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MANAGEMENT OF SPACE PROBLEMS

PLANNING FOR SPACE MAINTENANCE

The primary determinant of dental arch malocclusion is the mesial- distal tooth size/arch size imbalance. Nevertheless, secondary factors can dramatically influence the disposition of the dental arch during childhood. Dental arch status is subject to the ravaging effects of environmental factors that can include early loss of primary teeth, interproximal caries, pathology, ankylosis of primary teeth, oral habits, trauma, and early eruption of permanent second molars. The environmental factors most commonly affecting dental arch status are probably caries and premature loss of primary teeth. Early primary tooth loss and caries can have a profound effect on dental arch status.

Space Maintenance

It is defined as the process of maintaining a space in a given arch previously occupied by a tooth or a group of teeth.

Space Maintainer

It is a fixed or removable appliance designed to preserve the space created by the premature loss of a primary tooth or a group of teeth.

Objectives of space maintenance

1. Preservation of primate space.
2. Preservation of the integrity of the dental arches.
3. Preservation of normal occlusal planes.
4. In case of anterior space maintenance, it should aid in esthetics and phonetics.

Requirement of a space maintainer

1. Should maintain the desired proximal dimensions of the space created by the loss of tooth.
2. Preferred to be functional.

3. Should not interfere with eruption of occluding teeth.

4. Should not interfere with the eruption of the replacing permanent teeth.

5. Should not interfere with speech, mastication or functional movement of mandible.

6. Should be simple and strong.

7. Should not impose excessive stress on adjacent tooth, that means it's passive in not imposing pressures on remaining teeth that might affect orthodontic movements

8. Easily cleansable without enhancing dental caries or soft-tissue pathology.

9. Should not restrict the normal growth and function.

Factors Affecting Planning For Space Maintainers

1. Time Elapsed Since Tooth Loss

If space closure is going to occur, it will usually take place within six months after the loss of tooth. Therefore, the appliance must be placed as soon as possible, following the extraction of tooth.

2. Amount of Space Loss

a. Loss of maxillary second primary molars results in the greatest amount of closure, up to 8 mm of space loss in a quadrant.

b. Loss of mandibular second primary molars shows the next greatest amount, up to 4 mm in a quadrant.

c. Loss of upper or lower first primary molars shows almost equal amounts of space closure when compared with one another; the amount is most affected by timing of the first primary molar loss.

d. Space loss potential is particularly high if the primary molar loss occurs in approximation to first permanent molar eruption, irrespective of which primary molar is lost and in which arch the loss occurs.

e. After first permanent molars have erupted into occlusion, loss of second primary molars may still result in significant space closure.

f. Loss of a first primary molar with retention of the second primary molar shows minimal amounts of space closure because the second primary molar serves to buttress first permanent molar positions after occlusion is established.

3. Rate of Space Closure

a. The younger the patient, more is the space loss.

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

4. Direction of Space Closure

Maxillary posterior spaces close predominantly by mesial bodily movement and mesiolingual rotation around the palatal root of the first permanent molars. Only minimal mesial crown tipping of the first molar is usually noted. In contrast, mandibular spaces close primarily by mesial tipping of the first permanent molars, along with distal movement and retroclination of teeth anterior to the space. Bodily movement of first molars is not typically notable in the lower arch as seen in the upper arch. Lower molars also tend to roll lingually in conjunction with their mesial crown-tipping during space loss movements.

5. Eruption Status of the Adjacent Teeth

It helps us ascertain mesial shift for molars and distal tipping for canines. For example, if the first primary molar is lost during the time of active eruption of the first permanent molar, a strong forward force will be exerted on the second primary molar, causing it to tip into the space required for the eruption of the first premolar. In addition, if the loss of the second primary molar occurs after the first permanent molars have fully erupted and normal cuspal interdigitation has been established, the degree of space loss should be less dramatic than earlier during molar transition

6. Amount of Bone Coverage Over the Tooth

Predictions of tooth emergence based on root development and the influence of the time of the primary tooth loss are not reliable if the bone covering the developing permanent tooth has been destroyed by infection. In such a situation the emergence of the permanent tooth is usually accelerated. If there is bone covering the crowns, it can be readily predicted that eruption will not occur for many months; insertion of

a space- maintaining appliance is indicated. A guideline for predicting emergence is that erupting premolars usually require **4 to 5 months** to move through **1 mm** of bone as measured on a bite-wing radiograph.

7. Eruption Status of the Succedaneous Tooth

It is estimated by the amount of root completion (tooth erupts in oral cavity after 2/3rd root formation). Teeth normally erupt when **three fourths** of the root is developed, regardless of the child's chronologic age. However, the eruption timing of a permanent successor may be delayed or accelerated after premature loss of a primary tooth, depending on the developmental status, bone density of the area, and nature of the primary tooth loss. Very early loss before significant root formation of the permanent successor usually results in delayed eruption timing.

8. Dental Age of Patient

It is the age calculated according to the last tooth erupted in oral cavity in normal eruption sequence. This involves recognizing the teeth clinically present in the oral cavity in comparison to dental eruption charts.

The chronologic age of the patient is not as important as the developmental age. Delayed eruption timing may alter normal transitional adjustments in arch length, arch width, and arch circumference.

9. Sequence of Eruption

Knowledge of usual eruption sequence is important. For example, if the mandibular primary 2nd molar is prematurely lost and mandibular 2nd permanent molar is erupting before the 2nd premolar, arch length loss secondary to mesial forces generated on I^{s}t permanent molar as the 2nd permanent molar erupts can occur with subsequent space loss.

10. Delayed Eruption of Permanent Teeth

Over-retained or ankylosed primary teeth, or impacted permanent teeth, can result in a delay of the eruption process. With the removal of these types of primary teeth an appliance may be needed to hold the space until the permanent tooth erupts into a normal position.

11. Available Space

An evaluation of the available space should be performed to determine whether the deficiency is developmental or a result of the pre-existing condition. A space analysis conducted in the mixed dentition, will aid the practitioner in a prediction of the amount of available space for the unerupted permanent teeth. A decision may be made at this point on the type of appliance (space maintainer or space regainer) that is appropriate.

12. Congenital absence of the permanent tooth.

Before space maintenance, the presence of a normal successor must be ensured through radiographic evaluation. If permanent teeth are congenitally absent, the dentist must decide whether to hold the space for many years until a fixed replacement can be provided or to allow the space to close.

13. Abnormal oral musculature (Abnormal Oral Habits)

They will exert abnormal pressure on dental arches and so may influence the type and planning of space maintainer. **Strong mentalis** muscle patterns may have a pronounced negative effect after loss of mandibular primary molars or canines, with collapse of the arch and the distal drifting of the anterior segment that is often exhibited. Thumb or finger habits may similarly produce abnormal forces in initiating collapse of the dental arches after untimely loss of primary teeth.

14.Arch Length Adequacy

This will be estimated by position of incisors, Leeway space and incisor liability:

a. If analysis indicates a positive arch length or deficiency of less than 1 to 2 mm per quadrant, a space maintainer may be beneficial in holding tooth position. If the space is not held, the total arch length may be further decreased and lead to possible premolar extraction requirements. Holding the space may allow the permanent premolars and canines to erupt and utilize leeway space to alleviate anterior crowding.

b. If the arch length deficiency is 2 to 3 mm or more per quadrant, a significant discrepancy exists where space regaining, serial extraction, and/or comprehensive orthodontic treatment may be indicated.

c. If there is no question that permanent teeth will have to be removed to obtain a favorable occlusion, space maintenance may not be desirable because the space would need to be closed during orthodontic treatment anyway. In less obvious extraction cases, holding the space to allow teeth to erupt and prevent impactions can be a valuable service.

15. Miscellaneous Factors

These factors influence planning because they may be associated with either space gain or space loss. Some of these factors are growth of jaws, proximal caries, wear and attrition.