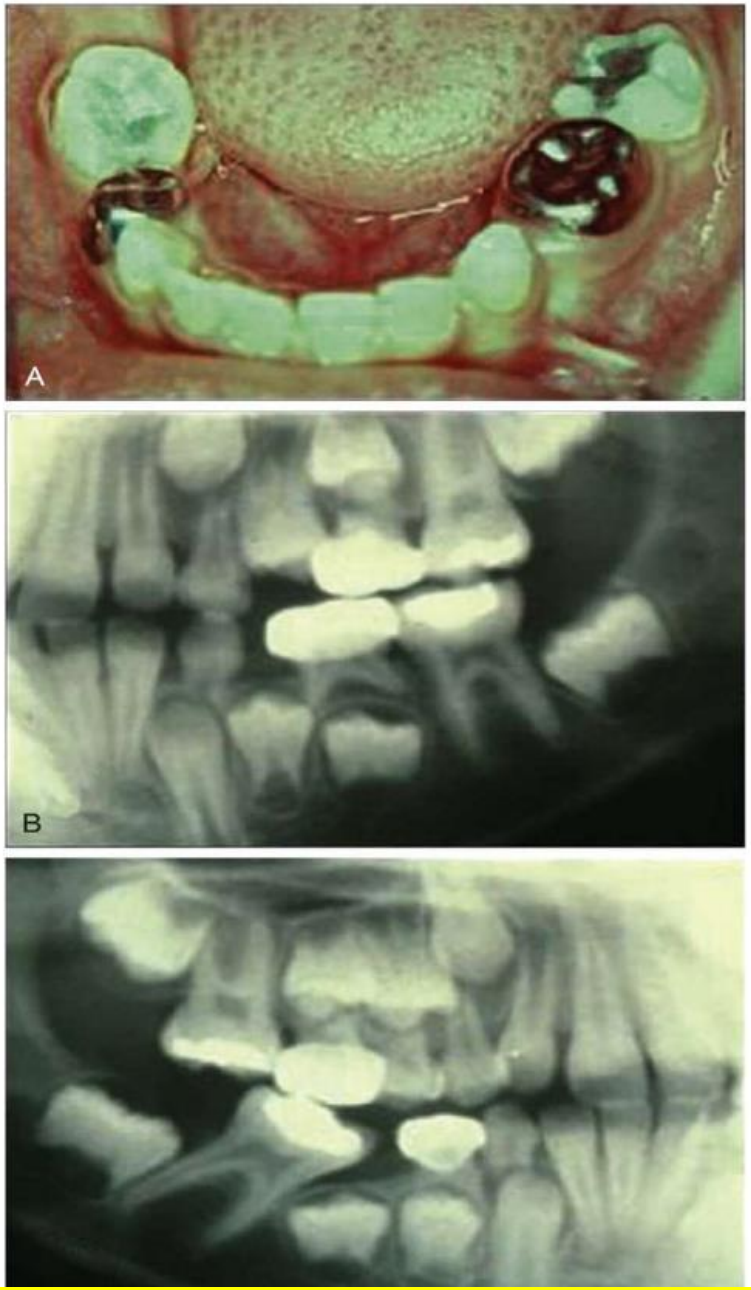
Dean JA, editor. McDonald and Avery's Dentistry for the Child and Adolescent-E-book. Elsevier Health Sciences; 2015 Aug 10.

4. AMOUNT OF SPACE CLOSURE

Maxillary space close faster compared to mandibular space

Loss of maxillary E results up to **8 mm** of space loss in a quadrant

Loss of mandibular E results up to **4 mm** in a quadrant



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- **Loss of upper or lower D** shows almost equal amounts of space closure & amount is most affected by timing of the D loss
- Space loss potential is *particularly high if the primary molar loss occurs in approximation to 6 eruption*, irrespective of which primary molar and which arch.
- After 6 have erupted into occlusion, loss of E may result in significant space closure.
- Loss of D with retention of the E shows minimal amounts of space closure because the E serves to buttress 6 positions after occlusion is established

Dean JA, editor. McDonald and Avery's Dentistry for the Child and Adolescent-E-book. Elsevier Health Sciences; 2015 Aug 10.

According to **Breakspear:**

Space loss after loss of 1st maxillary molar is **0.8 mm**

Space loss after loss of 1st mandibular molar is **0.9 mm**

Space loss after loss of 2nd maxillary molar is **2.2 mm**

Space loss after loss of 2nd mandibular molar is **1.7 mm**

According to **Clinch and Healy:**

Space loss before eruption of permanent molar is **6.1 mm**

Space loss after eruption of permanent molar is **3.7 mm**

Younger the patient, more is the space loss

Maximum space is lost during **first 6 months of extraction** and most **immediate loss is within 76 hours.**

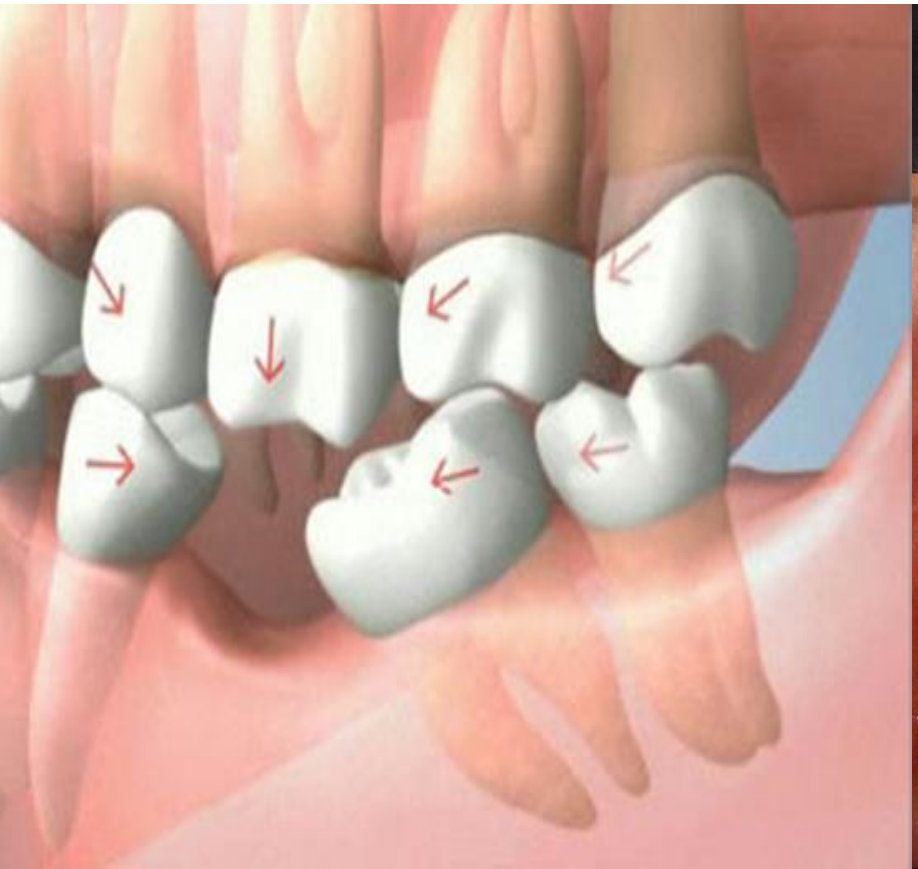
- **Pederson et al, 1978** 50% pt with space loss underwent premature extraction
- **Olsen, 1959** stated that greater loss occurs in mandible owing to a mesial axial orientation of 1st molar.
- **Cohen (1941), Seipel (1949), Richardson (1965)** stated that loss of 2nd deciduous molar will cause greater space loss.

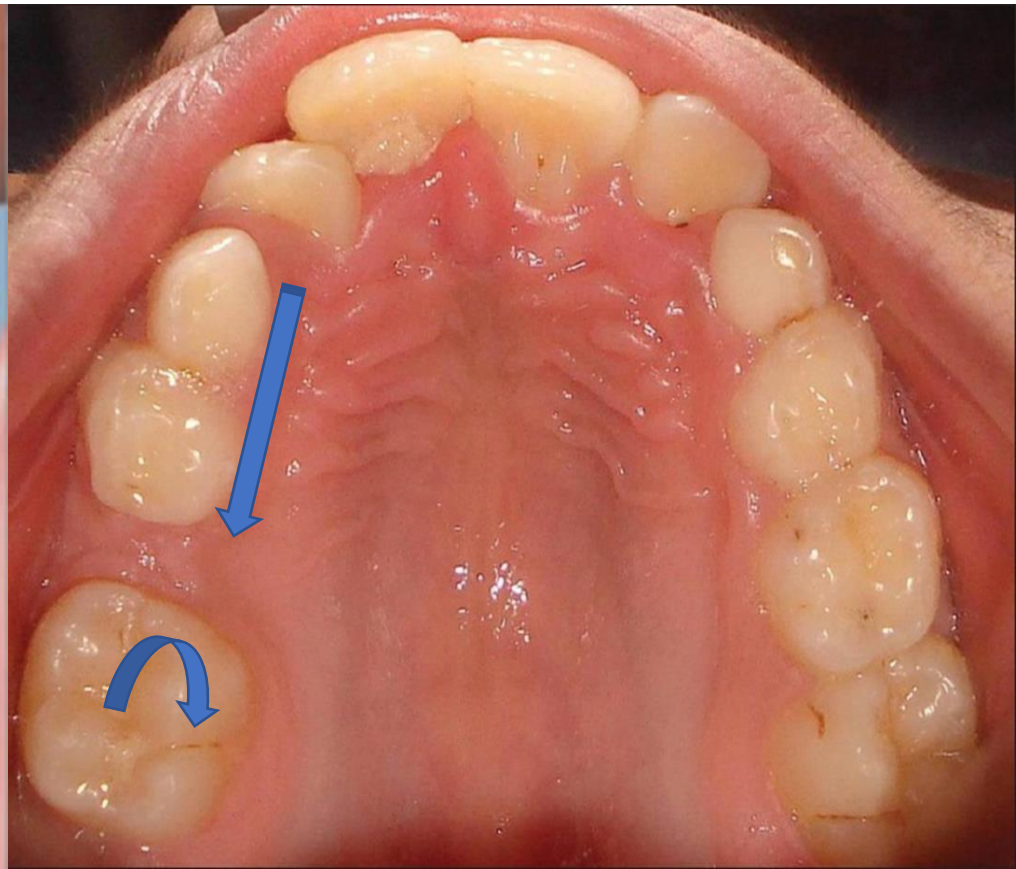
	Maxilla		*Mandible*	
	D	E	D	E
First year	1.3 mm	2.8 mm	1.8 mm	2.4 mm
Second year	1.8 mm	4.5 mm	2.7 mm	3.1 mm
Third year	3.2 mm	8.0 mm	3.3 mm	4.5 mm

5. DIRECTION OF CLOSURE

Space closed by:-

- Maxillary posterior - mesial bodily movement & ML rotation around palatal root of 6
- Lower arch – primarly by mesial tipping of 6 along with distal movement and retroclination of teeth anterior to the space.





- **Stewart FS (1965)** More severe space loss in terms of mm is in maxilla but severe space loss in terms of clinical management is in lower arch because molar space difficult to regain in lower arch.

- In mandible all *space losses greater than 2 mm* were brought about mainly by a **distal movement of the teeth mesial to the space.**

- **Rose JS (1966)** states that, space closure can occur in two ways either through **forward migration or rotation** of teeth distal to the site of extraction.

Kronfeld's theory states that there are neutral areas located :

- **Between the bicuspids** in maxilla
- Just **mesial to the first molar** in mandible

According to this theory:

- Teeth anterior to neutral zone have a tendency to drift distally.
- Teeth posterior to neutral zone have a tendency to drift mesially.

Textbook of Orthodontics – Graber 3rd edition

6. ERUPTION TIMING OF PERMANENT SUCCESSORS

- **Grøn,** teeth normally erupt when ¾ **th of the root** is developed, regardless of the child's chronologic age. **(Nollas Stage 8)**
- Eruption can be delayed or accelerated depending on :-
  - Developmental status
  - Bone density of the area
  - Nature of the primary tooth loss.

Several studies have indicated that:-

- Loss of a primary molar **before 7 years of age** leads to ***delayed emergence of the succedaneous tooth***
- Loss **after 7 years of age** leads to ***early emergence.***

"Mickey –mantle RULE OF 7"

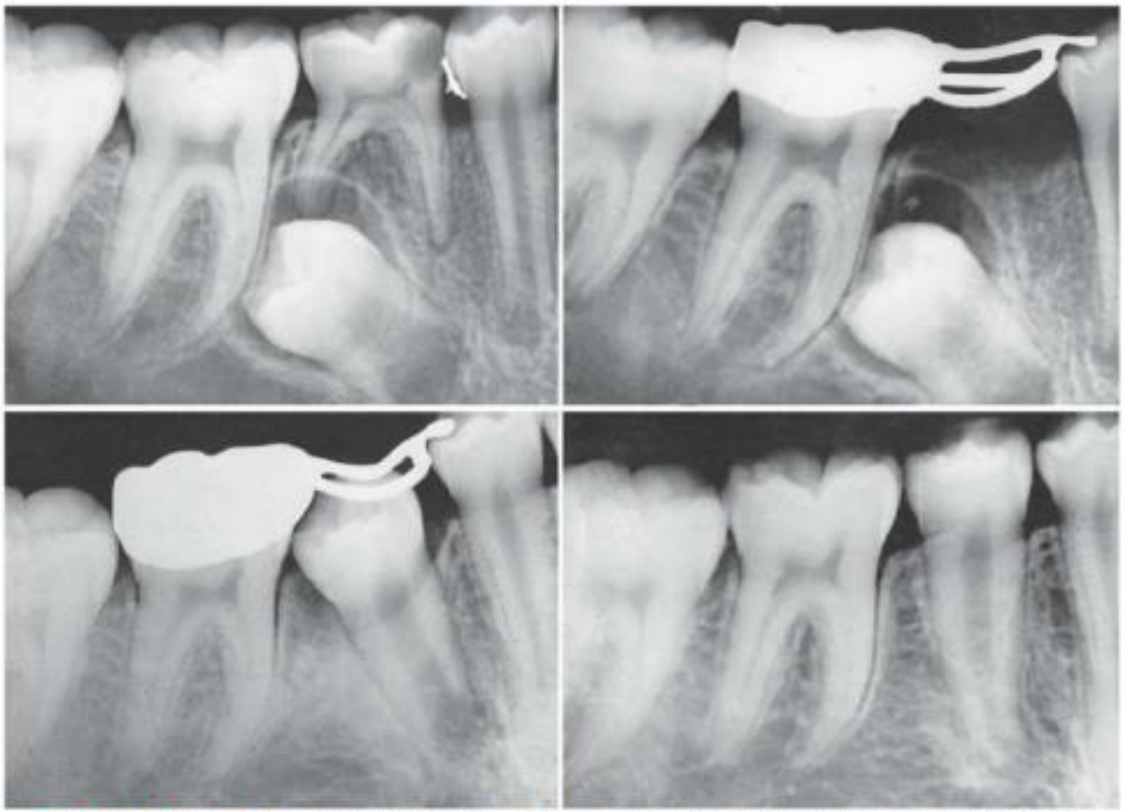
The magnitude of any timing change in eruption is affected by age at the time of tooth loss

- If a **primary molar is lost at 4 years of age**, the emergence of the ***premolar could be delayed by as much as 1 year***

- If the **loss occurs at 6 years of age**, a ***delay of about 6 months*** is more likely

- Primary tooth **loss within 6–12 months of normal exfoliation time** may result in ***acceleration in eruption timing*** of the underlying permanent tooth

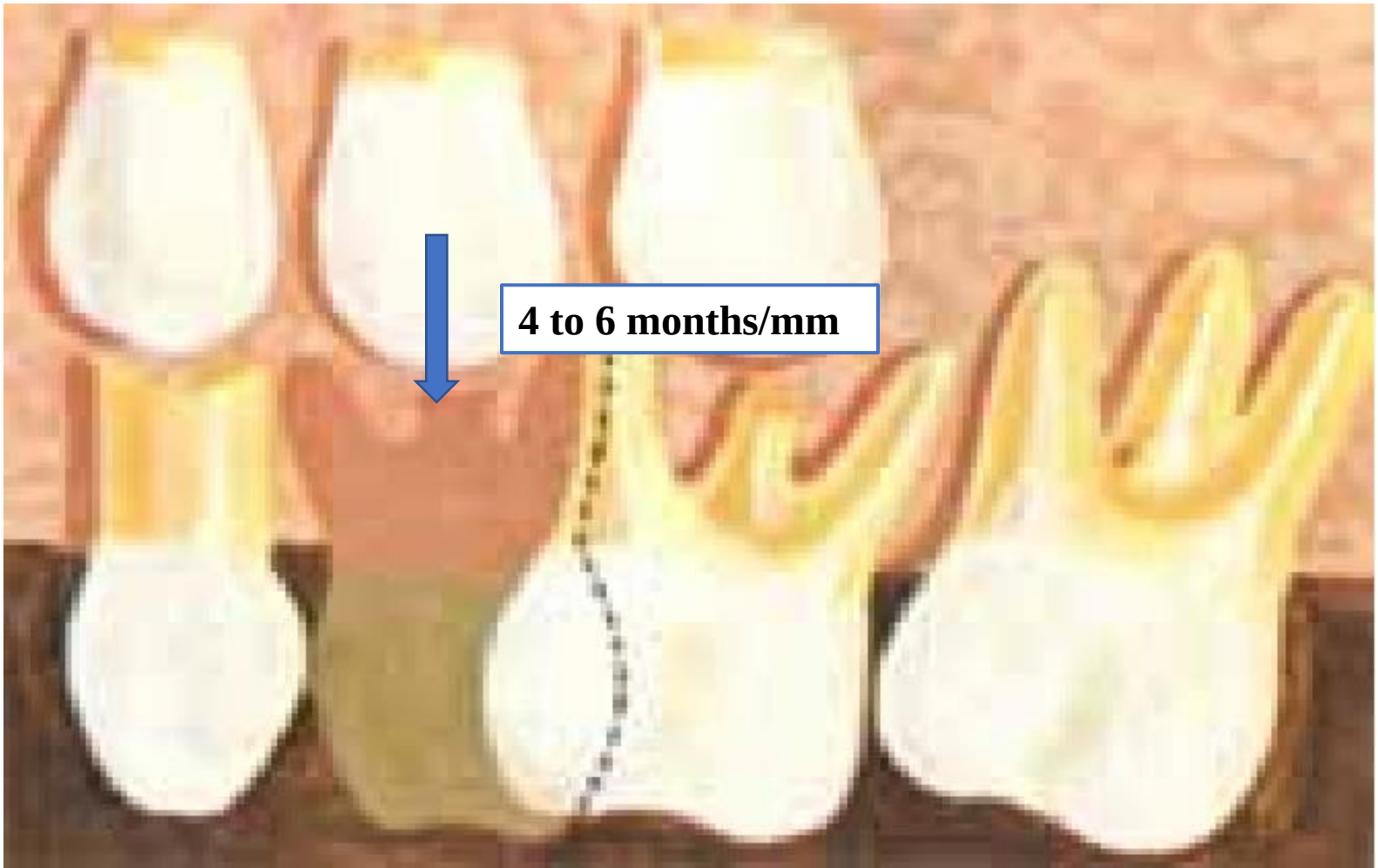
- **Impacted permanent teeth or deviations** in eruption paths result in abnormally delayed eruption times.



Extraction of the second primary molar and space maintenance were indicated because of prolonged retention of the primary tooth and impaction of the second premolar. The second premolar eventually erupted into its normal position.

7. AMOUNT OF BONE COVERING THE AREA

- Bone covering the permanent tooth destroyed by infection - Accelerated eruption is seen
- Premolar need almost 4 to 6 months to move through 1mm of bone, as measured on bitewing radiographs



- If 1mm or more bone overlying succedaneous tooth- space maintainer

- Available space:-
- If space > 1mm -fixed space maintainer
- If space < 1mm -Removable space maintainer

8. ABNORMAL ORAL MUSCULATURE

- **Strong mentalis action** can result in collapse of arch and distal drifting of anterior segment
- **Thumb or finger habits** produce abnormal forces - collapse of the dental arches after untimely loss of primary teeth

9. CONGENITAL ABSENCE OF THE PERMANENT TOOTH

- If succedaneous tooth is congenitally missing or malformed either orthodontic management for space closure or space maintained till permanent prosthesis can be placed

10. CURVE OF SPEE

- According to **Andrews**, ideal occlusion will have a near flat curve of Spee thus additional space can be gained.
- 1 mm of space is gained per 1mm of depth of curve of Spee.

11. AMOUNT OF ROOT FORMATION

-If **2/3rd of root** formed – tooth pierces through the **bone**

-If **3/4th root** formed –tooth pierces through the **mucosa**

12.SEQUENCE OF ERUPTION

IDEAL REQUIREMENTS OF SPACE MAINTAINER

- Maintain the mesiodistal dimension of the space created by the lost tooth.
- **Be functional** if possible, at least to the extent of preventing the overeruption of the opposing tooth or teeth.
- ***Simple and strong*** as possible.
- **Should not interfere** with normal occlusal adjustments.
- **Should not exert excessive stresses** on the adjacent teeth.
- **No interference** with erupting teeth.
- **Maintain individual functional movements** of teeth.
- **Not interfere with vertical eruption** of adjacent teeth.

- Provide **mesiodistal space opening** (simple design).
- Easily **adjustable.**
- **Should not restrict normal growth** and development process.
- Should not interfere with **mastication, speech and deglutition.**
- Easily **cleansed.**
- **Durable and corrosion resistant.**
- Reasonable in **cost.**
- **Universal application.**

No space maintainer will fulfill all of these requirements, except the primary tooth in sound condition with good contact relations

IDEAL REQUIREMENTS

- Restore function
- Prevent supra eruption
- Maintain space
- Simple in construction
- Oral hygiene maintenance
- Should not exert undue forces

Dean JA, editor. McDonald and Avery's Dentistry for the Child and Adolescent-E-book. Elsevier Health Sciences; 2015 Aug 10.

TREATMENT PLANNING

The decision to place a space maintainer and the choice of design to use are affected by the following:

1) The specific tooth that was lost
2) From which arch
3) At what time
4) Whether the permanent successor is present and developing normally
5) The patient's overall oral health status and motivation
6) The status of existing arch length to accommodate the permanent teeth

SYSTEMATIC REVIEW

- A reported immediate space loss of **1.5 mm** per arch side in the mandible and **1 mm** in the maxilla—when normal growth changes were considered—was found.
- The magnitude, however, is not likely to be of clinical significance in most cases.
- Nevertheless, in cases with incisor and/or lip protrusion or a severe predisposition to arch length deficiency prior to any tooth loss, this amount of loss could have treatment implications.

- **Tunison et al**

- Dental arch space changes following premature loss of primary first molars: a systematic review.
- *2008 Pediatric dentistry*, *30*(4), pp.297-302.

- **Bishara et al**. found that for maxillary arch, **intercanine width increases** between **3 and 13 yrs** by 6 mm but decreases by 1.7 mm between **13 and 45 yrs.**

- **Intermolar width** increases *by 2 mm* between **3 and 5 yrs** & *by 2.2 mm* between **8 and 13 yrs**

- There is a ***slight decrease in arch length*** with age because of uprighting of the incisors.

Dimensional changes for dental arch length, circumference, and **intermolar and intercanine widths** during childhood and adolescence have been compiled by **Moorrees.**

Average dimensional dental arch changes from **ages 6 to 18 years** for maxillary and mandibular arches are as follows:

Lower Arch	
Arch width	Bicanine: 3 mm increase; Bimolar: 2 mm increase
Arch length	1 mm secondary to incisor uprighting
Arch circumference	4 mm decrease
Upper Arch	
Arch width	Bicanine: 5 mm increase; Bimolar: 4 mm increase
Arch length	Slight decrease secondary to incisor uprighting
Arch circumference	1 mm increase

J Indian Soc Pedod Prev Dent - June 2006 ISSN 0970 - 4388

Loss of space and changes in the dental arch after premature loss of the lower primary molar: A longitudinal study

PADMA KUMARI B.[a], RETNAKUMARI N.[b]

Abstract

The purpose of the study was to evaluate the space changes, dental arch width, arch length and arch perimeter, after the unilateral extraction of lower first primary molar in the mixed dentition period. A longitudinal study was conducted among forty children in the age group of 6-9 years, who reported for extraction of lower first primary molar in the department of Pedodontics, Govt. Dental College, Trivandrum. Study models were made from alginate impression taken before extraction and after extraction at the periodical intervals of two months, four months, six months and eight months. The mesiodistal width of lower first primary molar of the non-extracted side was taken as the control. The results of the study showed statistically significant space loss in the extraction side (*P* value <0.01) and no significant space loss in the control side (*P* value > 0.05). The rate of loss was greatest in the first four months. The arch width, arch length and arch perimeter had no significant change from initial to eight months follow up. The present study challenges the use of a space maintenance under the circumstances of premature loss of mandibular primary molar for preventing space loss.

Key words: Arch length, arch perimeter, arch width, space loss

JADA, Vol. 131, December 2000

THE NOT-SO-HARMLESS MAXILLARY PRIMARY FIRST MOLAR EXTRACTION

WILLIAM M. NORTHWAY, D.D.S., M.S.

ABSTRACT

Background. Premature loss of primary molars has been associated with space loss and eruptive difficulties, especially when the loss occurs to the primary second molars and when it occurs early. This has not been thought to be the case for primary first molars.

Methods. The author revisited 13 cases from an earlier study on the effects of premature loss of maxillary primary molars. These longitudinal cases were scrutinized, using serial panoramic radiographs, to explain the irregular response in terms of dental migration. The author presents two case reports.

Results. In the earlier study, the author used digitized study casts and the concept of D + E space—the space occupied by the primary first and second molars—to describe the dental migration that occurred after premature tooth loss. Using analysis of variance on data generated using an instrument capable of measuring in tenths of millimeters, the author produced findings regarding the amount of space loss, rate of space loss, effect of age at loss, amount of space regained at the time of replacement by the permanent tooth and effect on Angle's classification. Finally, the author created a simulation describing directional change; this revealed that the maxillary primary first molar loss resulted in a mesial displacement of the permanent canine during eruption.

Conclusions. When the maxillary primary first molar is lost prematurely, the first premolar erupts in a more mesial direction than normal, as a result of the mesial incline of the primary second molar, and consumes the space of the permanent canine, which becomes blocked out.

Clinical Implications. Rather than use a space maintainer after the premature loss of the maxillary primary first molar, the author suggests, clinicians can choose from a number of other options for preventing the first premolar from erupting too far in a mesial direction.

DOI: 10.1111/j.1365-263X.2010.01105.x

Twelve-month space changes after premature loss of a primary maxillary first molar

YAI-TIN LIN[1], WEN-HSIEN LIN[2] & YNG-TZER J. LIN[3]

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International Journal of Paediatric Dentistry 2011; 21: 161–166

Background. Many early investigations concerning space changes following premature extraction of primary molars had a cross-sectional design, a small sample size, and a somewhat crude methodology, which may have led to misunderstandings.

Aim. The aim of this study was to use established longitudinal data to investigate ongoing (12-month) dental-arch space problems arising as a result of premature loss of a primary maxillary first molar.

Design. Thirteen children (mean ± SD age at time of tooth extraction, 6.0 ± 0.74 years) with unilateral premature loss of a primary maxillary first molar were selected for this study. Maxillary dental study casts were obtained from participants 2 or 3 days after the tooth was removed, as well as at a follow-up appointment 12 months later. Six reference lines were measured on the study cast: D + E space, arch width, arch length, intercanine width, intercanine length, and arch perimeter. For each participant, the D + E space of the contralateral intact primary molar served as a control. A paired *t*-test was used to compare the cast measurements between initial examination and 12-month follow-up. A *t*-test was used to compare D + E space changes with those of the control group.

Results. The D + E space of the extraction side after 12 months was significantly smaller than that of the control side ($P < 0.05$) and the initial D + E space ($P < 0.05$). A significantly greater arch perimeter, intercanine width, and intercanine length were found after 12 months compared with the initial parameters. No significant differences were found, however, in arch width or arch length between the initial examination and the 12-month follow-up examination ($P > 0.05$).

Conclusions. The 12-month space changes in the maxillary dental arch after premature loss of a primary maxillary first molar consist mainly of distal drift of the primary canine toward the extraction site. Mesial movement of permanent molars or tilting of the primary molars did not occur. An increased arch dimension was found especially in the anterior segment (intercanine width and length). There is no need for the use of space maintainers from the results in this study in cases of premature loss of a primary first molar.

JADA, Vol. 141 http://jada.ada.org January 2010

Evidence indicates minimal short–term space loss after premature loss of primary first molars

A critical summary of Tunison W, Flores-Mir C, ElBadrawy H, Nassar U, El-Bialy T. Dental arch space changes following premature loss of primary first molars: a systematic review. Pediatr Dent 2008;30(4):297-302.

Jacob DaBell, DDS; Greg J. Huang, DMD, MSD, MPH

Systematic review conclusion. The reported magnitude of space loss after premature loss of primary first molars—1.5 millimeters per arch side in the mandible and 1.0 mm per arch side in the maxilla—is not likely to be of clinical significance in most cases.
Critical summary assessment. The reviewers' conclusion was made on the basis of the results of only three studies, which included a total of 70 patients who were followed by investigators for up to eight months.
Evidence quality rating. Limited.

intervention, as well as individual cases or case series reports. Space loss was the primary outcome assessed. The reviewers hand searched reference lists and contacted authors for additional information as needed for methodological evaluation. Two independent reviewers assessed the

found space loss of 1.19 millimeters and 1.75 mm eight months after tooth loss. The investigators in one of the studies examined the unilateral loss of maxillary primary first molars and found space loss of 1.08 mm six months after tooth loss.

- The investigators in none of the three studies reported statistically significant changes in arch width or arch perimeter.
- Only the investigators of the study looking at loss of maxillary primary first molars found statistically significant decreases in arch length.

Conclusions. The reviewers found that space loss of 1.5 mm per side in the mandible and 1.0 mm per side in the maxilla occurred after the loss of primary molars. They felt that the selected studies had limited methodological quality and limited sample sizes.

No sources of funding for this systematic review were listed.

Journal of Dental Sciences (2016)

ORIGINAL ARTICLE

Long-term space changes after premature loss of a primary maxillary first molar

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Available online ■ ■ ■

KEYWORDS
premature loss;
primary maxillary first molar;
space maintainer

Abstract *Background/purpose:* The consequence of premature loss of primary teeth resulting in the need for space maintainers has been controversial for many years. There is no longitudinal long-term report in literature regarding the premature loss of a primary maxillary first molar. The aim of this study was to continue observing the long-term space changes of 19 cases following premature loss of a primary maxillary first molar during the transition from primary to permanent dentition.

Materials and methods: Ten of the 19 original participants were excluded because of extensive decay or loss to follow-up. Nine children (mean age at time of tooth extraction, 6.0 ± 0.42 years) with unilateral premature loss of a primary maxillary first molar were examined. Maxillary dental study casts were obtained 2 days or 3 days after tooth removal and, on average, 81 months later. The contralateral intact primary molars in each participant served as controls. The arch width, arch length, intercanine width, intercanine length, and arch perimeter of each study cast from the initial and follow-up examinations were measured and compared using paired *t*-tests.

Results: Eight of nine cases (88.9%) did not show crowded permanent successors or canine block-out at the extraction site. Interestingly, the permanent dentition was more crowded at the control site (2/9) than at the extraction site (1/9). The arch width, arch length, intercanine width, and intercanine length significantly increased at 81 months ($P < 0.05$), whereas the arch perimeter increases approached significance ($P = 0.071$).

Conclusion: The anterior and posterior arch dimensions significantly increased 81 months after premature loss of a primary maxillary first molar, which suggested that space maintainers were not needed in these cases.

Angle Orthodontist, Vol 85, No 2, 2015

The premature loss of primary first molars:

Space loss to molar occlusal relationships and facial patterns

Stanley A. Alexander[a]; Marjan Askari[b]; Patricia Lewis[c]

ABSTRACT

Objective: To investigate space changes with the premature loss of primary first molars and their relationship to permanent molar occlusion and facial forms.

Materials and Methods: Two hundred twenty-six participants (ranging in age from 7 years 8 months to 8 years 2 months; 135 female, 91 male) met all inclusion criteria designed to study space loss as a result of the premature loss of the primary first molar. After 9 months, space loss was evaluated in relationship to molar occlusion and facial form. Statistical evaluation was performed with the paired *t*-test and with a two-way analysis of variance for independent groups.

Results: Patients with leptoprosopic facial form and end-on molar occlusions all exhibited a statistically significant difference when compared to controls in terms of space loss ($P < .001$). The mandibular extraction site for individuals with a mesoprosopic/euryprosopic facial form and end-on molar occlusion displayed space loss as well ($P < .05$). All patients with a leptoprosopic facial form and Class I molar occlusion displayed space loss in the maxilla ($P < .05$) and the mandible ($P < .001$) respectively, that was statistically significant when compared to that of the control. Individuals within the mesoprosopic/euryprosopic group and with Class I molar occlusions showed no significant difference in space loss.

Conclusions: The relationship between the first permanent molar occlusion and facial form of the child has an influence on the loss of space at the primary first molar site. (*Angle Orthod.* 2015;85:218–223.)

KEY WORDS: Premature tooth loss; First primary molar; Occlusal relationship; Facial pattern

The American Academy of Pedodontics 1983, Vol. 5 No. 2

A new design for space maintainers replacing prematurely lost first primary molars

Robert Rapp, DDS, MS, FRCD(C)
Isik Demiroz, DDS, MS

Abstract

Studies of the developing anterior occlusion in the mixed dentition indicate a physiologic distal and labial repositioning of the primary canines concomitant to eruption of the maxillary and mandibular permanent incisors. In order not to impede these canine movements, a modification of the loops of bandloop space maintainers is recommended. In place of the usual concavity which encircles the distal surface of the canine crown, a distolabial slope is incorporated into the anterior portion of the loop. This revised design will allow the canine to migrate labially and distally while simultaneously preventing loss of arch length necessary for the unerupted first premolar. In addition, arch space required for eruption and alignment of permanent labial incisors can be preserved.

Space maintainers frequently are recommended to preserve arch space resulting from premature loss of first primary molars. Changes occurring in the developing anterior occlusion during mixed dentition require that the space previously occupied by a prematurely lost first primary molar be maintained. This article will describe a modification of the design of first primary molar space maintainers based on growth changes occurring in the canine areas of the mixed dentition.

Indications for Space Maintenance

Space maintainers replacing prematurely lost first

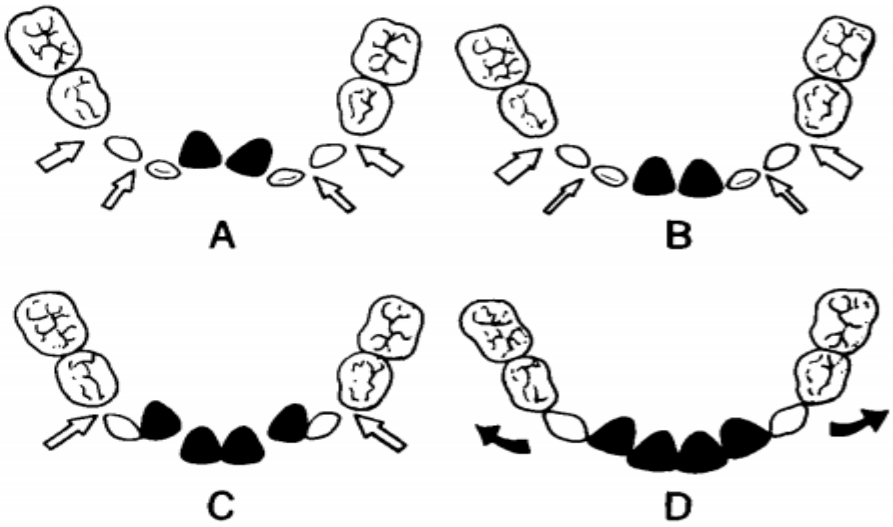


Figure 1. Model of the developing mandibular anterior occlusion showing repositioning of primary canines.
a. Eruption of the permanent central incisors (shaded) lingual to the position previously occupied by the primary central incisors. The width of the arrows indicates relative amount of interdental spacing.
b. The permanent central incisors have moved into the dental arch displacing the primary lateral incisors distally and reducing the interdental spacing.
c. The erupting permanent lateral incisors (shaded) ready to occupy arch space previously held by the exfoliated primary lateral incisors. Notice reduction of the primate spacing.
d. The primary canines repositioned labially and distally in the dental arch as a result of eruption of the permanent lateral incisors. Mandibular primate spacing has closed and intercanine width has increased.

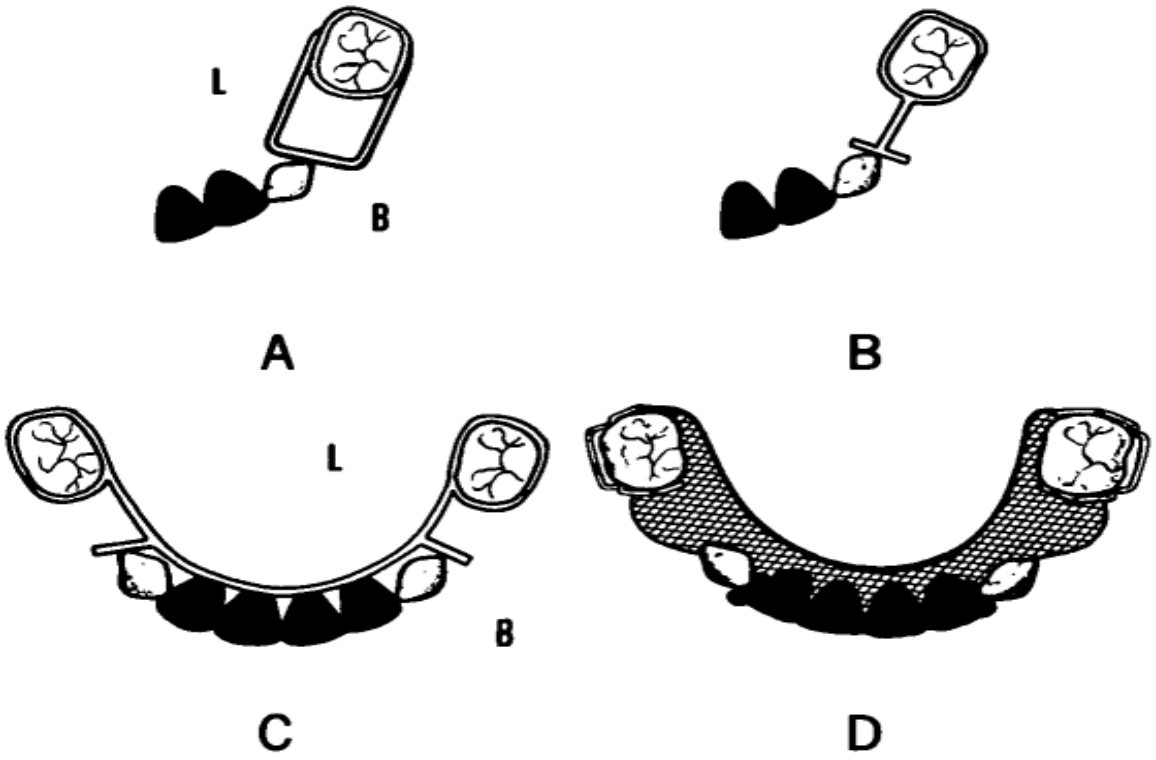
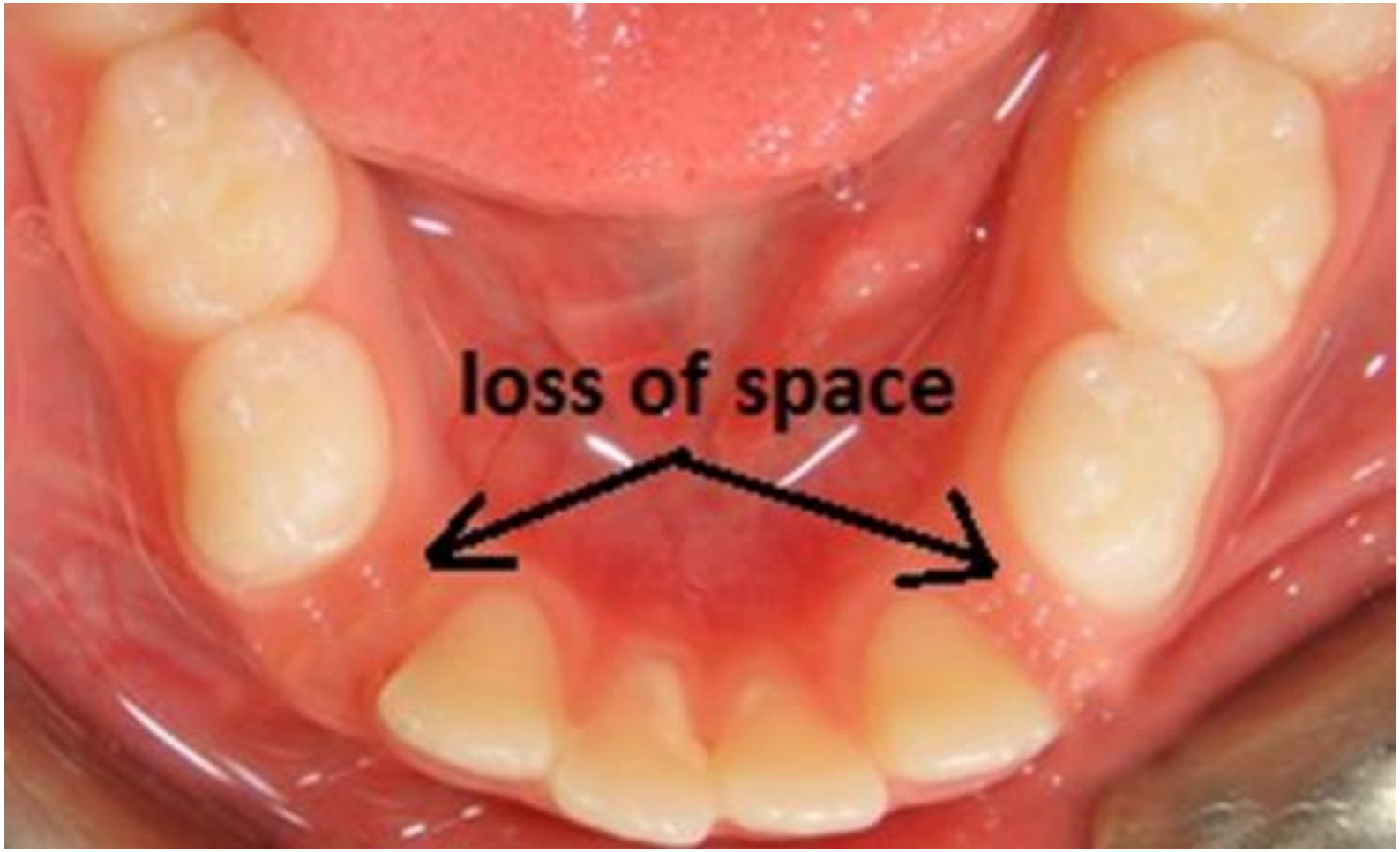


Figure 3. Modification of space maintainers which facilitates normal occlusal development in the canine region.
a. A band and loop space maintainer replacing a prematurely lost first primary molar. The anterior portion of the loop slopes in a buccal (B) and distal direction to allow physiologic movement of the primary canine. Sufficient space in the arch is maintained to accommodate the unerupted first premolar.
b. A cast T-bar space maintainer, replacing a prematurely lost first primary molar. The bar of the T-bar space maintainer slopes in a distobuccal direction to allow canine movement.
c. A lingual arch, bilateral space maintainer replacing prematurely lost first and second primary molars. Finger springs positioned distal to the primary canines are sloped in a distobuccal direction to facilitate canine repositioning.
d. A removable, bilateral space maintainer replacing prematurely lost first and second primary molars. Note the distobuccal slope created in the acrylic base material.

INDICATIONS

- If the space after premature loss of deciduous teeth shows signs of closing.



- If the use of space maintainer will aid in or make the future orthodontic treatment less complicated.

- If the need for treatment of **malocclusion at a later date is not indicated.**

- When the space for a permanent tooth should be **maintained for two years or longer.**

- To **avoid supraeruption** of a tooth from the opposing arch.

- To **improve the physiology of a child's masticatory system and restore dental health** optimally.

INDICATIONS
(CURRIER AND AUSTERMAN, 1992 ; MOYERS, 1988 ; NANDA, 1993 ; PROFITT AND FIELDS, 1993)

- Premature loss of any **primary first molar in the primary dentition**
- Premature loss of primary **maxillary first molar in the transitional dentition**.
  - In the above cases, the unerupted premolar usually is **more than 2 years from clinical eruption and its root length is less than one third mature**.

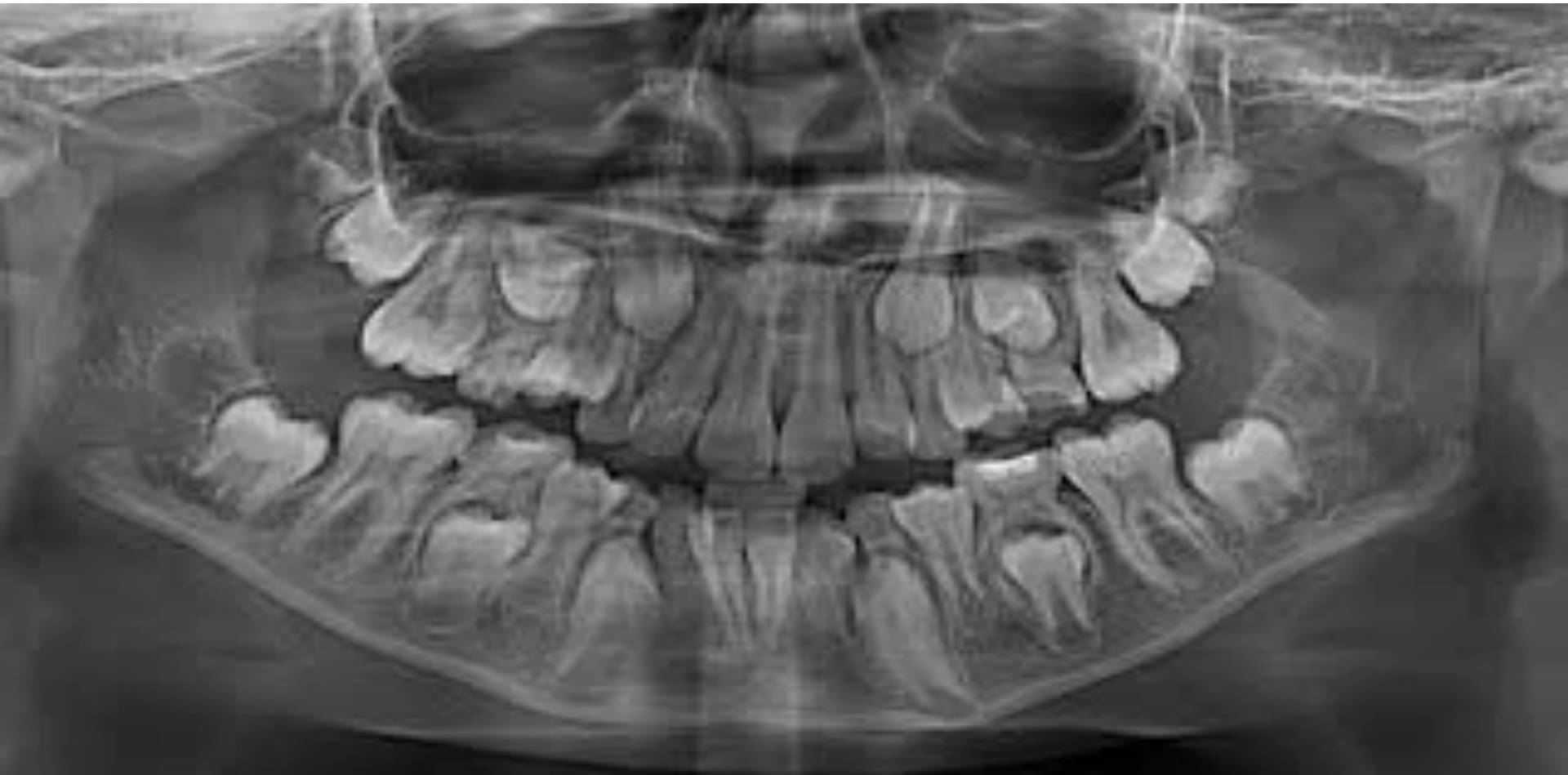
- Premature loss of a **primary second molar** as the permanent first molar is erupting clinically.

  These cases must be followed up with other types of appliance therapy as the entire occlusal portion of the permanent first molar erupts.

Mathewson RJ, Primosch RE. Fundamentals of pediatric dentistry.

CONTRAINDICATIONS

- Radiograph showing well erupted succedaneous tooth with 1/3rd of root formation completed
- When the space left by primary tooth loss is more
- When succedaneous tooth is absent
- If the space shows no signs of closing.



CONTRAINDICATIONS

1. Crowded dental arch which already exhibits marked space loss.
2. High dental caries activity.
3. Replacement of primary anterior teeth
4. Replacement of primary second molars in the primary dentition without partial clinical eruption of the permanent first molar
5. Replacement of primary second molars in the transitional dentition with the permanent molar banded (rare exception)
6. Cases that need guidance of eruption (sequential extraction of primary teeth without removal of permanent teeth)
7. Eg, ectopic loss of a primary canine, which indicates arch perimeter shortage on one side of the arch and necessitates removal of the contralateral primary canine in the mandibular arch for correction of the midline discrepancy

Mathewson RJ, Primosch RE. Fundamentals of pediatric dentistry.

DETERMINANTS OF APPLIANCE SELECTION (According to DCNA 1978).

PATIENT COOPERATION:

Greater patient cooperation needed - removable appliance.

Fixed appliance patients - wear the appliance full time.

INTEGRITY OF THE APPLIANCE:

Long-term wear/Appliance breakage or is lost must be considered.

MAINTENANCE:

Clasps or the acrylic or removable appliances require minor adjustments.

Cement on the abutment areas often disintegrates with time and loose bands will lead to decalcification of the underlying enamel & food stagnation and acid production.

Periodic removal of appliance, checking for decalcification, polishing of tooth and cementation is necessary.

MODIFIABILITY:

Successor tooth erupts out of alignment the wire of a fixed appliance may be difficult to adjust.

Anticipating future modifications owing to occlusal development can reduce the number of appliances required.

LIMITATIONS:

The clinician should project the number of appliances needs for the patient whenever possible.

TIME:

Required to construct removable acrylic appliances is greater than for fixed appliance.

ADVERSE EFFECTS

1. Dislodged, broken, and lost appliances
2. Plaque accumulation
3. Decalcification of tooth
4. Caries
5. Interference with successor eruption
6. Undesirable tooth movement
7. Inhibition of alveolar growth
8. Soft tissue impingement
9. Pain.

The **Reference Manual** of Pediatric Dentistry **2020**-2021/P. 400

AAPD RECOMMENDATIONS
Revised 2019
Treatment Consideration

Factors to consider include:

- Specific tooth loss
- Time elapsed since tooth loss
- Preexisting occlusion
- Favorable space analysis
- Presence and root development of permanent successor
- Amount of alveolar bone covering permanent successor
- Patient health status
- Patient cooperative ability
- Active oral habits
- Oral hygiene

FACTORS CONTRIBUTING FOR SPACE CLOSURE

- Inclination of long axis of permanent molars — tendency of molar to shift mesially because their long axis is mesially inclined.

- Premature loss of deciduous teeth

- Influence of buccal musculature — buccinators exerts forces that can derange occlusion.

- Path of least resistance — this is created following loss of support because of extraction or missing tooth.

- Effect of position of center of rotation of mandible: **Smyd** pointed out that more the axis of mandibular rotation is lowered in respect to occlusal plane less is the amount of horizontal thrust transmitted to teeth in occlusion

CLASSIFICATION

According to **Hinrichsen**

FIXED SPACE MAINTAINERS

1. Class I

Non functional

- Bar type
- Loop type

Functional

- Pontic type
- Lingual arch type

2. Class II

- Cantilever type (Distal shoe)

REMOVABLE SPACE MAINTAINERS

- Acrylic Partial Denture

According to **Hitchcock**

1. Removable, fixed or semifixed
    - With bands or without bands
2. Functional or non functional
    - Active or passive
3. Certain combinations of the above

According to **Raymond C Thourow**

- Removable
- Complete arch – Lingual arch & Extraoral anchorage
- Individual tooth

According to **Minoru Nakata and Stephen Wei:**

- **Semi-fixed** type space maintainer
  - Crown – distal shoe space maintainer
  - Crown – loop space maintainer
  - Band – loop space maintainer

- **Fixed** type space maintainer
  - Lingual-holding arch space maintainer
  - Nance holding arch

- **Removable** type space maintainer

According to **Mathewson(1977):**

- Removable

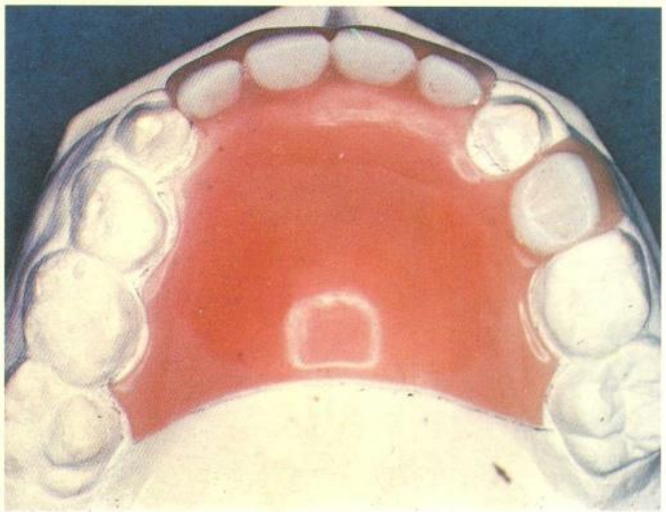
- Fixed:
  - Band/ Crown loop
  - Nance Holding arch
  - Lingual arch
  - Distal shoe

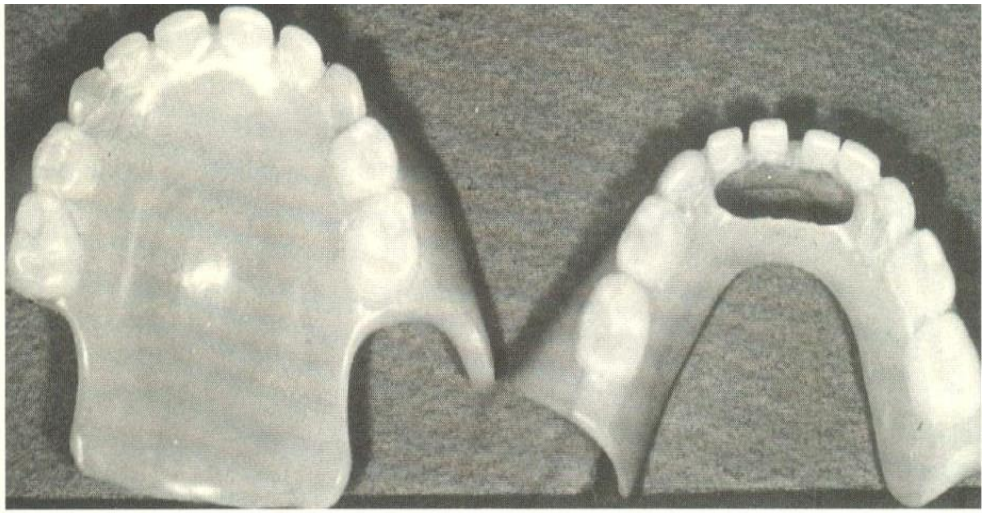
CLASSIFICATION

- Space maintainers
  - Removable
    - Cast partial
      - passive
    - Wrought partial
      - active
  - fixed
    - Banded
      - passive
      - functional
        - Band and loop
        - Lingual arch
        - Nance palatal
        - Distal shoe
    - bonded
      - active
      - Non functional

REMOVABLE SPACE MAINTAINERS

- Removable space maintainers:- appliances designed for easy removal for cleansing and/or adjustment.





CLASSIFICATION

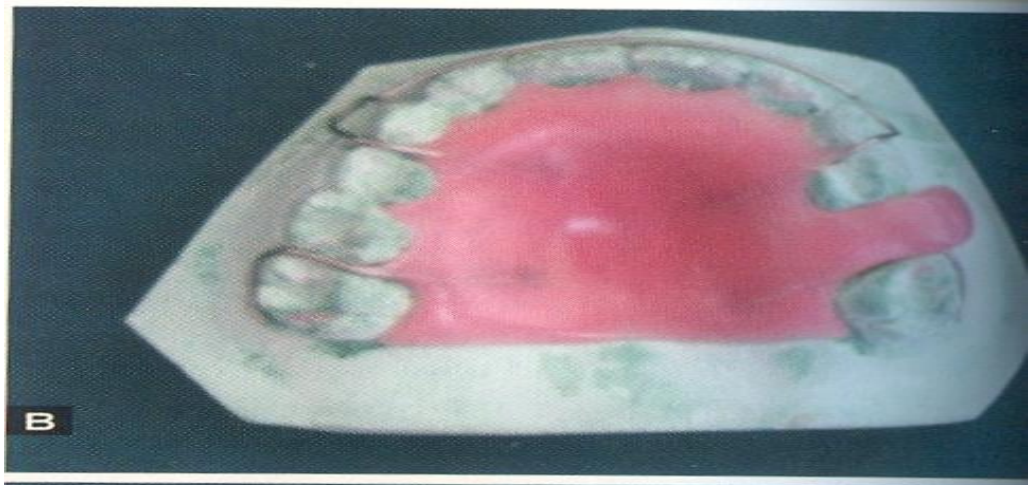
According to **BRAUER**

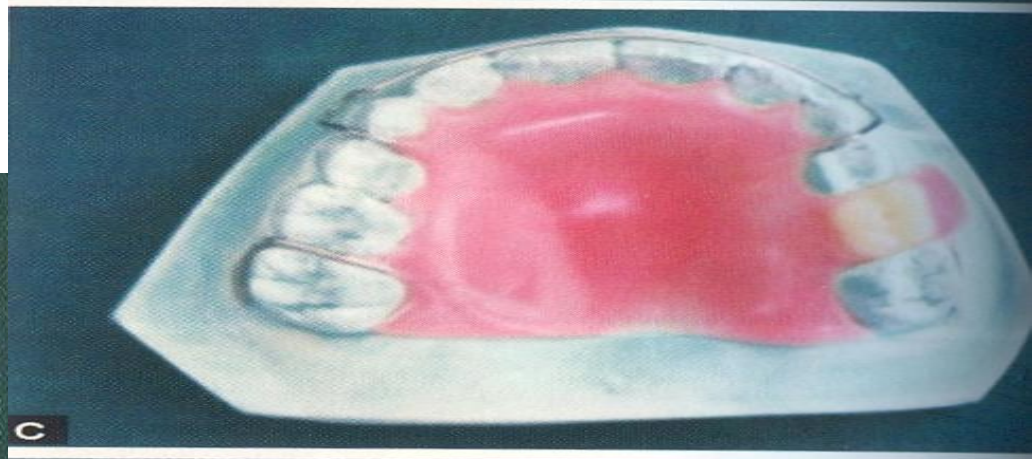
- Class I : unilateral maxillary posterior
- Class 2: unilateral mandibular posterior
- Class 3: bilateral maxillary posterior
- Class 4 : bilateral mandibular posterior
- Class 5: bilateral maxillary anterior posterior
- Class 6: bilateral mandibular anterior posterior
- Class 7: one or more primary or permanent anterior
- Class 8: complete primary

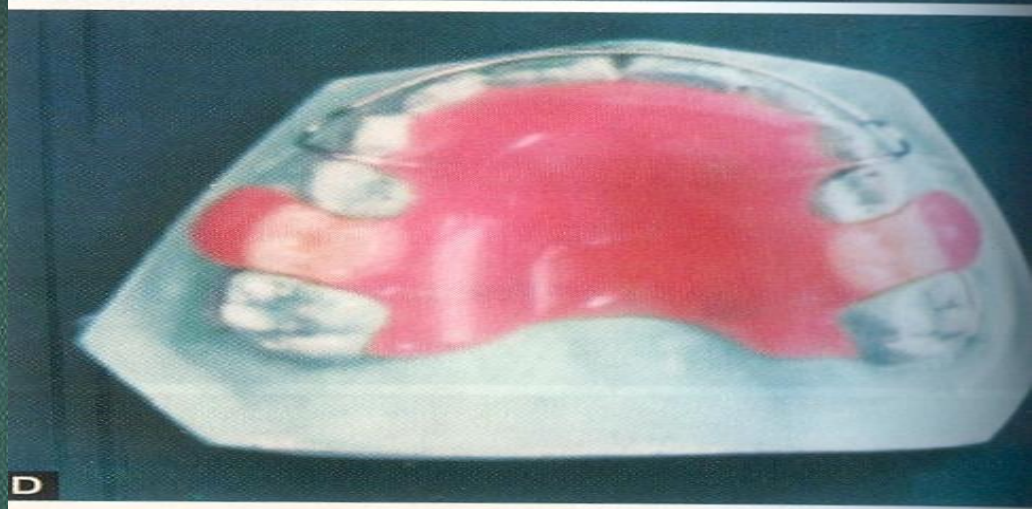

a
b

CLASSIFICATION

- Functional
  - Unilateral functional
  - Bilateral functional
- Non-functional
  - Unilateral nonfunctional
  - Bilateral nonfunctional
- With clasps
- Without clasps







COMPONENTS OF REMOVABLE APPLIANCES

- **Acrylic plate** with extensions on to the edentulous space
- **Clasps** for retention
- **Occlusal rests** if first permanent molars are to be clasped
- **Acrylic teeth**, if the appliance is functional

INDICATIONS

- ❖Aesthetic is of importance
- ❖In cases where the abutment teeth cannot support a fixed appliance
- ❖In cleft patients who require obturation of the palatal defect
- ❖In cases where the radiograph reveals that the unerupted permanent tooth is not going to erupt in less than 6 months time
- ❖If the permanent teeth have not fully erupted(difficult to adapt bands)
- ❖All the primary teeth have erupted.
- ❖Multiple loss of deciduous teeth which may require functional replacement in the form of either partial or complete dentures

CONTRAINDICATIONS

- Lack of patient parent co-operation
- In patients allergic to acrylic materials
- Epileptic patients who have uncontrolled seizures
- High caries active children
- Child not attained mental age of 2.5 years

ADVANTAGES

- Easy to clean
- can be used in combination with other preventive procedures
- Restore vertical direction
- Removed to allow blood circulation(Worn part time)
- Prevent development of aberrant tongue habits
- Improves esthetics, phonetics & mastication
- No need of band construction
- Stimulate eruption of permanent teeth
- Room can be made for permanent teeth to erupt without changing applinaces

DISADVANTAGES

- Lost/broken
- Patient compliance
- Local jaw growth restricted if clasps are incorporated
- Irritate underlying tissues

ACRYLIC PARTIAL DENTURE

- When the number of missing teeth prevents use of a fixed partial denture, a removable partial denture becomes a restoration of necessity

INDICATIONS:

- Excessive span length.
- Inability to achieve adequate retention for a fixed prosthesis.
- Congenital malformations
- Injuries that have caused multiple teeth and often alveolar bone to be lost.

A modified removable space maintainer for compromised dentition of children: a case series

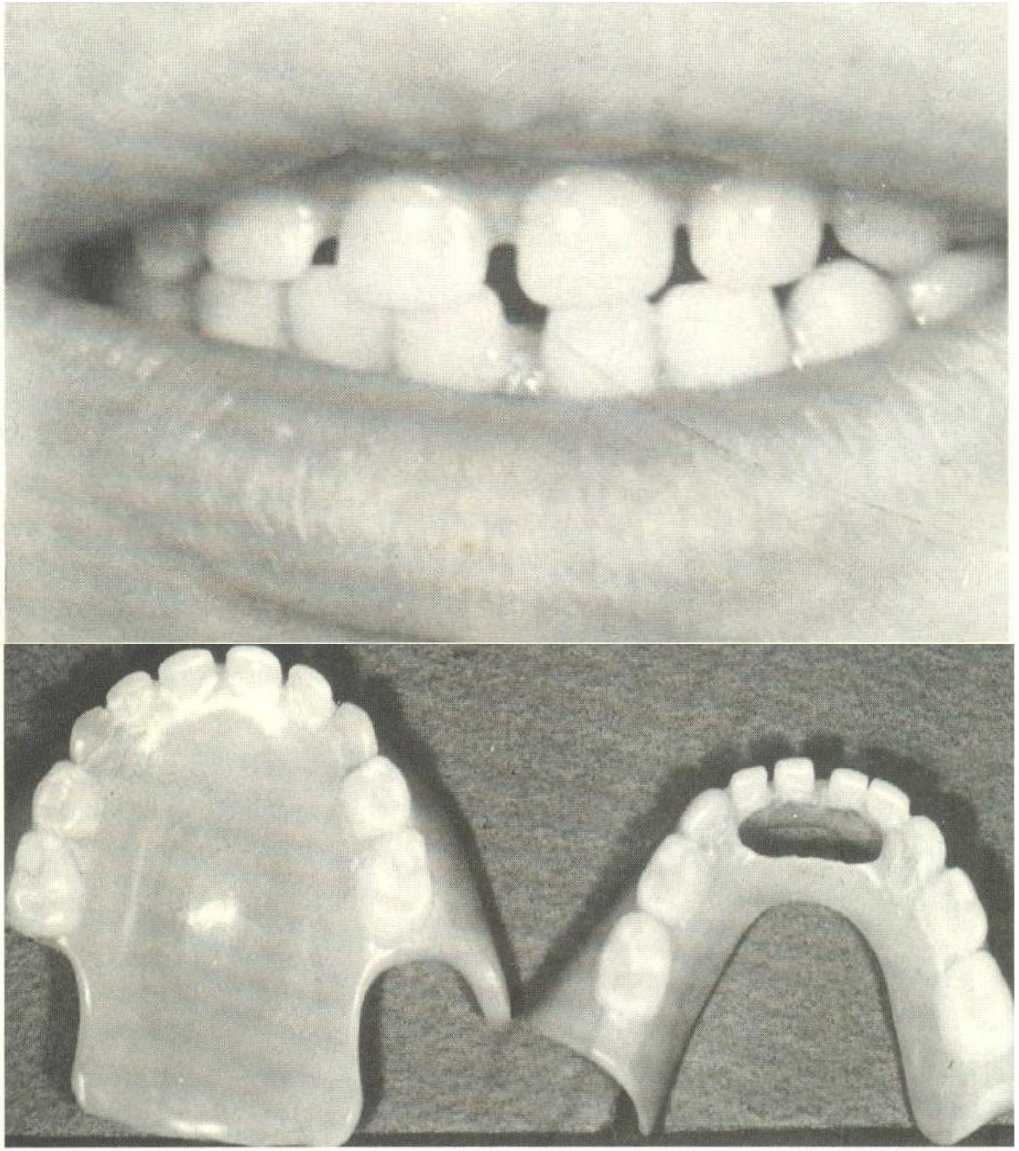
TANYA AGARWAL et al

International Journal of Clinical Pediatric Dentistry (2020): 10.5005/jp-journals-10005-1843

an innovative modified removable functional SM that is a straightforward and rapid method to fabricate but also omits band adaptation in uncooperative children and helps restore the functional harmony.

FULL OR COMPLETE DENTURES

- Due to **rampant caries**, sometimes all the carious unrestorable primary teeth of a pre-school child may require extraction
- This procedure was **more common in pre-fluoridation era**.
- These cases are *managed by the use of a complete denture.*
- It not only restores masticatory function & esthetics, But also guides the first permanent molars into their correct position
- When permanent incisors & first permanent molars erupt, a partial denture space maintainer can be used until the remaining permanent teeth erupt.



REMOVABLE DISTAL SHOE MAINTAINER

- If one or both second primary molars are lost at a short time before the eruption of the first permanent molars, the acrylic removable appliance can be considered.
- An '**immediate' acrylic partial denture** with an acrylic distal shoe extension successfully guides first permanent molar into position.
- The tooth to be extracted is cut away from the stone mode and a depression is cut into the stone model to allow the fabrication of the acrylic extension.
- The acrylic will **extend into the alveolus after the removal of the primary tooth.**
- The extension may be removed after the eruption of the permanent tooth

FIXED SPACE MAINTAINERS

- Fixed space maintainers are the appliances, which are fixed onto the teeth and utilize bands or crowns for their construction

ADVANTAGES

- No tooth preparation
- No interference with abutment eruption
- Jaw growth not hampered
- Guidance of permanent tooth
- Masticatory function restored
- Uncooperative patient

DISADVANTAGE

- Elaborate skill
- Decalcification under bands
- Torque forces on abutment teeth
- Supra eruption if no pontics

BAND AND LOOP

INDICATION (Moyers, 1988)

- Premature loss of any primary 1st molar in primary or transitional dentition & root length of successor is less than one third mature
- Premature loss of primary second molar as the permanent 6 erupted clinically.
- Bilateral loss of single primary molar before eruption on permanent incisor
- Premature loss of primary canine

UNILATERAL, NONFUNCTIONAL, PASSIVE FIXED SPACE MAINTAINER

CONTRAINDICATION(Mattewson)

- Crowded dentition
- High caries activity
- Decalcification under bands
- If it prevent the continuing eruption of opposing teeth
- Interferes with chewing function
- Limited to maintenance of single tooth loss

FABRICATION

Classification of Bands:

According to fabrication:

- **Loop bands**
  a.Precious metal
  b.Chrome alloy bands

- **Tailored bands:**
  a.Precious metal
  b.Chrome alloy

- **Preformed seamless bands**

Band and loop space maintainer - Made Easy

Nayak et al.

J Indian Sot Ped Prev Dent September (2004) 22 (3) 134- 136

- **Direct technique or Single sitting technique** done in 50 cases and found it to be successful without any technical errors.

- The average time taken for the entire procedure from band ***pinching to cementation*** of the space maintainer is **approximately 20 minutes**, which is acceptable by patients and also by dentists

BAND MATERIAL

TOOTH	SIZE
Anterior teeth	0.003 X 0.125 X 2 inches
Bicuspids	0.004 X 0.150 X 2 inches
Primary molars	0.005 X 0.180 X 2 inches
Permanent molars	0.006 X 0.180 X 2 inches

MARGINS OF BAND

TOOTH SURFACE	MARGIN OF BAND
Occlusal	Slightly below the proximal ridges
Gingival	0.5mm-1.0mm into gingival sulcus (Owen et al., 1984)
Buccal	Just below the level where the opposing, cusps touch the grooves
Lingual	Just below the deepest portion of the development groove

STEPS IN BANDING

Fig. 35.2A: Initial spot weld

Fig. 35.2B: Rounding off margins

Fig. 35.2C: Buccal grove adaptation

Fig. 35.2D: Pinching with hoe pliers

Fig. 35.2E: Festooning

Fig. 35.2F: Final pinching with peak pliers

Fig. 35.2G: Spot welding after final adaption

Fig. 35.2H: Presentation of band

Fig. 35.2 I: Seating of band

Fig. 35.2J: Infolding of seam

Fig. 35.2K: Final spot welding of band seam

Fig. 35.2L: Completely adapted band

TRANSFER OF BAND TO CAST

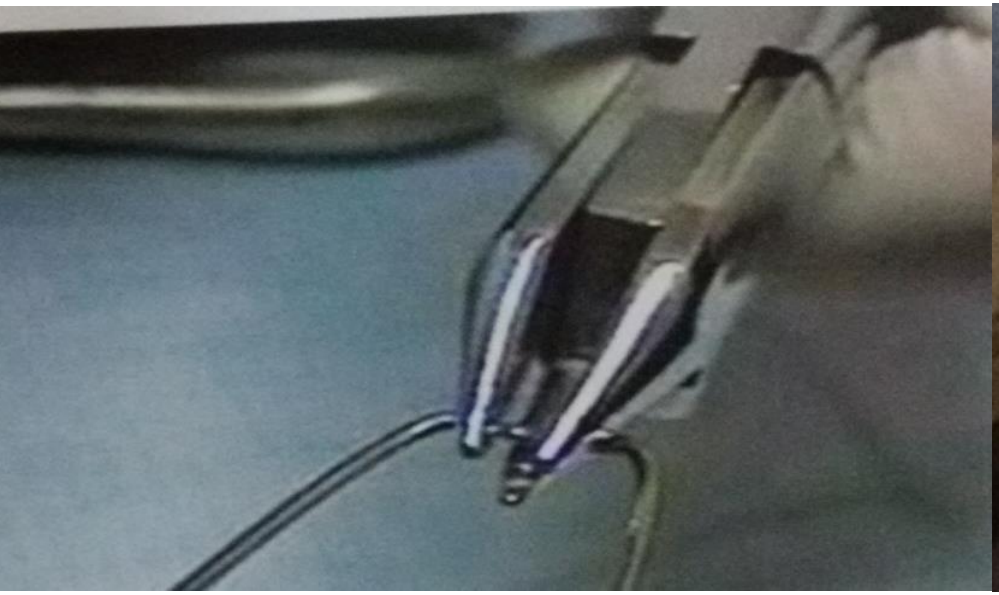
LOOP FABRICATION

- Loop should be made parallel to edentulous ridge, 1mm off the gingival tissue and should rest against the adjacent tooth at the contact area.
- Faciolingual dimension – 8-9mm
- Distal free end should lie in the middle of band.

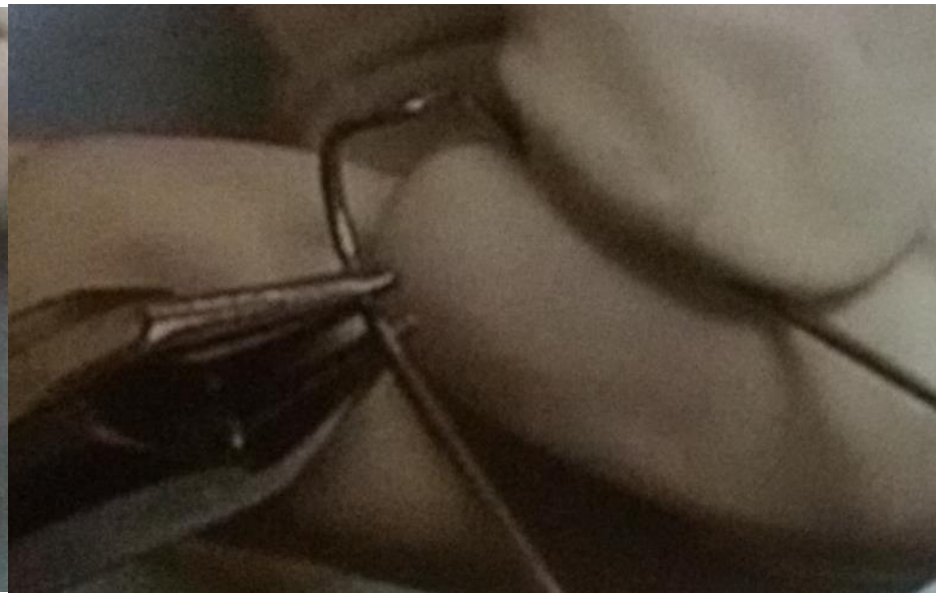
DESIGN OF WIRE LOOP

- LOOP ARMS PLACEMENT
- CONTOUR OF LOOP
- FACIOLINGUAL HEIGHT
- WIDTH OF LOOP

DESIGN OF WIRE LOOP



Bending of wire using three prong pliers



Bending of the arms

should be placed at the junction of middle and cervical third of the crown

Fig. 35.3A: Initial loop fabrication

Fig. 35.3B: Curve formation with three prong plier

Fig. 35.3C: Adaption according to mucosa

Fig. 35.3D: Marginal adaption of loop

Fig. 35.3E: Retentive band of loop

Fig. 35.3F: Complete loop placement

SOLDERING

OXIDISING CONE
COLOUR - BRIGHT ORANGE

This is the coolest part of the flame(1000°C-1500°C) where all the gas has burnt and an oxidising atmosphere is created. This is due to combustion occuring with the oxygen in the air.

This area of the flame is used to heat pieces surrounding the area to be soldered and for slow warming of the flux to stop the solder from moving.

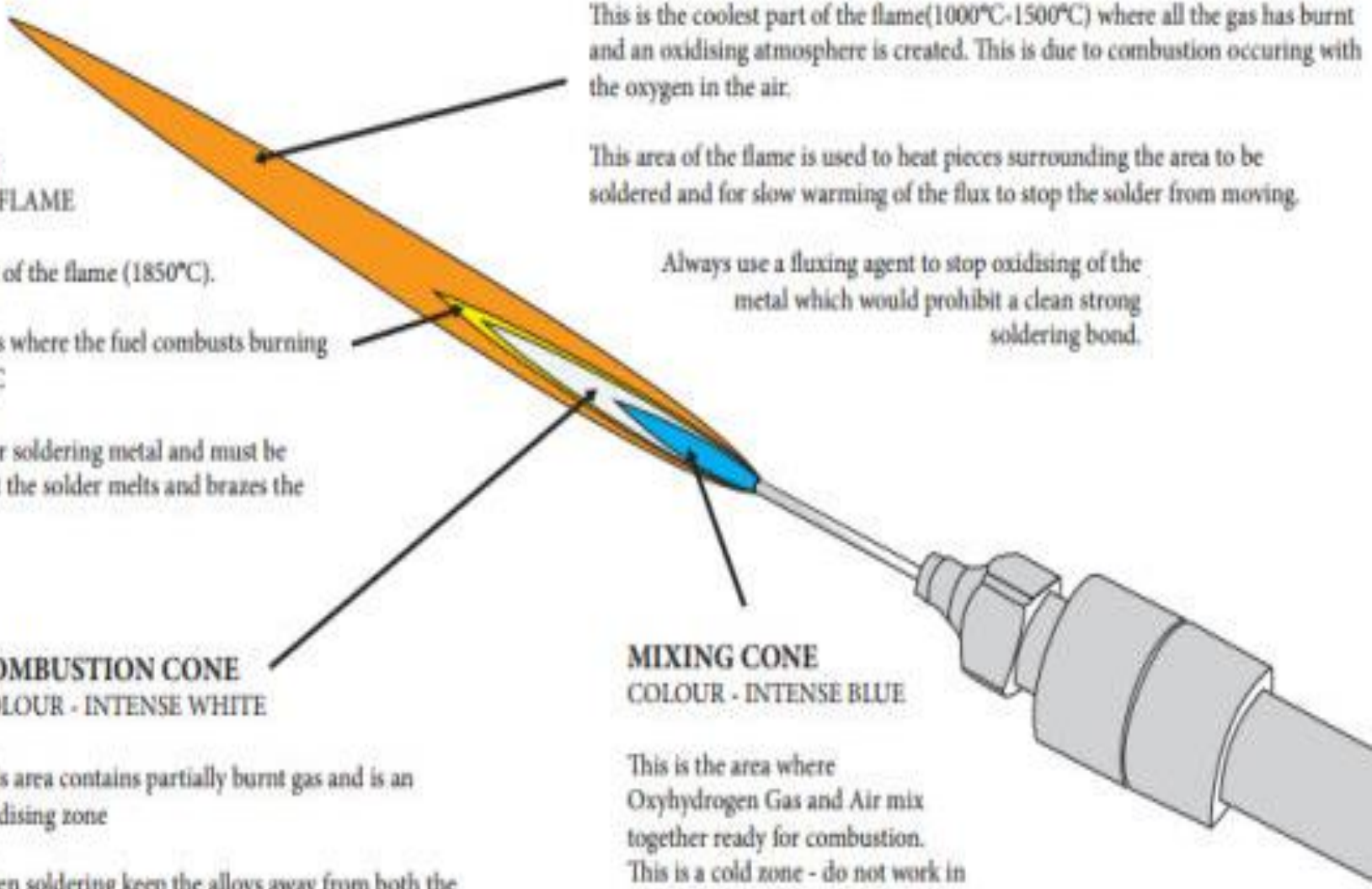
Always use a fluxing agent to stop oxidising of the metal which would prohibit a clean strong soldering bond.

REDUCING CONE
COLOUR - YELLOW FLAME

This is the Hottest Part of the flame (1850°C).

This part of the flame is where the fuel combusts burning at approximatly 1850°C

This is the ideal area for soldering metal and must be kept in this zone whilst the solder melts and brazes the peices together.



COMBUSTION CONE
COLOUR - INTENSE WHITE

This area contains partially burnt gas and is an oxidising zone

when soldering keep the alloys away from both the mixing and combusition cones.

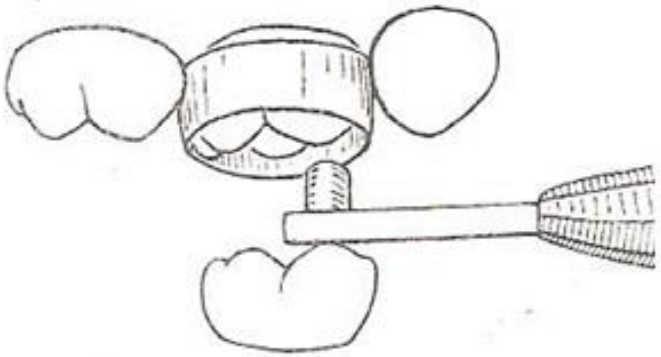
MIXING CONE
COLOUR - INTENSE BLUE

This is the area where Oxyhydrogen Gas and Air mix together ready for combustion. This is a cold zone - do not work in this area

FINISHING AND POLISHING

Finished solder joint	Smooth & free of porosity
Smooth transition	Green stone is used to contour
Surface roughness reduction	Rubber wheels
Final polishing	Gold rouge & rag wheel

PRE CONTOURED BANDS



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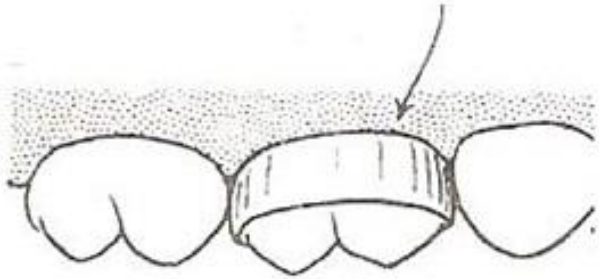

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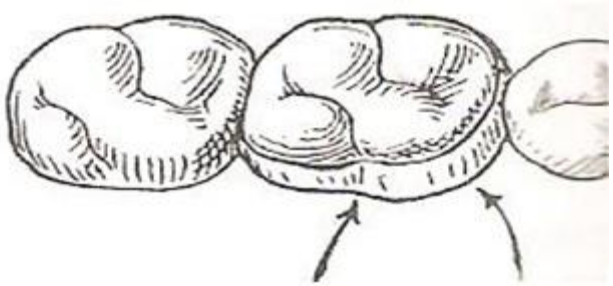

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ADVANTAGES

- Construction easy and fast
- Many modifications
- Inexpensive
- Easily adjustable
- Allow eruption of permanent teeth
- Non invasive
- Painless

DISADVANTAGES

- Cannot stabilize arch
- Non functional
- Slippage of loop by forces
- Not for multiple tooth loss
- Breakage of band material
- Decementation of band
- Two visits required for fabrication
- laboratory expenses
- Potential to cause soft tissue injury from fixed appliances
- First permanent molars can tip mesially more than in bilateral space maintainers

Space maintainers in the primary and mixed dentition – a clinical guide
BRITISH DENTAL JOURNAL | VOLUME 225 NO. 4 | AUGUST 24 2018

MODIFICATIONS

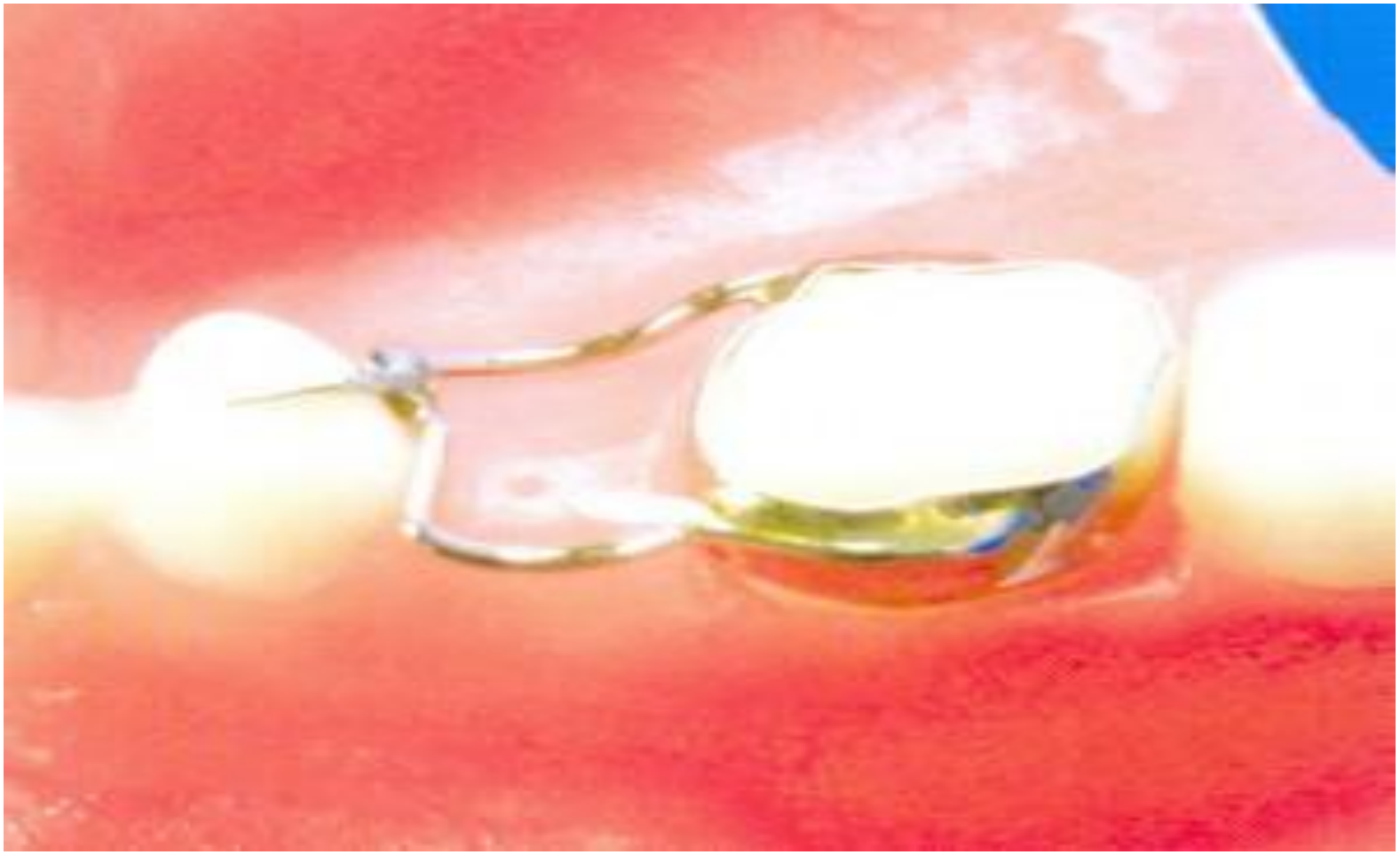
- Crown and loop
- Crown and loop with occlusal rest
- Reverse band and loop
- Band & loop appliance with occlusal rest
- Bonded band and loop
- Band and Bar

STOPPERS

- **Robert Rapp and Isik Demiroz (1983):** Stoppers can be used to prevent gingival as well as buccal movements of loop

WITH OCCLUSAL REST

An occlusal rest can be soldered on the anterior end of the loop to avoid gingival dislodgement of the appliance from masticatory forces and subsequent mesial tipping of the posterior tooth.



BUCCAL BAR

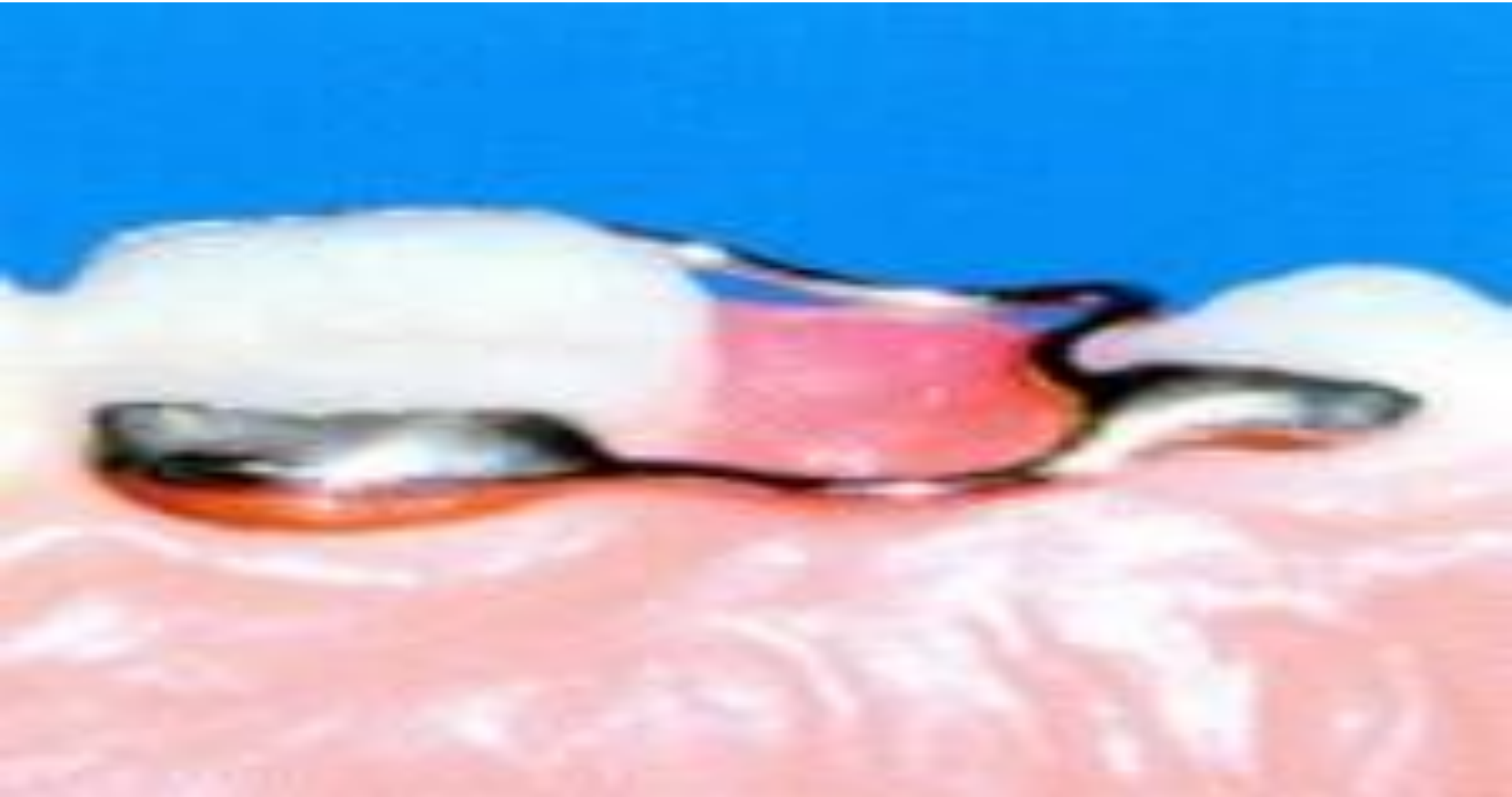
It is important that the appliance is restricted to single unit spaces

as the loop has limited strength and will not withstand the forces of mastication if the span is any longer.

BONDED SPACER

This appliance is bonded to both the buccal and lingual surface of the **partially erupted molar.**

When the other abutment tooth has a **well-defined occlusal surface**, a simple wire rest will suffice.



OCCLUSAL BAR

This two-band space maintainer with an occlusal bar is designed top prevent supra-eruption of the opposing teeth.

This cleansable design allows patients to easily maintain their oral hygiene.

OCCLUSAL PAD

- This two-band space maintainer has an acrylic pad over the edentulous region.

CROWN AND LOOP

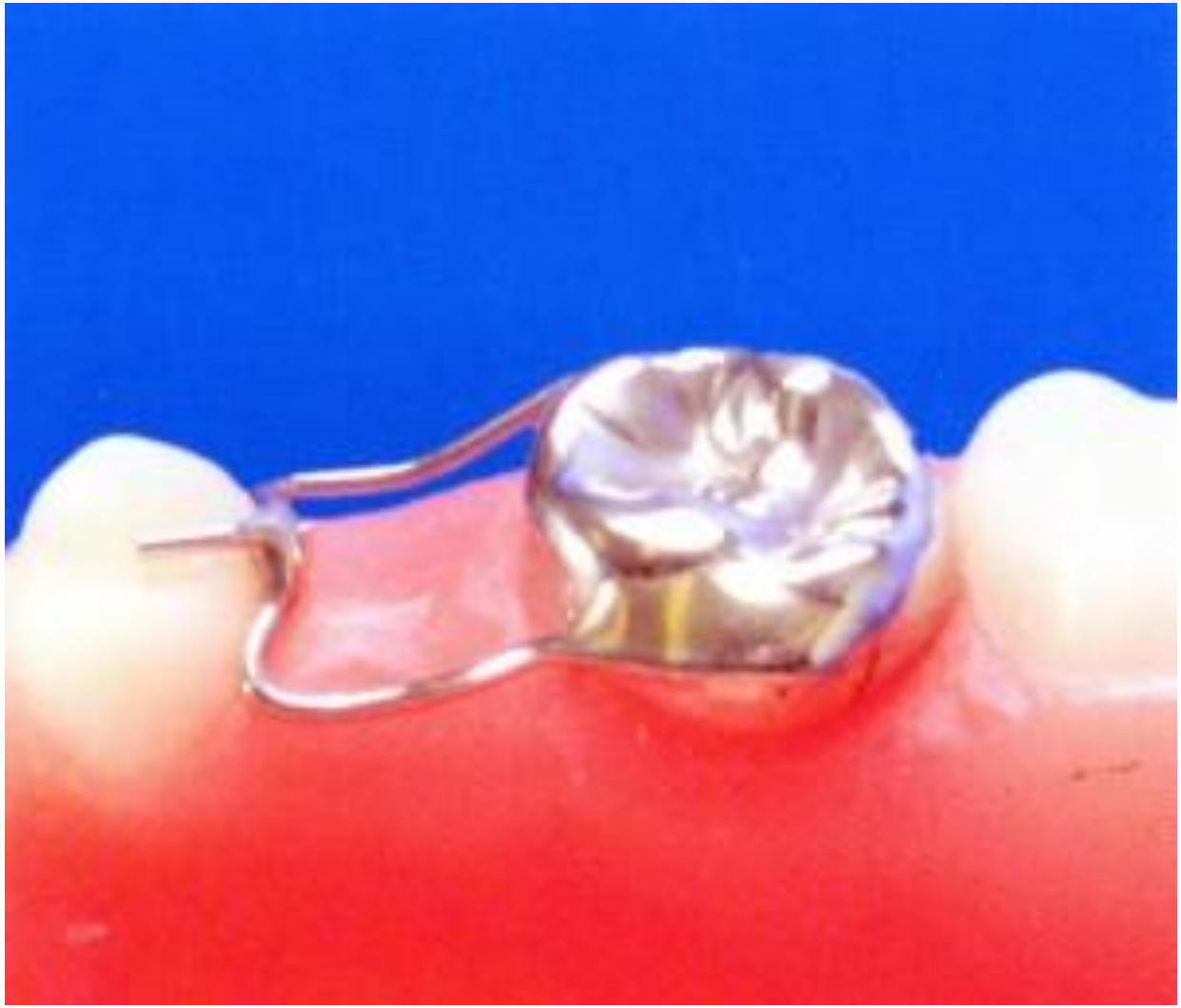
Same as band and loop but a stainless steel crown is used on abutment tooth instead of a band

CROWN BAND AND LOOP

Abutment tooth with crown is banded to place a space maintainer.

As with the other unilateral space maintainers, an occlusal rest on the adjacent tooth will prevent unwanted mesial tipping of the molar

CROWN AND LOOP WITH OCCLUSAL REST



MAYNES SPACE MAINTAINER

- Band and loop in which the loop is halved
- Only lingual extension given

REVERSE BAND AND LOOP

Reverse band and loop is given when there is premature loss of primary second molar and the permanent molars have not erupted fully to support a band

TRANSFER OF BAND FROM 74 TO 36

BAND AND BAR

Prevents eruption of premolar
Not used now a days

LONG BAND AND LOOP

Multiple loss of teeth in one segment

Lingual arch cannot be given due to eruption status or if removable appliance contraindicated

SUCCESS AND SURVIVAL RATES OF BAND AND LOOP (B&L) COMPARED TO CROWN AND LOOP (C&L) SPACE MAINTAINERS

- Evaluate the success and survival rates of band and loop (B&L) compared to crown and loop (C&L) space maintainers.

- The failure rate and mean survival time for C&Ls were clinically and statistically significantly better than those for B&Ls.

- Depending on the clinical presentation of the abutment tooth and the intended life expectancy of the space maintainer among other factors, it is recommended that, ***where a space maintainer is indicated in the primary dentition, preference is given to C&L over B&L space maintainers.***

Qudeimat MA, Sasa IS.
Clinical success and longevity of band and loop compared to crown and loop space maintainers.
European Archives of Paediatric Dentistry. 2015 Oct;16(5):391-6.

LITERATURE REVIEW

- **Garg et al & Subramaniam et al** showed **failure of FRCR** is due to **debonding of enamel composite** because of its placement on primary teeth

- Primary teeth shows the **presence of prismless enamel** areas which had **negative effect on resin retention**

- **Septia et al** comparing **Band & Loop, Ribond & Super splint** found **super splint** to be least successful SM in terms of long term retention & gingival health

Inside of band and outside of band bearing surface of SS crowns **scored lightly c diamond bur** to improve retention

MacDonald et al

If **bands and loops** are being has been used since long as a space maintainer with **good high success rates**

Baroni et al, Rajab (2002),Fathian et al.

Mean survival rate of **BLSM** using GIC cement is **13 months**

Sasa et al

Inspite of *good patient compliance, disintegration of cement, solder failure, caries formation* along the margins of the band and *long construction time* are some of the disadvantages associated with them

Kirzioglu et al,2004

Use of either **zin phosphate or polycarboxylate** to attach BLSM was recommended

Croll,1983

Most frequently used is **BLSM**

Wright & Kennedy

Original Article

Banded versus Single-Sided Bonded Space Maintainers: A Comparative Study

Sudhir Mittal, Archana Sharma, Amit Kumar Sharma, Kamal Kishore Gupta, Ankita Gaur, Vasundhra Pathania

Department of Pedodontics, Himachal Dental College, Sunder Nagar, Himachal Pradesh, India

Abstract

Background: The present study is conducted to evaluate and compare the clinical performance of conventional band and loop space maintainer and fiber reinforced composite resin (FRCR) space maintainers. **Materials and Methods:** A total of 45 extraction sites in the age group of 6–9 years having premature loss of primary molars or indicated for extraction were selected for the study. The patients were randomly divided into three groups as Group I, in which conventional band and loop space maintainer was given, Group II and Group III (FRCR), in which FRCR (everStick CandB) and impregnated glass fibers (Interlig) space maintainers were given, respectively. Patients were recalled at 3, 6, and 12-month interval for evaluation of all the three types of space maintainer. **Results:** Overall success rate of Group I was 86.7%, for Group II was 80%, and for Group III was 73.3% at the end of the study. Patient acceptability was significantly higher in Group II and Group III (FRCR) as compared to Group I (Conventional band and loop). In Group I, cement loss and fracture of loop, whereas in Group II and Group III, debonding at enamel composite was the most common failure followed by debonding at fiber composite and fiber fracture. FRCR space maintainers were found to be cost-effective as compared to Group I. More linear changes and angular changes were recorded in Group I as compared to Group II and Group III but difference was not significant ($P > 0.05$). **Conclusion:** Only single (buccal) surface application of FRCR space maintainers showed almost equal clinical efficacy compared to conventional band and loop space maintainer with significantly better patient acceptability, less cost, and time taken.

Keywords: Conventional band and loop, fiber reinforced composite resin, space loss, space maintainers

The average survival period of bonded space maintainers is **11.2 months.**
However, there is a necessity for additional clinical trials with strict protocols to better the level of evidence.

Deshpande et al, 2018.

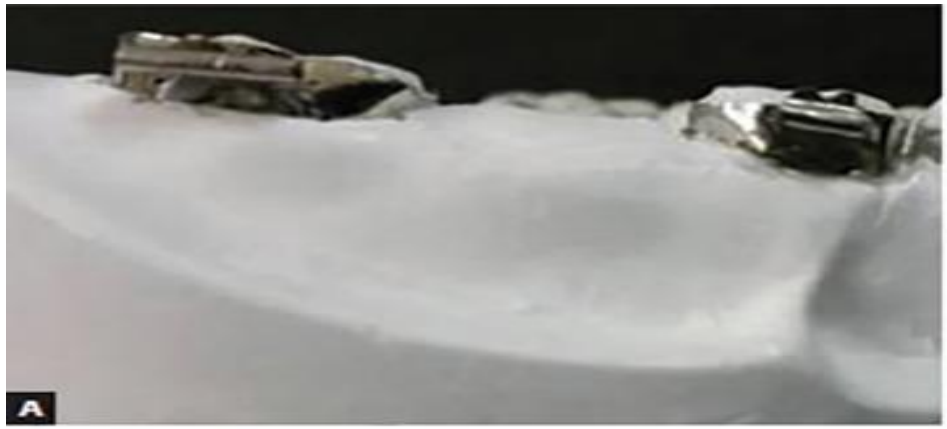
Survival of Bonded Space Maintainers: A **Systematic Review.**

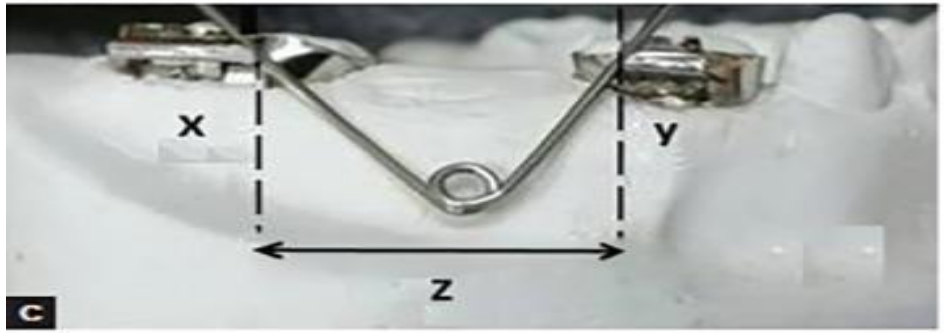
International Journal of Clinical Pediatric Dentistry.

SPACE MAINTENANCE WITH AN INNOVATIVE “TUBE AND LOOP” SPACE MAINTAINER (NIKHIL APPLIANCE)

- **Nikhil et al**
- **IJCPD – 2016**
- A 7 yr old patient with Grossly mutilated primary maxillary left second molar (tooth number 65).

TUBE AND LOOP





ADVANTAGES OF TUBE AND LOOP OVER CONVENTIONAL BAND AND LOOP

- Fabrication to delivery can be *completed in* ***one sitting***.

- **Baroni et al** in their study found that **solder breakage** was the most common cause of failure and accounted for **37%** of the total failures.

- Easily be rotated up for **routine cleaning of the area, adjusted/activated by coiling or uncoiling the helix** and **even removed** if required, without disturbing the bands.

Reason for failure of Band & Loop

- Several investigators have suggested **various reasons for this kind of failure, *viz.*,**

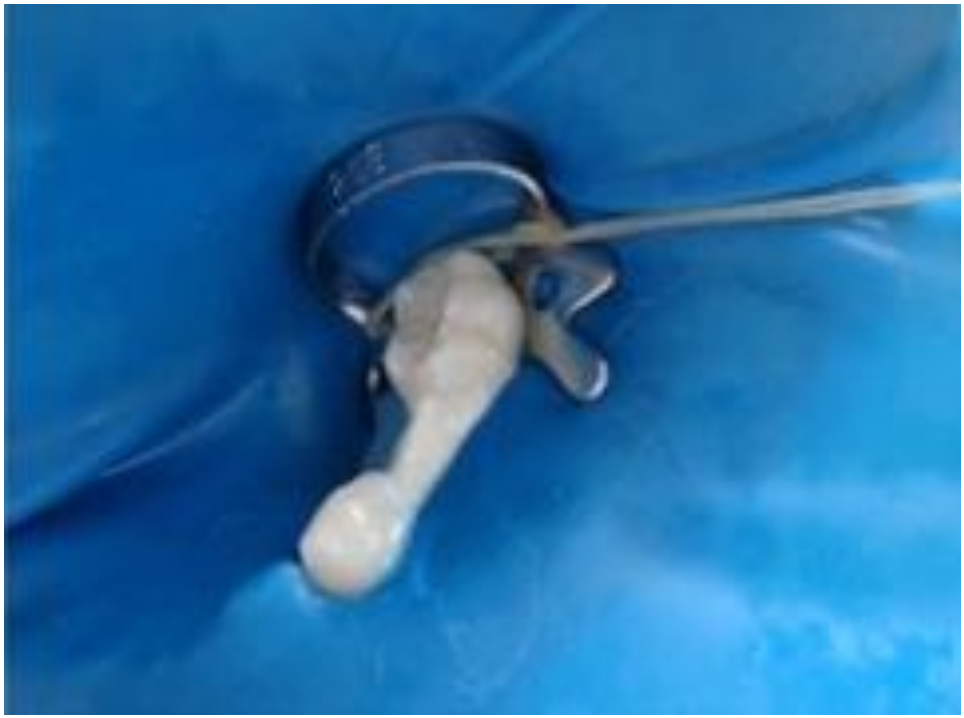
1. Incomplete solder joint,
2. Overheating of the wire during soldering,
3. Wire thinned by polishing,
4. Remnants of flux on the wire and
5. Failure to encase the wire in the solder.

BONDED SPACE MAINTAINER

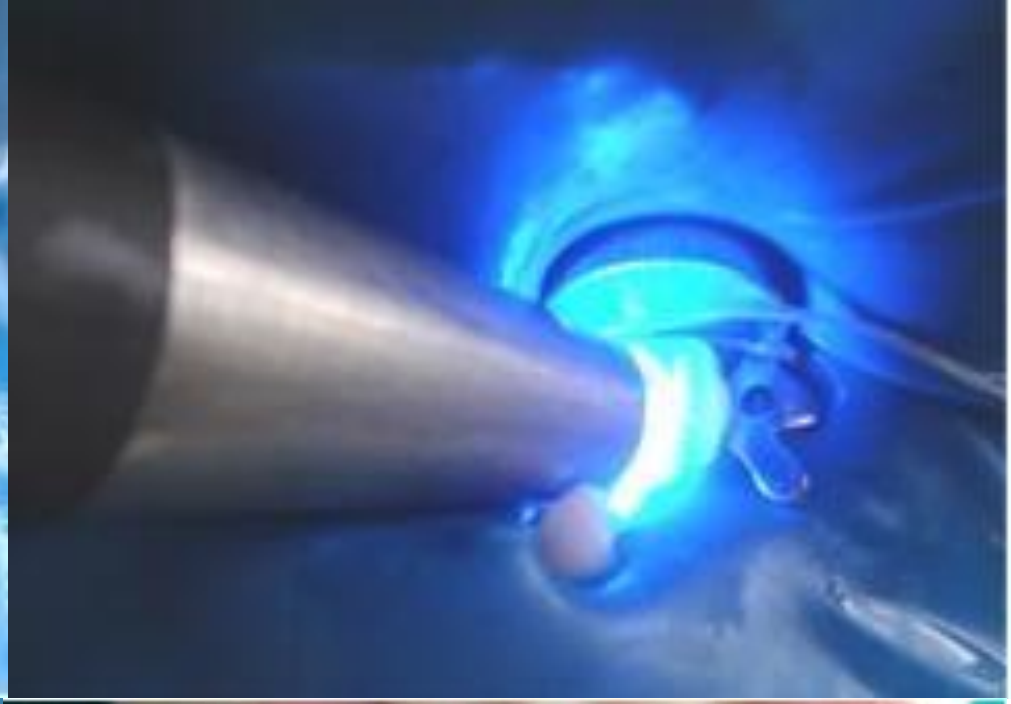
- Ribbond is a biocompatible esthetic material made from high strength polyethylene fibres.

Advantages

1. Ease of adhesion to the dental contours,
2. Fast technique of application and
3. Good strength .



FRCR - RIBBOND BANDS

To overcome the disadvantages of Conventional B & L (Wright GZ, Kennedy DB)

- Well tolerated by patient
- Less time consuming
- Esthetic

Common problems faced in FRCR

- Debonding of enamel, composite was the most common complication leading to failure followed by debonding of fiber composite.

Garg et al
'Metal to resin': A comparative evaluation of conventional band and loop space maintainer with the fiber reinforced composite resin space maintainer in children. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2014 Apr 1;32(2):111.

Chandra & Krishnamoorthy et al
International Dental & Medical Journal of Advanced Research • Vol. 4 • 2018

CORRESPONDENCE

ILL effects of Conventional band and loop space maintainers: Time to revolutionise

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Keywords:
Conventional band and loop space maintainer, Fiber-reinforced composite resin system, Fixed space maintainer, Malocclusion, Space maintenance

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Abstract

Background: Premature loss of primary teeth due to caries, trauma, or any other cause ultimately leads to undesirable movement of primary and/or permanent teeth resulting in arch length deficiency. Such a loss can produce or increase the severity of malocclusions with rotations, ectopic eruption, crowding, excessive overjet and overbite, unfavorable molar relationships, and crossbite. Pediatric dentist as a part of managing developing occlusion prefers the use of space maintainers to eliminate or decrease the severity of such malocclusions. Fixed space maintainers are usually indicated to maintain space created by unilateral/bilateral premature loss of primary teeth in either of the arches. Of the various fixed space maintainers, band and loop type is most frequently used. Even though it has high success rate and good patient compliance, there are disadvantages in its construction and longevity.

Aim: In the present case series, we highlight ill effects of conventional band and loop space maintainers with appliance acting as plaque retentive causing gingival enlargement, mucosal overgrowth on the loop, band displacement causing blanching of gingiva, loop impingement on the mucosa causing ulceration, pain, and cement disintegration around the band.

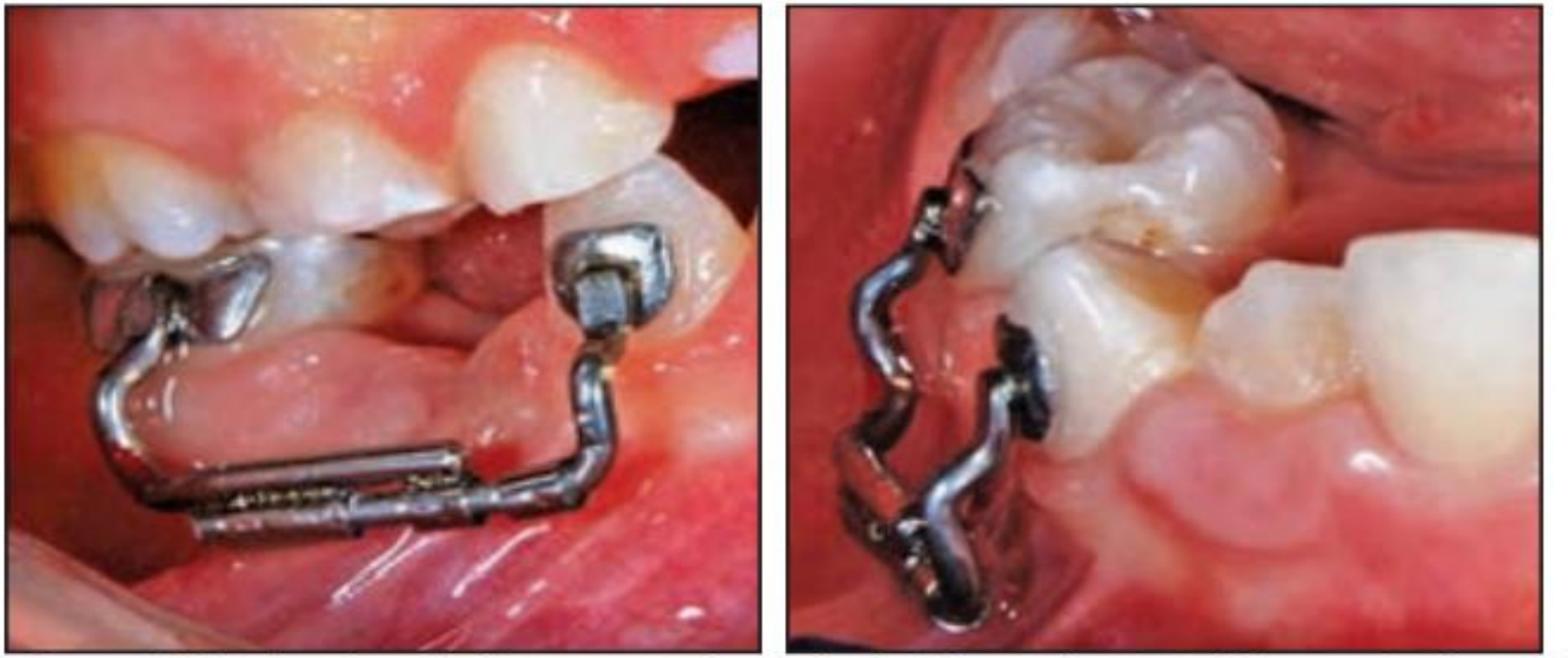
Conclusion: In the era of bondontics and with the advent of newer materials such as fiber-reinforced composite resin system (FRCR), now, it is the time to revolutionize the conventional band and loop space maintainers to overcome the disadvantages.

Clinical Significance: FRCR as space maintainers are esthetic which is need of the hour in the present century, easy to clean, does not impinge on the soft tissue and with no laboratory procedure involved.

EZ SPACE MAINTAINER.

Güray E. EZ Space Maintainer.

- Developed by **Dr Enis Gurray** in 2008
- The appliance is adjusted according to the mesiodistal dimension of the extraction space, then stabilized by squeezing one of the tubes with a plier.
- Can be modified by **NiTi coil** to regain space



EZ Space Maintainer bonded 2mm away from gingival tissue (reprinted by permission of D

Band and loop space maintainer with unilateral band and bent was used in cases of space loss

Pushpalatha et al, 2016

Journal of Dental & Oro-facial Research, Vol 12, Issue 02, Aug 2016

LINGUAL ARCH

- Most effective, custom-made appliance, popularized by **Burstone**
- Mandibular **fixed bilateral nonfunctional passive**

ARCH HOLDING APPLIANCE

- Maintains arch perimeter:
- Prevents both mesial and lingual drifting of molar tooth & Lingual collapse of anterior teeth

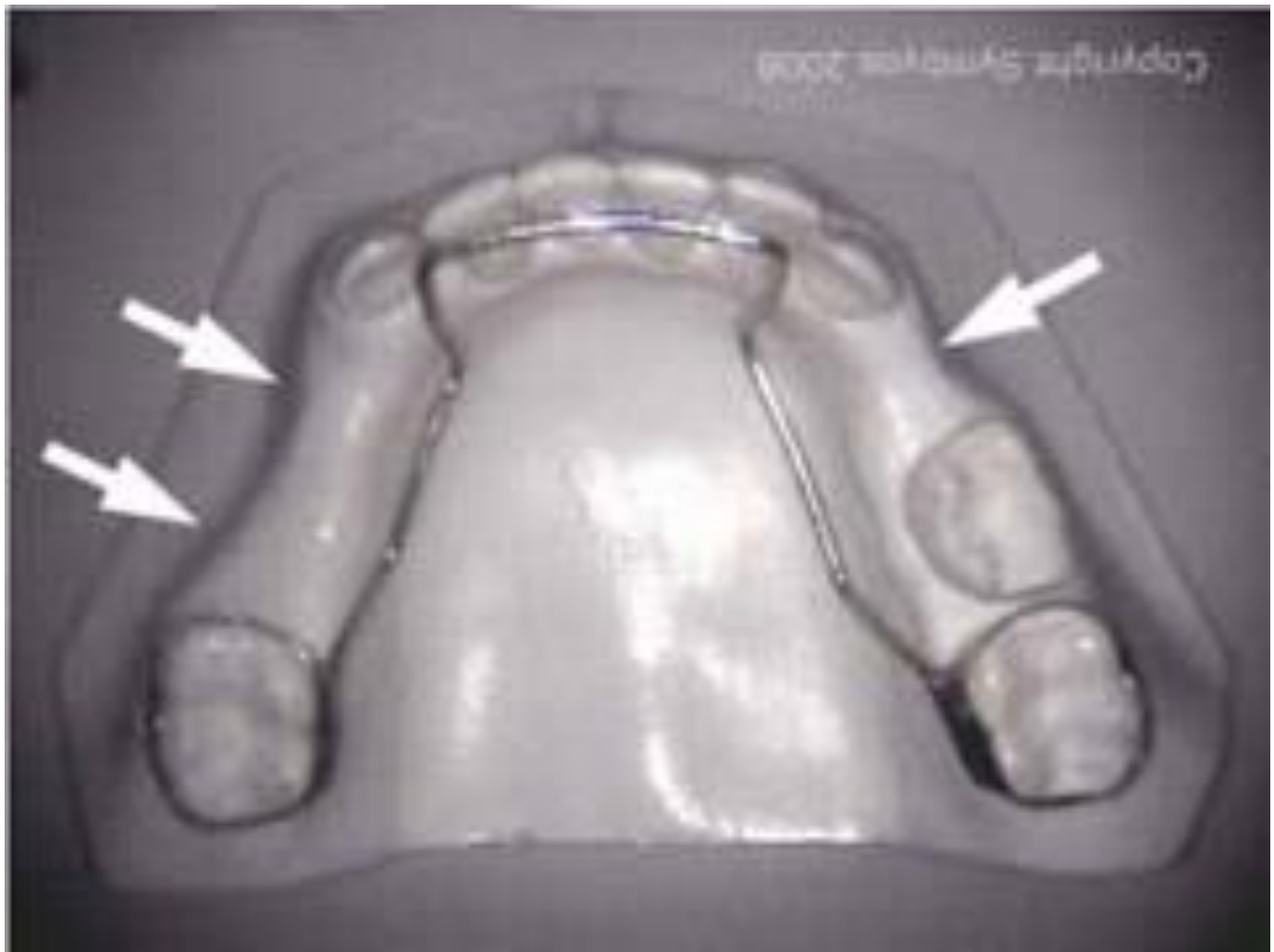
FABRICATION

Arch wire should contact at the cingulum
Rest 2mm below the gingival margin
Soldar joint parallel to band & in mid third
Should meet the band at the mesiobuccal cusp

INDICATION

- Bilateral single or multiple tooth loss in mandible
- Not recommended when primary incisors still present

• Minor space regaining



CONTRAINDICATION

- Primary dentition

ADVANTAGES:

- Excellent source of anchorage, because it incorporates resistance of several teeth
- Allows free individual movement of teeth while maintaining space
- Causes little or no inconvenience to the patient
- Less bulky than acrylic space maintainer
- Less conspicuous than other space maintainers
- Serves as a space maintainer for more than one succedaneous tooth in the arch

DISADVANTAGES:

- Decalcification of the teeth
- Arch wire may become embedded into the soft tissue
- Wire may be distorted by masticatory forces and move teeth into undesirable positions

MODIFICATION

1. Hotz lingual arch with U loop
2. Removable lingual arch
3. Omega bends

MODIFICATION

- **HOTZ LINGUAL ARCH**
- U loop for space regaining
- Distalization of molars

- **OMEGA BENDS**

Given in canine region to prevent interference

Omega bends act as stops

Prevents distal tipping of anterior teeth

Konstantinos *et al*

- **REMOVABLE LINGUAL**
  Special attachments to the bands permit the construction of a lingual arch wire that is removable for easy adjustment of the loops or for adding attachments

TYPES

Fixed: by soldering

Semifixed: by locking

LINGUAL ARCH WITH FINGER SPRING

- Finger springs placed distal to the primary canines are sloped in a distobuccal direction to facilitate canine repositioning

FUNCTIONAL LINGUAL ARCH WITH HINGE-TYPE LOCKABLE DENTULOUS COMPONENT

- **Hinge-type design** provides easy visualization of the ridge by opening the dentulous component.
- Periodic inspection of the ridge is required to check for any mucosal alterations and to check for eruption of the premolars.
- The **locking component** can be opened by cutting and removing the wire that passes through the molar tubes on the buccal aspect.

Paul Chalakkal et al

Int J Clin Pediatr Dent. 2017

Functional Lingual Arch with Hinge-type Lockable Dentulous Component

NANCE PALATAL ARCH SPACE MAINTAINER

- Bilateral non-functional passive maxillary fixed appliance
- H.N. Nance in 1947

INDICATION

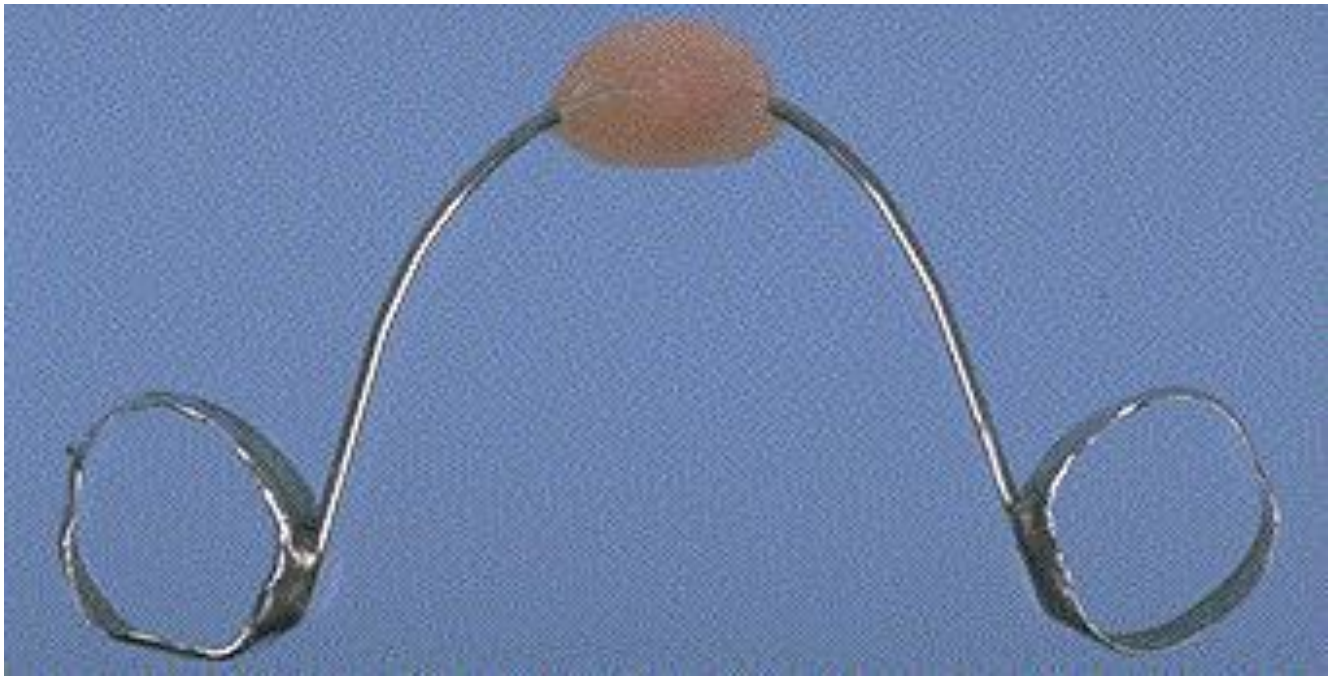
- Bilateral premature loss of primary molars
- Rest away from incisors so good for primary dentition

Contra indications

- Palatal lesions
- Ist permanent molars are unerupted

design

Kupietzky and Tal (2007) compared the use of the TPA and the Nance appliance,



Nance palatal appliance

disadvantage

- Soft tissue irritation
- Pressure effects
- Acrylic allergy

advantage

- Modified nance palatal arch for unilateral molar distalization

Unilateral spring space regainer: A smart way to drive molar distally

Nance palatal arch for distalization of molars

Case report

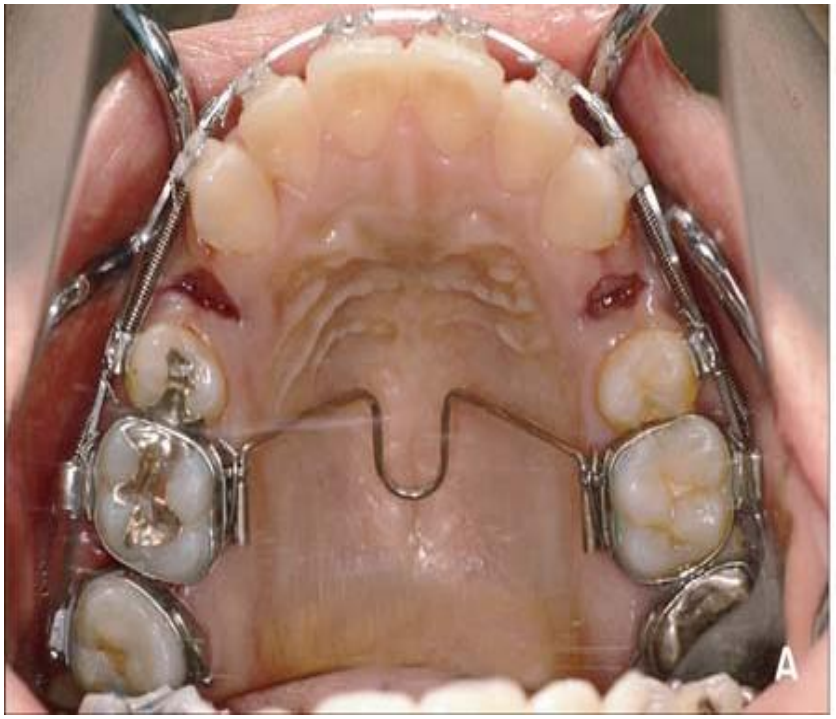
Distalization of molars

TRANSPALATAL ARCH

- Originally described by Robert Goshgarianin 1972
- Unilateral, nonfunctional. Passive, fixed maxillary appliance
- Cases of Primary molar extraction

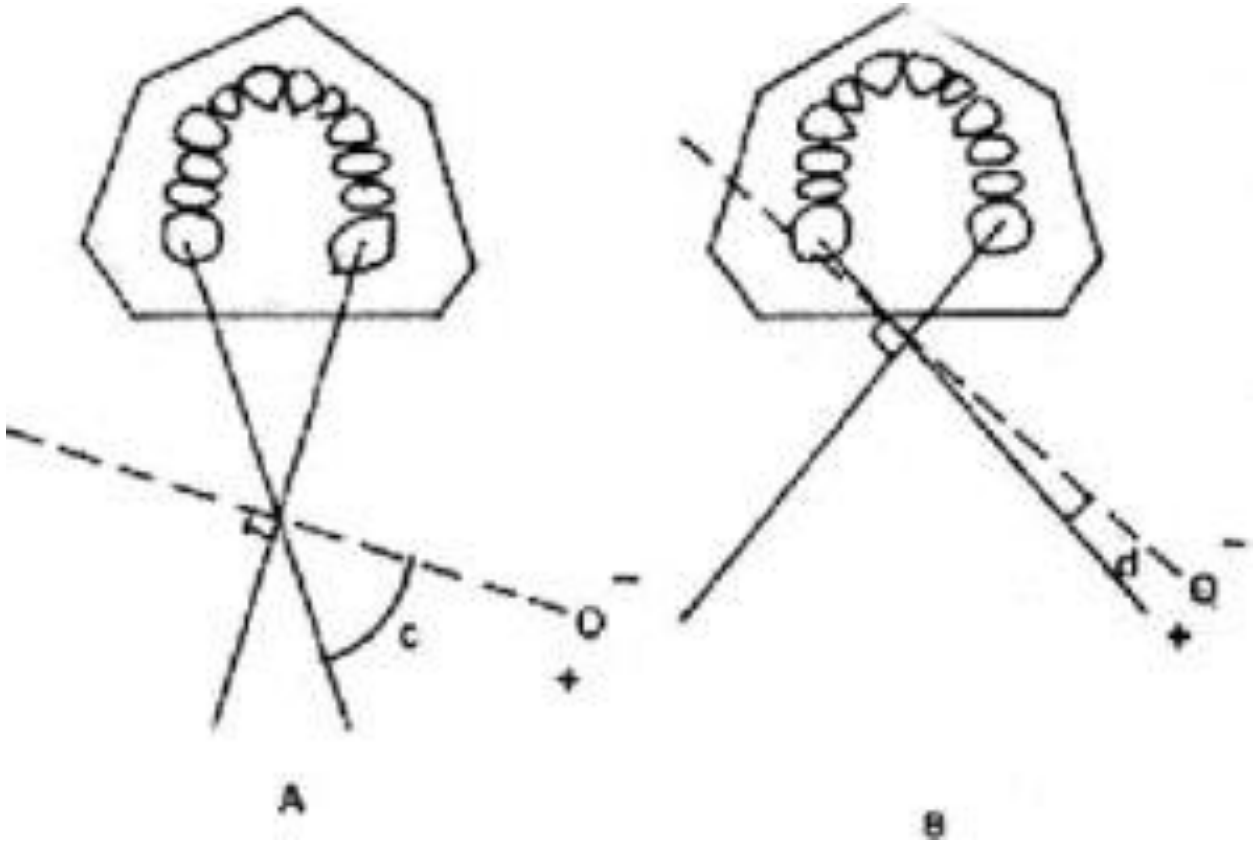
Indication

- Intact one side and missing opposite sides
- Primary molars lost bilaterally
- Prevent molar from rotation
- Arch expansion



DISADVANTAGE

- Molars may tip together
- Molars may rotate



DISTAL SHOE APPLAINCE

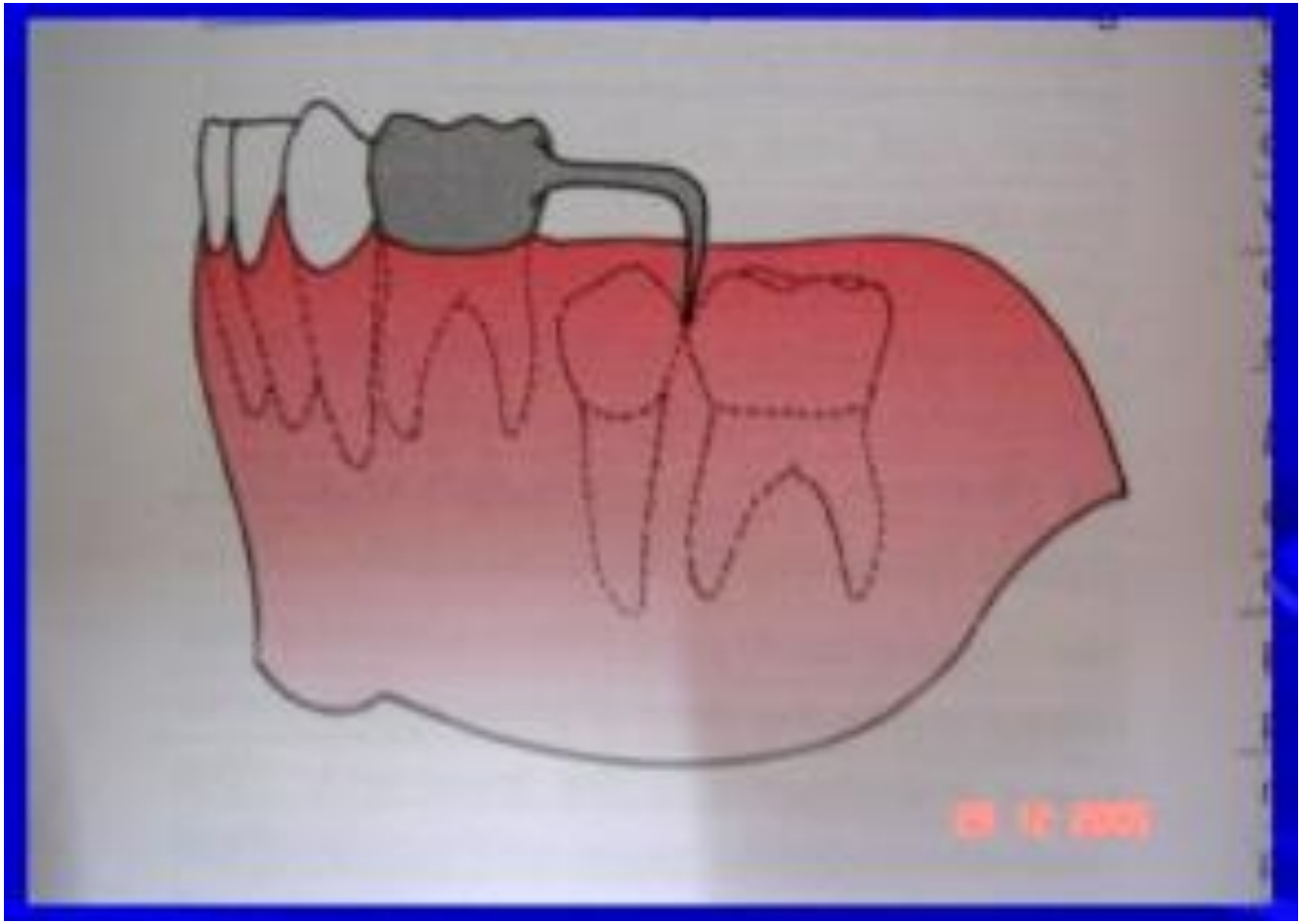
- Intra alveolar appliance
- Guiding eruption of permanent molars in mandible

DESIGNS

- WILLETS distal shoe
- ROCHES Distal shoe

construction

- Distal extension:
- Length of extension: 1mm below the mesial marginal ridge of erupting 1st molar



The procedure for distal shoe placement involves :

- first appointment for extraction of the primary second molar and impression taking.
- At the second appointment, an incision is made in the gingival tissues immediately mesial to the first permanent molar so that the distal shoe can be embedded in tissue, and the appliance is then cemented into place.
- Some clinicians combine the extraction and placement procedure to reduce patient discomfort from local anaesthetic administration at both appointments.
- Alternatively, prefabricated distal shoes may be used, although as they are not customized to the patient, they are unlikely to be acceptable in every situation

INDICATIONS

- When second primary molar is lost before eruption of first permanent molar

CONTRAINDICATIONS

- Inadequate abutments
- Poor hygiene
- Medically compromised patient
- Congenitally missing 1st permanent molar

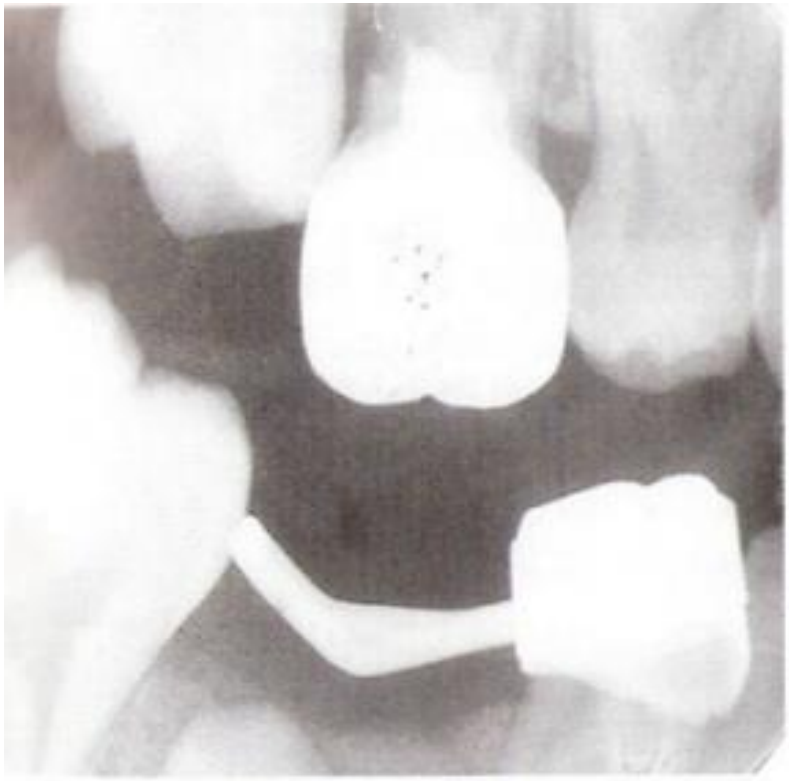
Guiding of permanent molar

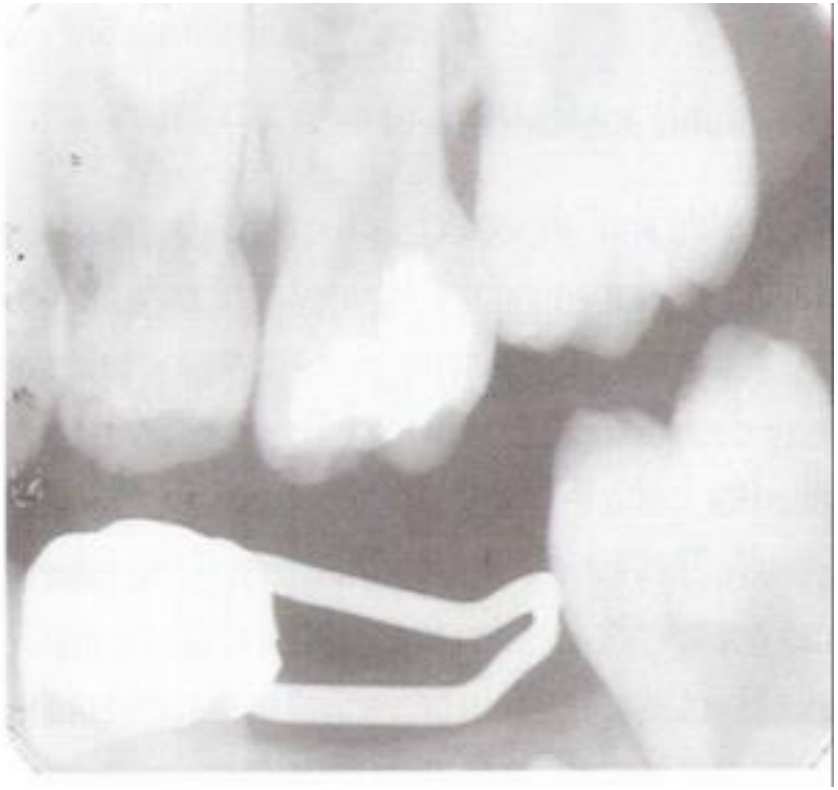
ADVANTAGES

- only space maintainer used in case of premature loss of primary second molar

Disadvantages

may cause tipping
interference with epithelization of socket
cause infection
may deviate permanent tooth bud
might need replacement at a later stage



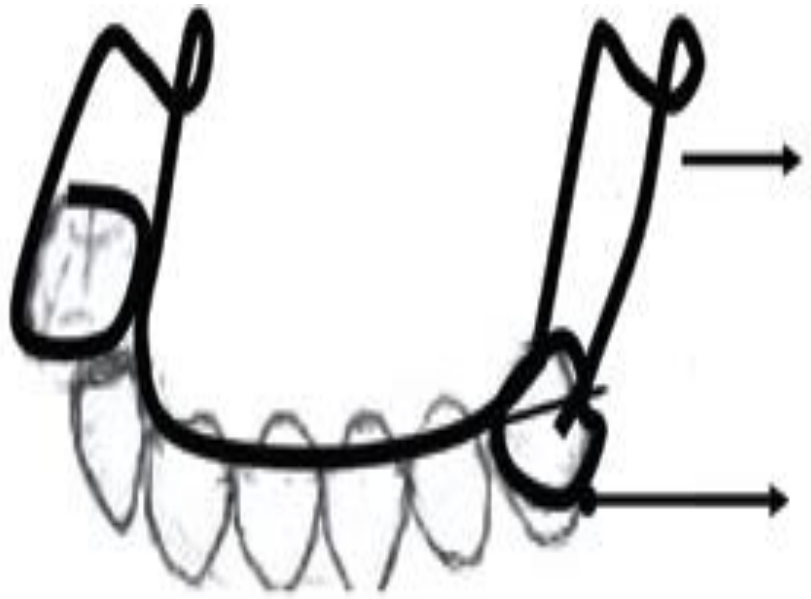


Modified Willet's appliance for bilateral loss of multiple deciduous molars: A case report

- In this patient Willet's appliance, distal shoe or intraalveolar, eruption guidance appliance type of space maintainer was indicated on both the sides

J Indian Soc Pedod Prevent Dent - September 2008 Dhinds a A.1, Pandit I. K.2

DESIGN



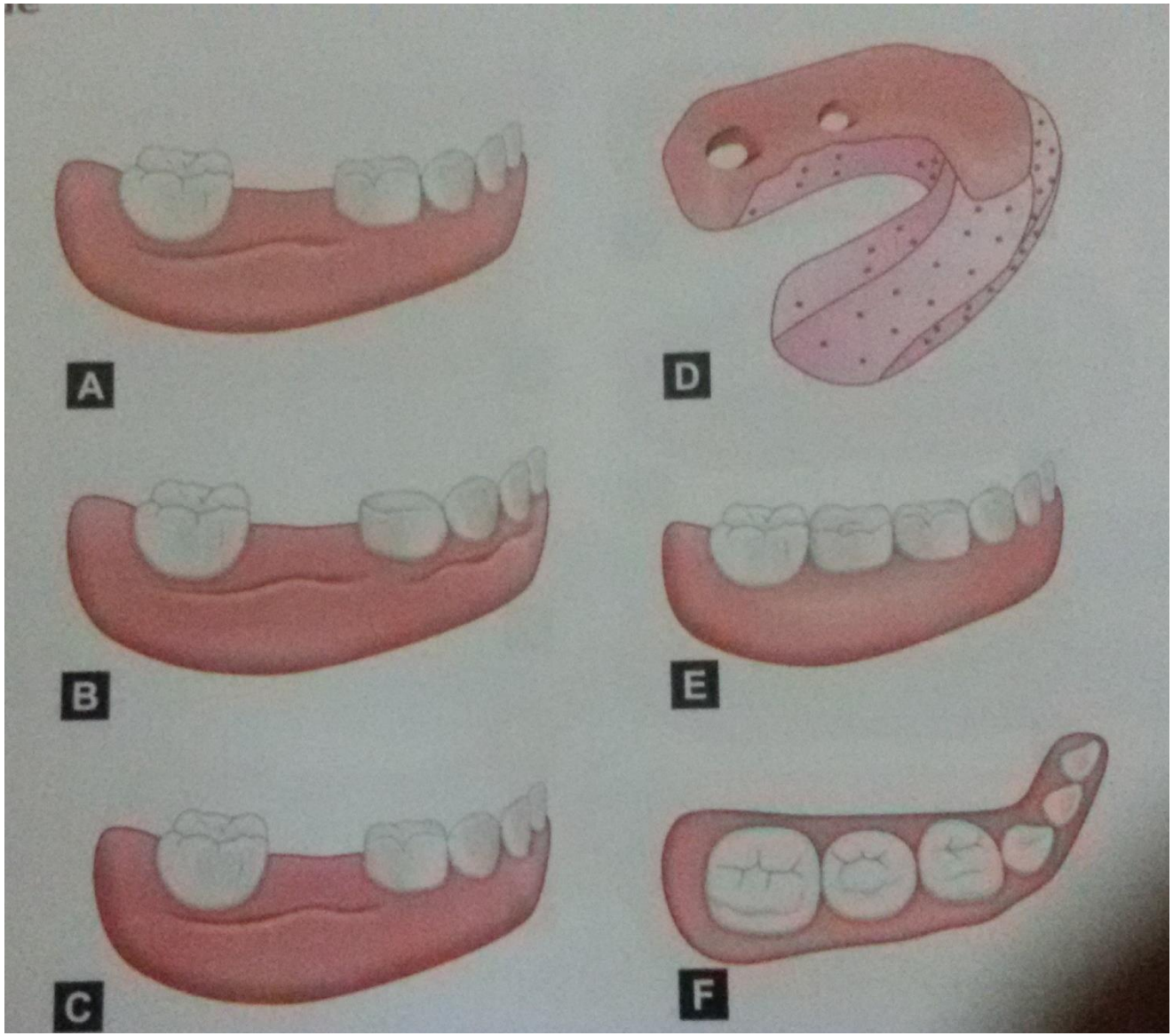
Posterior wire component of distal shoe

Anterior arch holding wire and band

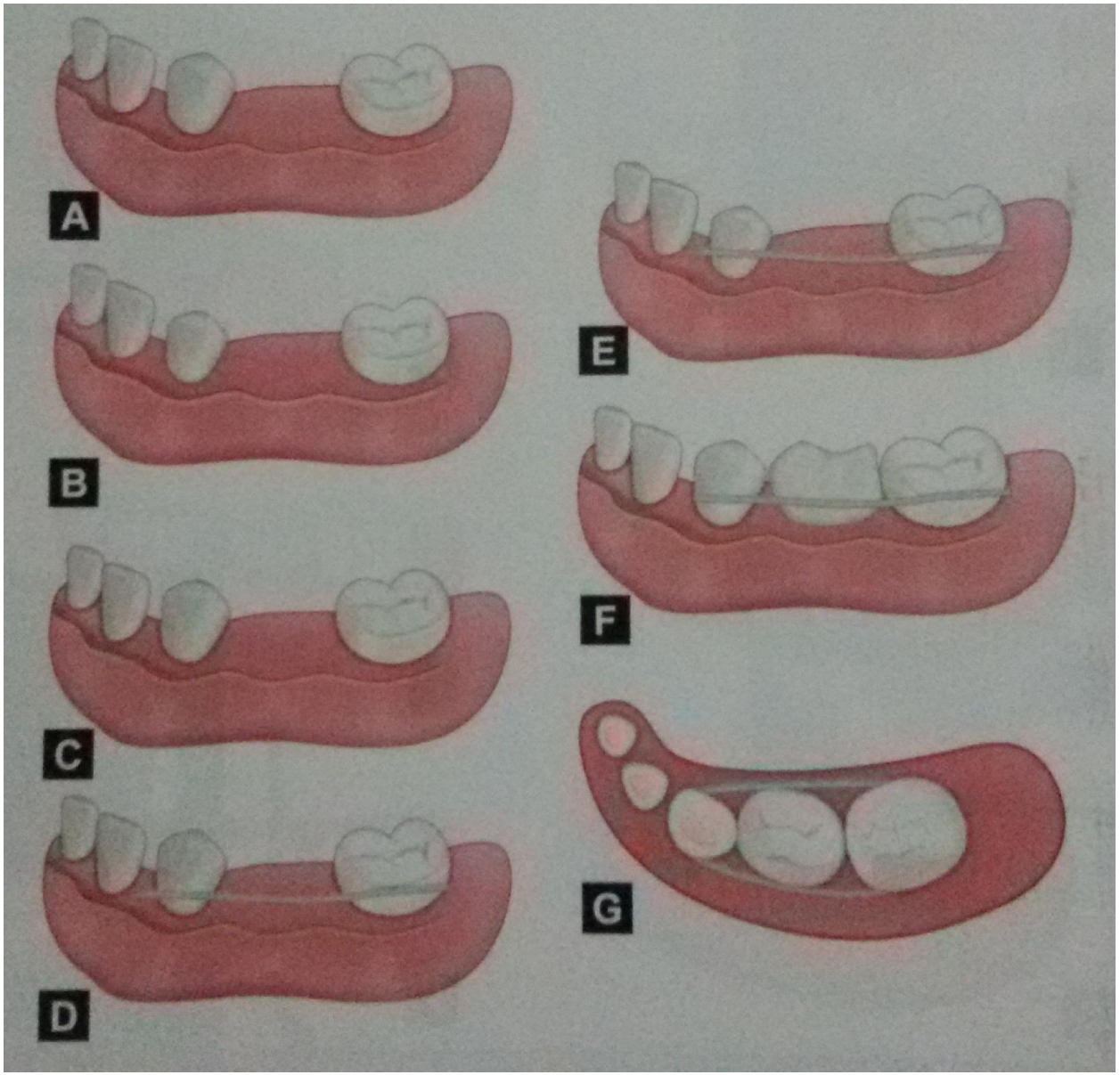
Functional space maintainers

- When space for a permanent tooth has to be maintained for two years or longer a unilateral functional space maintainer has to be placed

INDIRECT TECHNIQUE

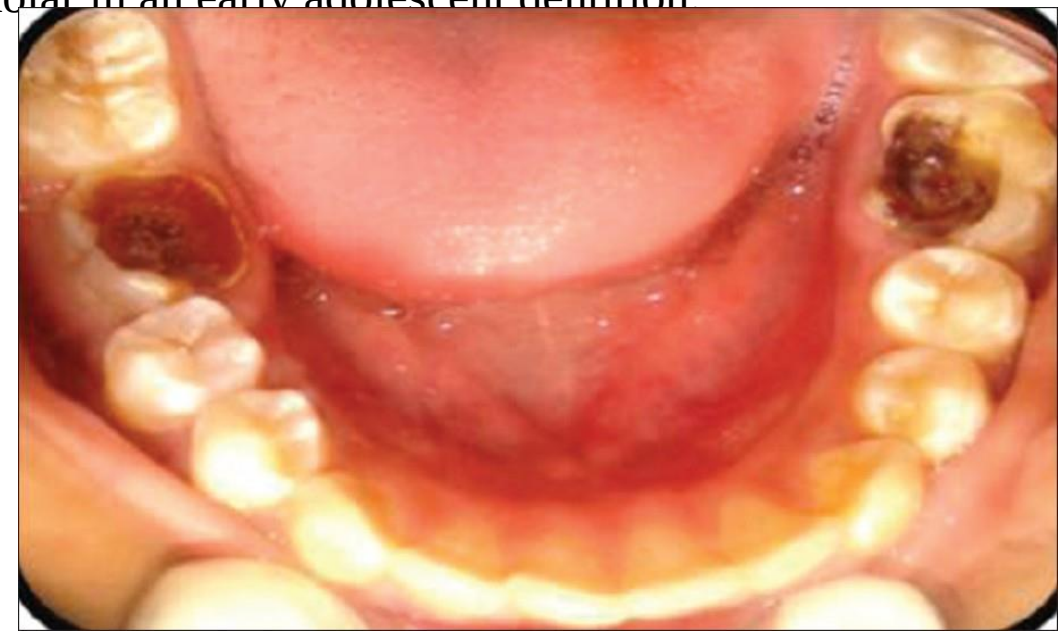


DOUBLE ABUTMENT TECHNIQUE



Management of early loss of first permanent molar: A new technique

- functional and cost-effective bridge as an interim restoration after the loss of permanent first molar in an early adolescent dentition



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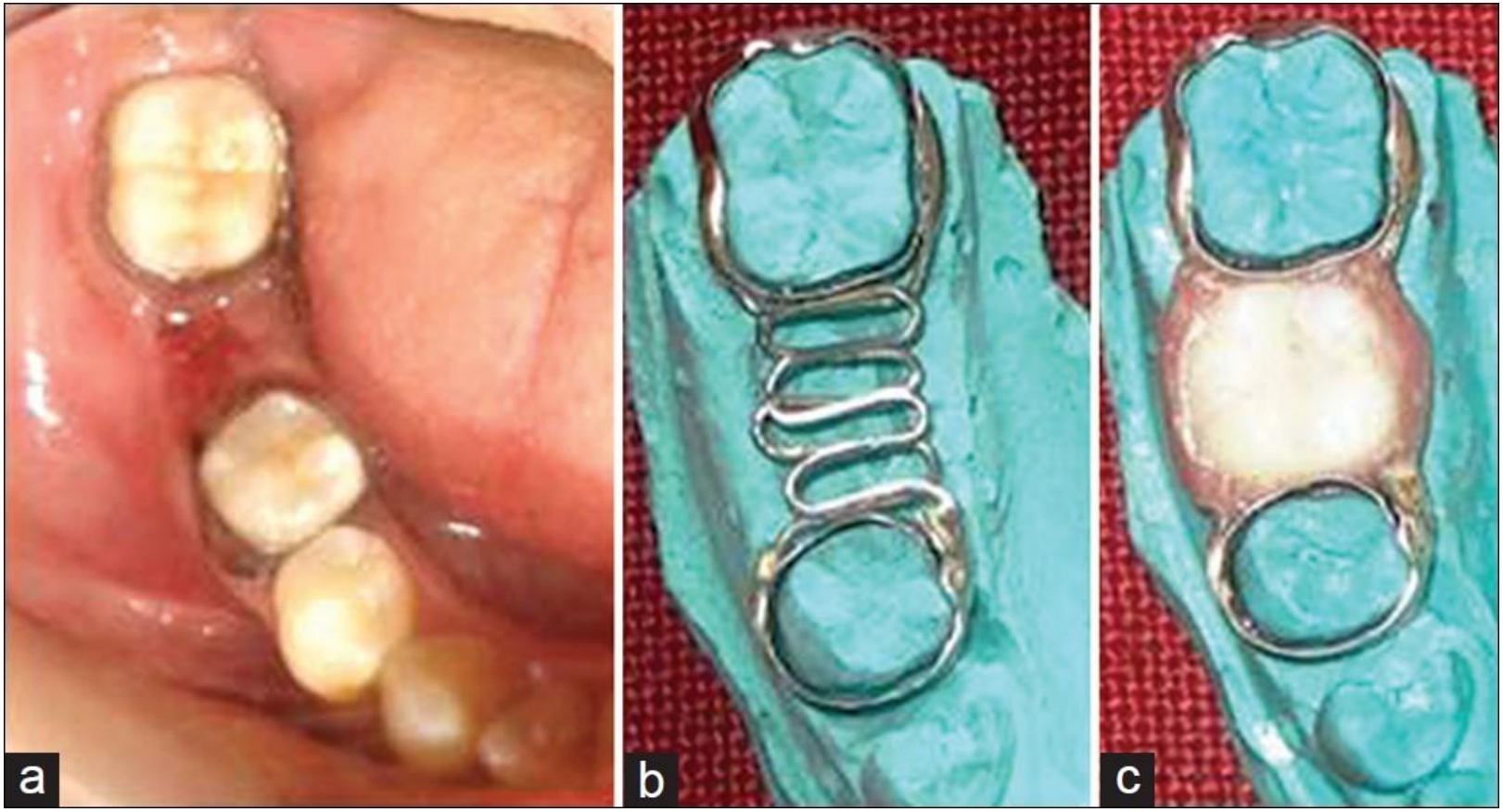
Appliance fabrication



Fabrication completed

The space can be maintained, this may be accomplished in one of the several ways.

- Cast overlay band and loop.
- Band and loop maintainer with occlusal bar and rest.
- Conventional fixed bridge work.
- Etched casting, resin-bonded posterior bridge.
- Single-unit implant prosthesis.
- Auto-transplantation of third molars into the first molar position.
- Stainless steel crown bridge

ANTERIOR SPACE MAINTAINERS

- Pedo Bridge

This patient-pleasing fix appliance can accommodate up to four primary replacement teeth attached to a maxillary lingual arch.

Treatment options

- Max incisor
- Max laterals
- Max canine
- Max 1st molar
- Max 2nd molar
- Mand molars

- No appliance
- Band and loop
- Band and loop
- Band and loop
- Distal shoe
- Lingual arch

CONCLUSION

- Space maintainers play a very important role in maintaining the esthetic and phonetic function as in case of anterior tooth and helps in aiding mastication and maintaining arch integrity as in case of posterior tooth loss.

THANKYOU