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DEVELOPMENT OF OCCLUSION

Occlusion develops from the primary dentition through the transitional (or mixed) dentition to the permanent dentition, a sequence of events occurs in an orderly and timely fashion. These events result in a functional, esthetic, and stable occlusion. When this sequence is disrupted, however, problems arise that may affect the ultimate occlusal status of the permanent dentition. When such disruptions do occur, appropriate corrective measures are needed to restore the normal process of occlusal development. Such corrective procedures may involve some type of **passive space maintenance, active tooth guidance, or a combination** of both. Usually, the tooth is maintained in its correct relationship in the dental arch as a result of the action of a series of forces. If one of these forces is altered or removed, changes in the relationship of adjacent teeth will occur.

Early loss of primary teeth may develop problems such as:

1. It may affect the alignment of the permanent dentition.
2. Opposing teeth can supra erupt.
3. More distal teeth can drift and tip mesially.
4. More forward teeth can drift and tip distally.
5. Altered tooth positions may include:
    - "Symptomatic" space deficiency with loss of arch length and circumference.
    - Blocked or deflected eruption of permanent teeth.
    - Unattractive appearance.
    - Food impaction areas.
    - Increased caries and periodontal disease, and other negative aspects of malocclusion.

The altered occlusal relationships may evidence traumatic interference and untoward jaw relationships. When early primary tooth loss occurs, corrective measures such as passive space maintenance, active tooth guidance with space regained, or a combination of both may be needed to optimize the normal process of occlusal development.

ARCH LENGTH ANALYSIS

Tooth size and alveolar size are the primary factors that determine the status of the permanent dental arch. If tooth size and arch size are not balanced, the effect on the permanent dental arch is crowding or spacing. Crowding is the most common feature of dental arch malocclusion. Only when the combined size of the permanent teeth is balanced with the size of the alveolar apical area is an ideal dental arch possible. Arch length analysis is done to estimate the space adequacy for the succedaneous tooth and to fairly predict how much space will be required for eruption and proper alignment in the dental arch. Various analysis used for estimating space adequacy are:

1. Nance Analysis

This analysis compares the space required and space available to arrive at the arch length discrepancy. It is used during the mixed dentition period, As a result of comprehensive studies, Nance concluded:

1. The length of the dental arch from the mesial surface of one mandibular first permanent molar to the mesial surface of the corresponding tooth on the opposite side is always shortened during the transition from the mixed to the permanent dentition.

2. In the average patient's mandibular arch a leeway of 1.7 mm per side exists between the combined mesio-distal widths of the primary

3. mandibular canine and first and second primary molars and the mesio-distal widths of the corresponding permanent teeth, with the primary teeth being larger. This difference in the total mesio-distal width of the corresponding three primary teeth in the maxillary arch compared with the width of the three permanent teeth that succeed them is only 0.9 mm per side.

Method:

1. Measure the mesio-distal width of the erupted permanent teeth
2. Measure the mesio-distal width of each unerupted tooth, cuspids and bicuspids from intraoral periapical radiographs
3. The total mesio-distal width of all the teeth in each quadrant will indicate space required to accommodate the permanent teeth

4. Using brass wire, measure the arch perimeter
5. Compare the space required and space available to determine the arch length discrepancy

Limitations:

The Nance arch-length analysis is seldom used, partly because the involved procedures for this analysis require a complete set of periapical radiographs. The clinical reliability of other analyses that do not use radiographs is sufficient for determining major arch-length inadequacies.

2. Moyer's Mixed Dentition Analysis

There is high co-relation between sizes of different teeth in the same individual, thus making it possible to predict the size of unerupted tooth by looking at the teeth present in oral cavity. It is also used during the mixed dentition period.

Advantages:

- It has minimal error and the range of possible error is precisely known.
- It can be done with equal reliability either by a beginner or by an expert.
- It is not time consuming.
- It requires no special equipment.
- It can be completed in the mouth as well as on casts.
- It may be used for both arches.
- The analysis is based on a correlation of tooth size; one may measure a tooth or a group of teeth and predict accurately the size of the other teeth in the same mouth.
- The mandibular incisors, because they erupt early in the mixed dentition and may be measured accurately, have been chosen for measurement to predict the size of the upper, as well as the lower, posterior teeth.
- If the predicted value is greater than available arch length, crowding of teeth can be expected.

Method:

1. Measure the mesio-distal width of mandibular incisors

2. Measure the space for mandibular cuspids and bicuspids from the distal of aligned lateral incisor to mesial aspect of the first permanent molar

3. Measure the space for the maxillary cuspids and bicuspids from the distal aspect of aligned lateral incisor to mesial aspect of the first permanent molar

4. Using Moyer's probability chart find out sum total mesio-distal width of upper and lower cuspids and bicuspids for the given sum width of the lower central and lateral incisors at 75% probability

5. Compare the space available and space required in all four quadrants to determine arch length discrepancy

3. Tanaka and Johnston Analysis.

The Tanaka and Johnston method of arch-length analysis is a variation of Moyer's analysis except that a prediction table is not needed. It is also used during the mixed dentition period. The method includes:

1. The sum of the widths of the mandibular permanent incisors is measured and divided by 2.
2. For the lower arch, 10.5 mm is added to the result
3. For the upper arch, 1 mm is added to the result to obtain the total estimated widths of the canines and premolars. For example, fi the width of the lower incisors is 23 mm, divide by 2 and add 10.5 mm for the lower arch. The result is 22 mm compared with 22.2 mm obtained from Moyer's table.
4. One can then take these tooth mass predictions and compare them with the total measured arch length and obtain any inadequacies in the arch length.
5. If the result is positive, there is more space available in the arch than is needed for the unerupted teeth
6. If the result is negative, the unerupted teeth require more space than is available to erupt into ideal alignment

Advantages

- The technique involves simple, easily repeated procedures and minimal material needs.
- It does not use prediction charts.

- This method does not require additional radiographs, but it tends to over predict slightly the widths of the unerupted premolar.

4. Bolton analysis.

Also called as **Bolton's tooth size ratio analysis**. This analysis is used during the permanent dentition period. According to Bolton, a ratio exists between the mesio-distal widths of maxillary and mandibular teeth. This analysis addresses tooth mass discrepancies between the maxillary and mandibular arches.

1. It can be used to compare the sum of the mesio-distal widths of the 12 maxillary teeth with that of the 12 mandibular teeth, first molar to first molar, and to compare the 6 maxillary teeth with the 6 mandibular teeth, canine to canine.

2. The Bolton analysis ratio measurement is as follows:

a) If overall ratio is <91.5%, it indicates **maxillary tooth material excess** which can be determined by:

Sum of mandibular= sum of maxillary / 100 x 91.3

b) If overall ratio is >91.5%, it indicates **maxillary tooth material lack** which is determined by:

Sum of maxillary = sum of mandibular / 100 x 91.3

c) If the anterior ratio is <77.2%, it indicates maxillary anterior excess which is determined by:

Sum of mandibular= sum of maxillary / 100 x 77.2

d) If the anterior ratio is >77.2%, it indicates mandibular anterior excess which is determined by:

Sum of maxillary = sum of mandibular / 100 x 77.2

3. When a significant discrepancy with these ratios is noted, the clinician must assess where the tooth mass problem is located and decide on the best method to resolve it.