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Orthodontics *Alert*™

Duration of Pubertal Spurt and Class III Malocclusions

Skeletal maturation plays a large role in determining the outcome and stability of orthodontic treatment. In particular, the beginning and end of the pubertal growth spurt, as well as the duration of the growth spurt, are important factors in deciding when to initiate treatment. While such information has been determined for Class I malocclusions, information about the duration of the growth peak is lacking for Class III patients. Using the cervical vertebral maturation as an index of skeletal maturity, Kuc-Michalska from Silesian University, Poland, and Baccetti from the University of Florence, Italy, undertook an investigation to define the duration of the pubertal growth spurt in patients with Class III malocclusions compared with patients with normal occlusion.

Lateral cephalograms were obtained for 900 untreated patients (age range, 8–18 years). Cervical vertebral maturation was determined using Baccetti's analysis, while skeletal class was determined by Björk's classification. The cephalograms were traced and measured by 2 operators. After application of inclusion criteria (Class I or Class III, based on A-N-Pog angle; vertical skeletal relationship of 19–33°; and skeletal stages CS3 or CS4) and exclusion criteria (previous treatment, missing teeth), 218 cephalograms remained.

Among those remaining, 113 were CS3 (67 Class I and 46 Class III), and 105 were CS4 (56 Class I and 49 Class III). Student *t*-tests were performed on each group to determine the difference in age between CS3 and CS4 participants for both Classes I and III.

Descriptive statistics used to compare the Class I and Class III cohorts found no significant differences. In Class I patients, the pubertal peak was determined to be 11 months. In Class III patients, it was 16 months. The 5-month difference between these 2 populations was statistically significant.

Conclusion

These results are consistent with reports in the literature of an increase in mandibular length (commonly seen as a marker for maturity) later in Class III patients than in Class I; similarly, mandibular growth is larger in Class III patients than in

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Class I patients. It is possible that the longer duration of the pubertal spurt in Class III patients, as determined here, may be responsible for the larger growth of the mandible. Clinicians should keep in mind the possibility that patients with a Class III growth tendency may continue to grow for a longer period of time. OI

Kuc-Michalska M, Baccetti T. Duration of the pubertal peak in skeletal Class I and Class III subjects. Angle Orthod *2010;80:54-57.*

Table 1. *Average resting tongue pressure (g/cm²) for maxillary central incisor*

Time	Study group (n = 13)	Control group (n = 6)	Mann-Whitney value	p value
Beginning	16.42 ± 8.95	19.5 ± 14.95	38.5	.965
Crib removal	13.31 ± 2.46	16.93 ± 3.46	17	.053
2 months postremoval	11.63 ± 4.7	19.1 ± 3.79	7	.005

The Relationship Between Tongue Pressures and Open-bite Therapy

Open-bite malocclusion has a wide range of contributing causes, including habits (thumb- or finger-sucking or retained infantile swallowing habit), genetics, unfavorable growth patterns, enlarged lymphatic tissue, tongue function and posture. The exact relationship, however, between bony malformation and muscle function has yet to be determined. For example, is tongue thrust, in which the tongue moves between the upper and lower teeth during swallowing, a cause or a result of an anterior open bite?

The tongue exerts strong pressure at frequent intervals. While the influence of lip and cheek pressure on intraoral pressure has been studied using imaging techniques, the same investigation has been applied less to the tongue. Taslan et al from Marmara University, Turkey, examined the changes in tongue pressure during rest position and swallowing before and after crib appliance therapy in patients with open bite and tongue thrust.

Nineteen patients with an anterior open bite and tongue thrust in the mixed dentition were selected.

- Thirteen patients were in the study group, which received 10 months of crib appliance therapy.
- Six patients of similar age were in the control group, which received no treatment.

The participants ranged in age from 7–12 years. When measurements were taken, the patients were seated in a dental chair with the head in a natural position.

Tongue pressure measurements at rest and when swallowing 10 mL water were recorded for both groups. Each swallow measurement was repeated 5×, and the average pressure was calculated. Initial measurements were taken from the upper right first molar and the upper and lower right central incisors in all patients.

For the study group, measurements were taken from the upper right first molar and the middle spur of the crib appliance at several timepoints: at insertion and at 1 week, 1 month, 3 months, 6 months and 10 months after insertion. At the time of appliance removal and again 2 months later, the initial measurements were repeated.

In the study group, the initial resting tongue pressure at the upper right molar increased after appliance insertion, and then decreased for the remaining time in the study. The resting pressures at the incisors were lower throughout the study (Table 1).

Swallowing pressures were essentially the same after treatment as before, with insignificant changes. Both resting and swallowing pressures decreased at the middle of the crib appliance over the course of the 10-month treatment period. There were no significant pressure changes in the control group. The study group experienced a significant increase in open-bite values over the 12 months.

Conclusion

Decreasing resting pressures over the course of the study confirmed that the tongue adapts to the presence of the crib appliance. This suggests that the tongue is responsive to open-bite closure and a new position of incisors. Clinicians should refer patients with open bites for treatment, realizing that the tongue's position and pressure will change with treatment. OI

Taslan S, Biren S, Ceylanoglu C. Tongue pressure changes before, during and after crib appliance therapy. Angle Orthod *2010;80:533-539.*

Root Shortening and Space Closure

A frequent iatrogenic outcome of orthodontic treatment, external apical root resorption (EARR), results from a combination of biologic and mechanical factors and is revealed on x-rays as root shortening. Few studies have looked at the prevalence and severity of EARR during various treatment stages, and none has investigated EARR during space closure.

Among the methods of space closure, 2 are widely used: 2-step and en masse with sliding mechanics. Because 2-step closure takes more time, it has been hypothesized that EARR would be more significant after the 2-step method than the en masse. Huang et al from Shandong University, China, studied the effect of both space closure methods on root resorption.

Fifty-two patients who met a variety of selection criteria, including a Class I or Class II malocclusion and complete root formation, participated in the study.

- Twenty-six patients were treated with a 2-step procedure to close the space.
- The other 26 received 1-stage space closure therapy.

In the 2-step method, first the canines were retracted, then the incisors. In the en masse procedure, the 6 anterior teeth were retracted together. All space closure was performed with sliding mechanics using nickel–titanium coil springs. Panoramic radiographs were taken before and after space closure, and tooth length was measured.

No significant difference in root shortening was found between the 2 methods of space closure (Table 2). On average, the maxillary lateral incisors had the greatest amount of root shortening, while the mandibular incisors had the least. Maxillary central incisors had less EARR than maxillary lateral incisors.

Conclusion

Clinicians should not be concerned that one method produces more EARR than the other. The method of space closure should be chosen according to anchorage requirements. QI

Huang Y, Wang X-X, Zhang J, Liu C. Root shortening in patients treated with two-step and en masse space closure procedures with sliding mechanics. Angle Orthod *2010;80:492-497.*

Table 2. *Incisal root shortening in mm with 1- or 2-stage space closure*

Incisor	Total n = 72	2-stage n = 36	1-stage n = 36	p value*
Maxillary				
Central	0.43 ± 0.12	0.45 ± 0.13	0.42 ± 0.12	.24, NS
Lateral	0.58 ± 0.10	0.60 ± 0.11	0.56 ± 0.08	.14, NS
p value†	<.001, S	<.001, S	<.001, S	
Mandibular				
Central	0.23 ± 0.07	0.23 ± 0.06	0.23 ± 0.07	.88, NS
Lateral	0.22 ± 0.06	0.22 ± 0.07	0.23 ± 0.06	.86, NS
p value†	.49, NS	.33, NS	.96, NS	

*NS, not significant; S, significant. *Two-sample t test for intergroup comparison; †Paired-samples t test for intragroup comparisons.*

Interceptive Orthodontic Treatment To Reduce Malocclusions

Interceptive orthodontic treatment is an inexpensive and effective means to treat developing malocclusions. While this approach is not appropriate for every individual, studies have suggested that early interceptive therapy can reduce the need for further treatment in a population. However, no randomized control or large cohort studies have been carried out to determine the effectiveness of interceptive treatment. To investigate this issue, King from the University of Washington and Brudvik from the University of Bergen, Norway, compared patients receiving interceptive treatment to a historical cohort.

A total of 133 patients who received interceptive therapy were included in the study, each with pre- and posttreatment dental casts. A group of 113 controls meeting the same inclusion criteria were chosen randomly from the 1970s archives from the University of Bergen. The controls received no orthodontic treatment and had 2 sets of casts taken 2 years apart. All casts were scored on an index of complexity, outcome and need (ICON) scale. The ICON paradigm measures and weighs the following and combines them into a single score:

- dental esthetics
- crossbite

- anterior vertical relationship
- maxillary crowding or spacing
- buccal segment anteroposterior relationship

Unweighted ICON scores were compared between pre- and posttreatment casts, and the control and experimental groups.

ICON scores decreased an average of 38.8% (from a score of 54.9 to 33.6) after treatment, while the scores for the control group remained unchanged. Most of the control participants were determined to be "not improved or worse," but only 36.1% of the treated patients were categorized as such. Specific improvements in esthetics, crowding, crossbite and overbite were noted in treated patients.

Conclusion

Interceptive treatment is not definitive therapy. Based on these results, however, clinicians should realize that it can reduce malocclusions and should be considered for some patients. OI

King GJ, Brudvik P. Effectiveness of interceptive orthodontic treatment in reducing malocclusions. Am J Orthod Dentofacial Orthop *2010;137:18-25.*

Temporary Anchorage Devices to Treat Class III Malocclusions

Class III patients with a maxillary deficiency are most commonly treated with protraction face-mask or reverse-pull headgear therapy. However, because the forces in these treatments are applied only to the teeth, unwanted dentoalveolar side effects can occur. Using a temporary anchorage device with intermaxillary elastics may result in desirable skeletal changes without the dentoalveolar effects. Heymann, a private practitioner from North Carolina, et al, investigated this possible treatment approach for Class III maxillary deformities and used 3-dimensional analysis to describe the resulting skeletal and dental changes.

Six prepubertal patients, each with a Class III maxillary deficiency, participated in the pilot study. Each patient underwent surgery in which 4 miniplates were inserted (1 in each infrazygomatic buttress of the maxilla and 1 in the anterior mandible on each side). The miniplates were loaded 3 weeks after surgery. One elastic was placed on each side, creating a downward and forward force for the maxilla, and upward and backward force for the mandible.

Treatment was continued for 9 to 14 months, until adequate positive overjet was reached. Cone-beam computerized tomography (CBCT) was used to visualize the treatment change. CBCT was performed at the time of miniplate insertion (T1) and either 1 year later or at completion of treatment (T2). To analyze the images, each patient's CBCT images were superimposed on the anterior cranial base to track changes over the course of treatment.

All patients showed a positive change in the region of the zygomatic process, and all but 1 had positive change in the anterior maxillary region. Overjet was positive in all patients at T2. Changes in the anterior mandible varied among the patients, but all had a positive change on the posterior surface and a negative (inward) change on the anterior surface. Soft changes in the upper lip and nasal area were positive to varying degrees for all patients. There was little change in the dentoalveolar area or the mandibular position.

Conclusion

Based on these results, temporary anchorage devices with intermaxillary elastics can be used to successfully treat Class III patients with maxillary deficiencies with few dentoalveolar side effects. Clinicians should be aware of this method for treating patients with retrusive maxillas. OI

Heymann GC, Cevidanes L, Cornelis M, et al. Three-dimensional analysis of maxillary protraction with intermaxillary elastics to miniplates. Am J Orthod Dentofacial Orthop *2010;137:274-284.*

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- Have esthetic preferences changed over time?

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