BIBLIOGRAPHY

A. Stability of Crowding and Rotation Corrections

- Various principles of increased stability from early-intervention.
    82% of straight incisors at 8 years of age were straight at 14, while 89% of crowded incisors at 8 years were crowded at 14.
    In treating with functional appliances before 6 years of age, 12.3% had relapse and 26.1% had other complications seen 4 years after completion of permanent dentition in 65 children.
    Treating at an early age reduces relapse of incisal crowding in 83 cases.
    Molar relations, overjet, overbite, rotations and crowding are 90% influenced by environment and only 10% by genetics.
    Shows same result as seen in Corruccini and Potter (#6, above).
    Rotations of permanent incisors can be seen radiographically at 2 years of age and won't usually erupt straight.
  9. The following 6 studies (#9 - #14) substantiate arch enlargement as a result of incisors erupting without rotations or displacement.

- The following 6 studies (#9 - #14) substantiate arch enlargement as a result of incisors erupting without rotations or displacement.
    Eruption of lower permanent incisors have (38%) less arch enlargement when these teeth erupt crowded (2.13 mm.) as when they erupt straight (3.44 mm.) or a mean difference of 1.31 mm. in the canine-to-canine arch increase.
    Incisal crowded cases have 2.13 mm. canine-to-canine enlargement while uncrowded cases have 3.44 mm. expansion.
    If permanent incisor does not erupt into arch, there is no increase in arch dimension. If lower incisors come directly into arch without rotations, the arch dimension can be increased as much as 5 mm. (upper, 6.5 mm.). Mean enlargement was 2.3 mm.. Spaced deciduous incisors result in 10% less arch enlargement as the permanent incisors erupt than deciduous incisors without spaces.
    Deciduous incisors that have interproximal spacing have 20% less arch enlargement than deciduous teeth without spaces.
    In a case with a missing lower permanent lateral, there was no change in deciduous arch size, while upper arch in same case with all incisors present had normal upper arch enlargement.

- Crowded adult dentitions have narrower arches (lower canine-to-canine is 3 mm. smaller) than well-aligned arches (tooth sizes being the same), #15 - #17:

  18. Relation of crowding and spacing between deciduous and permanent incisal dentitions.

  
  Crowded deciduous incisors  100% chance of permanent incisal crowding
  No spaces deciduous incisors  67% chance of permanent incisal crowding
  Less than 3 mm. spaces deciduous incisors  50% chance of permanent incisal crowding
  3 - 6 mm. spaces deciduous incisors 20% chance of permanent incisal crowding
Over 6 mm. spaces deciduous incisors    0% chance of permanent incisal crowding


- Studies Substantiating Arch Enlargement as a Result of Incisors Erupting without Rotations (#26 - #30):


- Deciduous Crowding Incidence:


  31. 14.0%    Barrow, G.V. and White, J.R. 1952.

  32. 3.7%    Heckman, U., 1973.

- Permanent Crowding Incidence:


  34. 61%    Seipel, C.M. 1946.

  35. 51%    Barrow, G.V., and White, J.R., 1952.


- Arch Enlargement During Incisor Eruption - Lower Arch Increases During the Eruption of Lower Permanent Incisors (#40 - #44):

  39. Lewis, S.J. and Lehman, I.A., 1929 N=31 3.06 mm.

  40. Korkhaus, G. and Neumann, F., 1931 N=18 2.62 mm.

  41. Baume, L.J., 1950 N=33 2.60 mm.


  43. Moorrees, C.F.A., 1959 N=87-107 2.75 mm. mean 3.21 mm.

- Upper Arch Increases During the Eruption of Upper Permanent Incisors (#45 - #48):

  44. Lewis, S.J. and Lehman, I.A., 1929 N=30 5.04 mm.

  45. Korkhaus, G. and Neumann, F., 1931 N=14 4.44 mm.

  46. Baume, L.J. 1950 N=33 2.76 mm.

  47. Moorrees, C.F.A., 1959 N=87-117 2.57 mm. mean 3.70 mm.

- Sequence of enlargement as eruption occurs.


<table>
<thead>
<tr>
<th>Arch</th>
<th>Percentage</th>
<th>Mean Enlargement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandible</td>
<td>47.5%</td>
<td>(1.64 mm.)</td>
<td>of the arch enlargement occurs as centrals erupt</td>
</tr>
<tr>
<td></td>
<td>37%</td>
<td>(1.28 mm.)</td>
<td>of the arch enlargement occurs as laterals erupt</td>
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<tr>
<td></td>
<td>15%</td>
<td>(0.52 mm.)</td>
<td>of the arch enlargement occurs 6 months after laterals erupt</td>
</tr>
<tr>
<td>Maxilla</td>
<td>73.3%</td>
<td>(2.57 mm.)</td>
<td>of the arch enlargement occurs as centrals erupt</td>
</tr>
<tr>
<td></td>
<td>26.7%</td>
<td>(0.93 mm.)</td>
<td>of the arch enlargement occurs as laterals erupt</td>
</tr>
</tbody>
</table>
• Maximum lower arch enlargement as the permanent incisors erupt:
  49. Lewis, S.J. and Lehman, I.A., 1932 N=21 5.5 mm.

• Maximum upper arch enlargement as the permanent incisors erupt:
  52. Baume, L.J., 1950 N=12 6.5 mm.

• Incidence and severity of crowding in permanent dentition (#54 & #55).
  53. Lundstrom, A., The Significance of Early Loss of Deciduous Teeth in the Etiology of Malocclusion, *Am. J. Ortho.*, 41: 819-826, 1955. 82% of crowding in maxilla is 3 mm. or less and 90% of crowding in mandible is 3 mm. or less.
  77.2% of all crowding is in the anterior segment, while only 22.8% of crowding is in the posterior segment. 82% of mandibular permanent incisal crowding (in Class I occlusions) is 3 mm. or less. 8.5% have 4 mm. of crowding and 4.9% have 5 mm. or more.

• Percentage of children with mandibular crowding (maxillary crowding in parenth. (#56 - #61):
  56. 51% Barrow, G.V. and White, J.R., 1952.
  57. 50% Lundstrom, A., 1955.
  60. 51% Seipel, C.M., 1946.

• Incidence of Malocclusions (#62 & #63):
  5-6 yrs  17% malocclusion  5-10 yrs 53.9% malocclusion
  6-7 yrs  17.5% malocclusion  9-10 yrs  55.7% malocclusion
  7-8 yrs  31.2% malocclusion  12-13 yrs  65.5% malocclusion
  8-9 yrs  49.7% malocclusion
  73.1% of all Class I malocclusions had crowding.
  77.2% of all Class II malocclusions had crowding.
  83.9% of all Class III malocclusions had crowding.
  82% of all crowding is less than 3 mm. (N=1000).

• Crowding and Rotation Treatment Instability and other Miscellaneous Principles:
  Untreated children with no crowding at 14 years of age had wider arches. Also showed that when permanent lower molars erupt distally and incisors labially, there is less tendency for crowded incisors..

• Arch Form and Cross-Bite Stability (#67 - #69)
  66. Leighton, B.C. 1975. Arch form stays the same from deciduous to permanent dentitions.
  67. Moorrees, C.F.A., 1959. "V" shaped arches remained the same from 6-7 years to 16-18 years.

B. Stability of Overbite and Overjet
• Principles of overbite and overjet and its relation to growth:


Showed that vertical jaw growth has significant influence on success of long-time overbite stability following orthodontic treatment.


Showed a significant relation between overjet at 2½ years of age and overbite at 18 years of age in the same untreated individuals. Can prevent overbite from developing by retarding the overeruption of the maxillary permanent incisors.


7 grams of force was sufficient to stop the eruption of rabbit incisors.


• Overbite increases about 2 mm. from the primary to the mixed dentition (#74 - #77):

73. 1.75 mm. N=51 Barrow, G.V. and White, J.R., 1952.
74. 1.64 mm. N=70-91 Moorrees, C.F.A., 1959.

• Overbite remains constant from 8 years to adulthood (#78 - #86):

78. Baurle, J.R., A Longitudinal Study of Incisor Overbite from Mixed Deciduous Dentition to Age Fifteen, M. S. Thesis, Univ. of Iowa, Iowa City, IA, 1949.
84. Moyers, R.E., et.al., Univ. of Michigan, Ann Arbor, Michigan, 1976.

• Relapse tendencies of overbite and overjet:


• Incidence and severity of overbite and overjet:


• Molar Relations:


80% of Class I occlusions did not improve from deciduous to permanent dentitions.

76% of Class II occlusions increased severity from deciduous to permanent dentitions.

89% of Class III occlusions increased severity from deciduous to permanent dentitions.

92. Leighton, B.C., 1969. Antero-posterior relation is constant from deciduous to permanent dentitions.


At 11-12 years of age, 73.1% had malocclusions.

50.7% had Class I malocclusions.
19.6% had Class II malocclusions.
2.55% had Class III malocclusions.
0.76% were unclassifiable.

95. Sillman, J.H., Development of Occlusions: A Serial Study from Birth to Seven Years, *J. Second Dist., Dent. Soc.*, 31: 153-163, 1945. At 20 months of age when the 1st deciduous molar (upper and lower) erupt, the prognosis of a malocclusion can be made and the outcome of the molar relation is predictable.

C. Prevents TMJ Problems:


Almost all malocclusions associated with TMJ problems and increases with age.

• Incidence of TMJ Symptoms (#101 - #108):


• Incidence of TMJ Clicking Sounds (#109 - #111):


• Importance of early detection of TMJ problems:


In children (N=150) from 7 to 16 years of age with TMJ problems 37% had degenerative arthritis and 46% had meniscal displacement without reduction.

D. Converts Difficult Cases and Gummy Smiles:


Shows the finished results of potentially compromised deciduous dentitions.


Indicated the most pleasing position for the teeth in a smile and frequency of gummy smiles in adults was 22.5%.


Indicated frequency and causes of gummy smiles, mainly overjet, overbite, increase palatal line to incisal edge distance, and greater adtivity of muscular elevation of the upper lip.


Indicated 41% have at least 1 mm. of gum tissue exposed during a high smile with females having twice the incidence as males (54% vs. 26%).

E. Gingival Tissue and Other Effects:


Showed significant correlation with overbite, lower incisal crowding, overjet and lack of posterior intercuspatation to periodontal status, pocket depth, gingivitis and looseness of teeth.

Deep bites are associated with periodontal disease, bone tissue resorption with looseness and loss of teeth in 142 patients.


Mouth breathing and severe protrusion of teeth causes periodontal problems.


Irregularity and crowding of lower incisors is associated with loss of gingival tissue.


The thinness of the mandibular symphisis is correlated with an increase in clinical crown height with gingival recession.


Teeth displaced during eruption had more long-term proximal bone loss than normal erupting teeth.

126. Position Paper of American Academy of Periodontology, Periodontal Diseases of Children and Adolescents, 67: 57-62, 1966. Children 5-11 years have up to 9% loss of periodontal attachment and bone support; 12-15 years have up to 46%. Generalized juvenile periodontitis, consisting of marked inflammation and heavy plaque and calculus, begins at or around puberty.


(CIPTN) from Ainamo - 6 sextants are measured and there are 6 categories, namely, supragingival calculus, subgingival calculus, pocket 4 to 5 mm., pocket of 6+ mm., bleeding after probing, recession (now eliminated).

43% of 7 year olds had healthy gingival tissue and, rather consistently dropped so that by 12 years only 27% had healthy tissues.

•    A philosophy of early open-bite corrections and the natural retraining of the tongue during swallowing - 6-10 years of age is optimum time for language learning with gradual decline in correct pronunciation:


•    Language skills learned 4-10 years of age when cerebrum is plastic and receptive:


•    Development of foreign accents at 10 years of age when cerebral neuroplasticity is lost:


•    Root Resorption:


Early treatment before root fully formed may prevent relapse due to formation of fibers after the teeth are straightened.


Early treatment before root formed would solve relapse because of fiber development after straightening. Fibers around root rearrange first after 28 days, marginal fibers takes longer than 7.5 months.


Cementoid delays root resorption. Uncalcified predentin is not attacked by resorbing cells, therefore treatment before root is fully developed can prevent resorption.


Treating at earlier ages with incomplete root formation reduces risk of root resorption. Functional appliances had half of the resorption that fixed appliances had. Especially risky are Class II elastics, edgewise fixed appliances and pre-treatment signs of resorption.

Depressing mature teeth causes scar tissue to form and does not completely repair itself if root end is mature. Roots with open apical foramen did not experience damage and recuperated rapidly.


Rosenberg, M.N., An Evaluation of the Incidence and Amount of Apical Root Resorption and Delaceration Occurring in Orthodontically Treated Teeth Having Incompletely Formed Roots at the Beginning of Begg Treatment, *Am. J. Ortho.*, 61: 524-525, 1972. Teeth with incomplete root ends will develop normal roots when active orthodontics is done and will have less root resorption when compared to teeth with completely formed roots.

**Tooth Correlations:**

Hixon, E.H. and Oldfather, R.E., Relations of lower permanent incisors to posteriors (canine, premolars) r = 0.69.


Relation of maxillary adult anterior and posterior vs. mandibular anterior and posterior r = 0.86.

Relation of maxillary anteriors vs. mandibular posteriors r = 0.80

Relation of maxillary posteriors vs. mandibular posteriors r = 0.80

Relation of mandibular anteriors vs. mandibular posteriors r = 0.64

Relation of maxillary anteriors vs. maxillary posteriors r = 0.61


Relation upper 1st premolar vs. lower 1st premolar r = 0.96

Relation upper 2nd premolar vs. lower 2nd premolar r = 0.5

Relation upper 1st premolar vs. lower 1st premolar r = 0.61

Relation lower incisors vs. lower canine, premolars r = 0.65

Moorrees, C.F.A., 1959. Relation between deciduous and permanent teeth are relatively low ranging for incisors of r = 0.23 to r = 0.41, not high enough for any significant predictions.


**Miscellaneous Principles:**


Teeth can be stopped in erupting and root ends will continue to normally develop. If tooth moved before root ends are completely developed, it will obtain normal root length, but might be bent toward the direction of the movement.


Recommended cutting the collagenous fibers to improve the retention of corrected rotations.


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