

Early treatment of skeletal open bite malocclusions

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The diagnosis and treatment of skeletal hyperdivergent open bite continues to be 1 of the most challenging situations facing orthodontists today. Two recent studies provide answers to a series of questions regarding early treatment of open bite malocclusions.

In a prospective cephalometric study, Tran et al¹ evaluated the combined effects of high-pull headgear (HPHG) therapy and light masticatory muscle exercise on craniofacial morphology. Thirty-one open bite patients with skeletal hyperdivergence (mean age, 9.3 ± 1.3 years) were treated with a bonded palatal expander (BPE), a transpalatal arch (TPA), an HPHG, and a mandibular lingual arch for an average of 23 ± 4.7 months. Patients were treated with a rapid palatal expander (RPE) and were then randomly assigned to either an exercise or a nonexercise group. Patients in the exercise group were instructed to clench a soft bite-wafer for 1 minute, 5 times a day. Morphologic data were derived from pretreatment and posttreatment lateral cephalograms. Lateral cephalograms from a retrospective control group were matched by age, sex, and mandibular plane angle. Maximal and submaximal bite forces, together with parameters of masseter muscle activity, were recorded before and after exercise training. The linear relationship between electromyographic activity and bite forces was used to evaluate muscle strength. Treatment results suggested that clenching exercises helped to control the vertical dimension. HPHG therapy alone appeared to increase the overbite and had an intrusive effect on the maxillary

molars. Exercise combined with HPHG therapy produced significant reductions in the ANB and gonial angles and reduced mandibular autorotation by an average of 2.2°. Maximum bite forces and electromyographic force slopes did not vary significantly between groups. Although isometric clenching exercises do not strengthen masticatory muscles, their effects on facial morphology might help to reduce aberrant vertical growth patterns.

In a retrospective cephalometric study, Sankey et al² evaluated a novel early treatment approach for patients with vertical skeletal dysplasia and maxillary transverse constriction. The sample included 38 patients (8.2 ± 1.2 years old) who were treated for 1.3 ± 0.3 years with lip-seal exercises, a BPE appliance, and a banded mandibular Crozat/lip bumper appliance. The BPE was constructed to function as a posterior bite block and was fixed in place throughout treatment. Patients with poor masticatory muscle force (79%) wore a high-pull chin cup 12 to 14 hours per day. The control group was matched for age, sex, and mandibular plane angle. The treatment changes were not significantly different for those who wore chin cups and those who did not. The results showed that treatment significantly enhanced condylar growth, altered condylar growth to a more anterior-superior direction, and produced true forward mandibular rotation 2.7 times the control values. Posterior facial heights increased, and the maxillary molars showed relative intrusion during treatment. The mandibular points pogonion, gnathion, and menton moved anteriorly 90% to 190% more than in the controls. Overbite increased with treatment, and overjet decreased. The 16 subjects who entered the study with open bites exhibited an average 2.7-mm reduction in overbite during treatment. The results indicate this treatment approach might be well suited for hyperdivergent patients with skeletal discrepancies in all 3 planes.

During a workshop discussion on early treatment held by the College of Diplomates of the American Board of Orthodontics (CDABO) in Quebec City, Quebec, Canada, from July 13-17, 1997, participants were divided into groups and asked a series of ques-

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tions. Some of these questions and others regarding early treatment of open-bite malocclusions follow.

What is early treatment?

The CDABO group defined early treatment as that initiated during the primary or the mixed dentition stage to enhance dental and skeletal development before the eruption of the permanent dentition. Its purpose is to correct or to intercept a malocclusion and to reduce the need for, or duration of, treatment in the permanent dentition.

What is the difference between dental and skeletal open bite malocclusions?

A dental open bite is related to thumb or digit habits, and age is an important consideration. Worms et al³ reported an 80% spontaneous correction of anterior open bite in patients from age 7-9 years to 10-12 years. Dental open bites self-correct when the patients discontinue the causal habits. A skeletal open bite often displays supereruption of the maxillary teeth with increased dentoalveolar heights.

Is there a difference in the amount of tooth eruption in dental versus skeletal open bite malocclusion?

According to Cangialosi,⁴ dental open bites demonstrate undereruption caused by an object that prevents incisor eruption. Once the digit is removed, a dental open bite tends to self-correct. Cangialosi reported that skeletal open bites show more molar and incisor eruption than do dental open bites.

What are the common phenotypic characteristics of a skeletal hyperdivergent open bite malocclusion?

Hyperdivergent patients display these characteristics: short posterior face height, long mandibular anterior face height, larger mandibular plane and gonial angles, and downward tipping of the posterior maxilla. Patients usually have increased dentoalveolar heights, and they might also have maxillary constriction and posterior crossbites, a retruded mandible and an anterior open bite in combination with a tongue thrust habit.

What are the benefits of early treatment for a hyperdivergent open bite malocclusion?

Treatment of patients with a hyperdivergent skeletal phenotype must be performed early to be successful. Patterns of facial growth are established early in development. If a patient with a hyperdivergent phenotype remains untreated until the permanent dentition stage of development, the opportunity for growth modification

could be lost, leaving surgical correction as the only possible treatment. Furthermore, early treatment can improve a child's self-esteem by improving appearance.

What type of treatment is most favorable for a hyperdivergent open bite malocclusion?

Control of the vertical dimension is considered the most important factor in successfully treating patients with hyperdivergency. Treatment should result in an increased posterior-to-anterior face height ratio, a forward autorotation of the mandible, and enhanced vertical growth of the condyle. Counterclockwise rotation of the mandible achieved by intruding the molars is central to treatment. In the Tran study,¹ treatment included the use of a bonded RPE fabricated to exceed the freeway space by 2 to 3 mm and to act as a posterior bite block. Expansion occurred at the rate of 0.25 mm daily until the maxillary molars approached a buccal crossbite. The RPE was stabilized for 3 months and then removed; a TPA was placed to maintain intermolar width. An acrylic button (15-mm diameter) was placed on the TPA in the middle of the palate, approximately 3 mm from the palatal tissue. Patients were then fitted with an HPHG with a force of 500 g per side and instructed to wear it 12 hours a day. A fixed lingual arch was placed to maintain arch length and perhaps inhibit molar extrusion; it remained in place throughout the treatment period.

At what age should the hyperdivergent open bite malocclusion patient begin treatment?

Overall growth potential and the possibility of improved cooperation are greater during childhood than during adolescence. Furthermore, younger children might be more cooperative than adolescents when undergoing complex treatment. Therefore, treatment should begin when the patients are 7 to 8 years of age, as soon as they are mature enough to cooperate during treatment.

Will masticatory muscle exercise in hyperdivergent open bite children improve their skeletal morphology by strengthening their muscles?

Currently, no single treatment modality effectively addresses the needs of skeletally hyperdivergent patients; therefore, the masticatory musculature and its functional relationship with the developing craniofacial complex should be considered. Hyperdivergent patients tend to have weak bite forces and small, inefficient muscles. Tran et al¹ evaluated the effects of light clenching exercises combined with HPHG and RPE treatment in young children. Results showed that HPHG use without exercise produced positive alveolar

effects by maintaining the vertical position of the maxillary molars and increasing overbite. HPHG use combined with exercise had a positive mandibular orthopedic effect created by facilitating autorotation, decreasing the ANB angle, and closing the gonial angle. Although exercise training does not strengthen masticatory muscles, its effects on facial morphology might help to reduce aberrant vertical growth patterns.

What is the outcome of treatment for hyperdivergent open bite malocclusion patients?

The ultimate outcome of early treatment depends on the orthodontist's ability to diagnose the cause of the malocclusion and to correct it. Growth is critical to successful treatment; if a nonsurgical approach is to be successful, early orthopedic treatment of all skeletal dimensions is necessary.

Should a patient with a skeletal hyperdivergent open bite malocclusion be treated during the mixed dentition stage?

Absolutely. Early orthodontic intervention is in the best interest of the child.

CONCLUSIONS

If this clinical research project were conducted again, I would modify the treatment to include the use

of a high-pull chin cup in conjunction with the bonded RPE and the HPHG. Sankey et al² and Pearson^{5,6} were correct in their early use of high-pull chin cups to treat hyperdivergent open bite malocclusions. Additionally, I would increase the light masticatory muscle exercise from 5 times a day for 1 minute to 5 times a day for 5 minutes. More clinical research is needed to find a better treatment approach for skeletal open-bite malocclusions.

REFERENCES

1. Tran M, English J, Throckmorton G, Buschang P. The adjunctive treatment effects of light masticatory muscle training on hyperdivergent open bite patients. A pilot study. Dallas (Tex): Baylor College of Dentistry, Texas A & M University; 2001.
2. Sankey W, Buschang P, English J, Owen A. Early treatment of vertical skeletal dysplasia: the hyperdivergent phenotype. *Am J Orthod Dentofacial Orthop* 2000;118:317-27.
3. Worms F, Meskin LH, Isaacson RJ. Open bite. *Am J Orthod* 1971;59:589-95.
4. Cangialosi T. Skeletal morphologic features of anterior open bite. *Am J Orthod* 1984;85:28-36.
5. Pearson L. Vertical control in treatment of patients having backward-rotational growth tendencies. *Angle Orthod* 1978;48:132-40.
6. Pearson L. Case report KP. Treatment of a severe open bite excessive vertical pattern with an eclectic non-surgical approach. *Angle Orthod* 1991;61:71-6.