Clinical Perspective

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An Approach to Openbite Cases with Tongue Thrusting Habits — With Reference to Habit Appliances and Myofunctional Therapy as Viewed from an Orthodontic Standpoint: PART ONE

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NOTE: The Japanese original of this article appeared in the Nippon Dental Review in three installments from December, 1979, to March, 1980. This English version has been prepared for IJOM at the suggestion of Mr. R.H. Barrett, 1978, who taught us much about myofunctional therapy (MFT). In view of space limitation, some historical matter about MFT and the etiological consideration of tongue habits, etc., are purposely omitted. Part Two of this article will appear in the next issue of IJOM.

1. Introduction

In recent years in Japan, many reports have been published, from pedodontists in particular, concerning an increase in various oral habits such as thumb or finger sucking (Figure 1). This is also true of our orthodontic clinics; patients with openbite or maxillary protrusion accompanied by tongue thrusting, which is thought to have derived from some kind of oral habit in their infancy, account for as much as 20% of the total patients consulted.

In administering orthodontic treatment to the patients accompanied by tongue habits, the installation of a tongue habit removal apparatus is used for those in the mixed dentition stage. The movement of teeth by use of a full-banded system is given more importance for those in the permanent dentition phase, in hopeful expectation that the tongue function may adapt itself to the new environment through morphological change to be brought about by a mechanical appliance.

In our daily orthodontic practice, it is not infrequent that we encounter orthodontic cases that do not easily

Figure 1. A large callus on the thumb (this patient continued thumb sucking until 8 years old).

lend themselves to our planning. For instance, when vertical elastics are used to bring about extrusion of the bimaxillary anteriors, we often fail to obtain a closed bite because of tongue habits on the part of a patient or, upon removal of the orthodontic appliance, relapse will soon take place owing to a tongue thrusting habit, thus leading to an undesirable space between the maxillary and mandibular anteriors.

The etiologic problem of malocclusion, which concerns itself with morphology and function, lies in the relationship between causes and results comparable to an age-old story of the

chicken being the first or the egg. It is not to be denied that these two are intimately related to each other. Even if a malocclusion has been corrected by orthodontic means, it does not always follow that the tongue function and various muscles associated with the oral cavity will adapt to a new occlusal relationship. Therefore, it becomes necessary to create new functions in addition to correcting the malocclusion itself. Although a full-banded system has an excellent effect in treating various types of malocclusion, there are many cases in which mere mechanics fail to cure the tongue thrusting problems. It is our opinion that, for the orthodontic patients with some kind of tongue thrusting habit, the time of initial treatment and subsequent cure of a tongue habit will determine the success or failure of our orthodontic treatment. For such cases with openbite or maxillary protrusion, in particular, oral myofunctional therapy (to be referred to as MFT hereafter) is considered to be absolutely necessary before and during treatment as well as after removal of an orthodontic appliance. In the present paper, our concern is not only with MFT but also with the problems involving the relationship between habit appliance and tongue, and high pull headgear on the part of orthodontic patients having some kind of tongue thrusting habit and, further, with the possibilities and limitations of MFT from a broad point of view.

2. The Present Situation of MFT in Japan

It is needless to point out that the

recognition that MFT would prove an effective clinical tool was brought about by the pioneering efforts of Barrett (1961, 1978), Garliner (1967, 1976), Hanson (1978), Zickefoose (1974, 1976) and many other oral myologists, who have been most instrumental in building up this relatively new discipline. In Japan, Enoki and Motohashi (1955), both of Nippon Dental College, reported cases in which plates or activators embedded with spurs were employed for treatment of patients having an abnormal deglutitional habit, together with the training of normal tongue habits. Despite the fact that reference to MFT is found in orthodontic textbooks written for the Japanese dental students, we did not possess any detailed information on the actual practice of MFT. What these textbooks contain, therefore, is based on the descriptions of Rogers in the 1920's. In 1972, Kamiyama wrote in a journal to the following effect:

In the U.S., there is an independent clinical branch called speech therapy, and its specialists give training concerning muscles associated with the oral cavity, including deglutitional movement. When an orthodontist finds this kind of task beyond his competence, he writes a letter of referral to a speech therapist and, thus, will be released from this kind of troublesome task.

Further, in 1972, Uchida stated:

Speech therapy in Japan is yet an unexplored field. Since an orthodontist is not conversant with the knowledge and technique of speech therapy, and in view of his limited time, it is hoped that speech therapy will highly advance in the future.

As is seen from these passages, there was an impression that MFT was performed only by speech therapists, and the existence of oral myologists was not much known to Japanese orthodontists. In recent years, the utility of MFT has come to be appreciated not only in orthodontics, but also in pedodontics. It is of interest to us that Fukada (1979) and Ogura (1976), both pedodontists with several papers on MFT, consider the problem of MFT to be an old and, at once, a new subject. Even in the U.S., there seems to be some discrepancy of opinion regarding MFT among orthodontists, some advocating its high merit while others discredit its clinical effect altogether. For instance, Hitchcock (1974) proposes a joint effort of dentist and speech therapist for the treatment of openbite patients accompanied by a tongue habit. Wildman (1976) advocates a team approach for such

Figure 2. MFT training course conducted by Mr. Barrett. The mothers stand by as family supervisors.

openbite cases, between an orthodontist and an oral myologist and stresses that they have to be good collaborators. In addition, clinical implications of MFT are recognized by orthodontists including Moyers (1972), Ricketts (1968), and Cottingham (1976) among others. In treating cases of openbite attended with tongue habit, as well as maxillary protrusion cases, we orthodontists deem it necessary, apart from any theoretical consideration, to provide some kind of measure for the tongue and orbicular muscle in addition to a full-banded system.

It is a fact that, in Japan, speech therapists, who are yet limited in number, are busily engaged in the daily treatment of children with speech disorders and those with cleft palate. For this reason, they are unable to respond to the needs of orthodontists satisfactorily. Under these circumstances, MFT for the patients having a tongue habit is provided in the various orthodontic clinics, and it is the responsibility of the orthodontist and his staff of dental hygienists and assistants to furnish the necessary therapy.

The orthodontist is restricted in terms of time, however. The best course available presently seems to be a proper diagnosis by an orthodontist followed by placement of the patient in the charge of either a dental hygienist or an assistant who has training in MFT and who knows how to communicate with the patient.

Ohno, one of the present authors, attended an MFT course given by Mr.

R.H. Barrett in Tucson, Arizona (Figure 2). Later in 1978, a group of orthodontists participated in a course taught by Mr. Barrett in Tokyo. This group also benefited from a lecture by Mrs. Jean Thompson, of San Diego, in the same year. The four dental hygienists whose names appear in this article attended an MFT course by Mr. Zickefoose in Sacramento, California (Figure 3). Having gone through these learning processes, our orthodontic clinics have organized training programs in which dental hygienists conduct and supervise MFT sessions for those orthodontic patients who have some kind of tongue thrusting habit.

3. What Effects Do Tongue-Thrusting Habits Exert on the Dental Arch as well as on the Jaw Bones?

The routine work of an orthodontist, at the time of initial consultation with a patient, is not only to analyze hard tissues but also to carefully observe soft tissues associated with them. He should further pursue his work with due consideration of the anterior-posterior positional relationship of lips in profile, any needed extractions, and final orofacial esthetics of soft tissues. The morphology and function of the lips are intimately related to those of the tongue, thus mutually influencing each other; one cannot be considered without regard to the other. The possible effect of tongue-thrusting on the dental arch will now be discussed.

It is well-known that, patients in

Figure 3. Mr. Zickefoose in his training session. 8mm photographic recordings are being made of the oral conditions including soft tissues both pre-and post-treatment.

whom a strong tongue pressure, nasal complaint, enlarged tonsil or adenoid manifestation, etc., are evident, habitually keep their mouths open because of mouth breathing and, for this reason, their labial pressure is appreciable weakened. In the cases of maxillary protrusion, there are frequently found patients whose labial pressure almost resembles myasthenia. Moreover, we frequently encounter clinical cases in whom a space has been engendered between the maxillary and mandibular anteriors because of an unbalanced labio-lingual directional force attributable to a tongue-thrusting habit. Kydd (1957), measured tongue pressure of patients with malocclusions associated with some form of tongue-thrusting habit. He said that, when compared with the labial pressure of normal subjects of 123 g/cm^2 , there is as much difference as 285 g/cm^2 , the labial pressure being weakened in all the cases examined. It is generally held that patients with tongue-thrusting habits have a tongue pressure anywhere from 2.9 to 4.5kg. According to Nezu (1973), in Angle Class II openbite patients, the lingual pressure becomes much greater during deglutition, amounting to as much as three times that of labial pressure, where the maxillary lingual pressure is particularly noteworthy. In view of this kind of a strong lingual pressure and the number of deglutitional movements, said to be 590 to 2,000 times per day, possible influence on the dental arch must be far greater than is

generally supposed. Further, a tongue-thrusting habit which has adversely influenced the mixed dentition will similarly exert pernicious influences on the direction of jaw development as well as its morphology, leading gradually to a case of skeletal openbite (Figure 4), which does not easily lend itself to Orthodontic treatment.

Figure 5 is a comparison of superimposed cephalograms of normal occlusal subjects and typical openbite cases. As indicated by the figure, as

Figure 4. The anterior protrusion of the tongue results in the inclination of anteriors, increase in F.M. angle and extrusion of molars. Alveolar openbite leads to skeletal openbite.

compared with normal occlusal subjects the cases of skeletal openbite are observed to have a larger F.M. angle, shorter mandibular rami and both the maxillary and mandibular molars are extruded. For this reason, facial height tends to become greater and

Figure 5. A superimposition of normal occlusal subject on a typical openbite case. In openbite cases, increase in F.M. angle and vertical height of the face is characteristic. The mentum is receded.

————— Normal occlusion
----- Openbite

results in a longish facial impression through the recession of the chin characteristic of openbite cases. Based on previous findings on skeletal openbite cases, we may summarize the known facts as follows:

1. The presence of a tongue-thrusting habit interferes with the eruption of the anteriors and thus prevents the vertical growth of alveolar bones.
2. Since the tip of the tongue is protruded between maxillary and mandibular anteriors and lips are open through mouth breathing, an extrusion of maxillary and mandibular molars is apt to occur.
3. F.M. angle tends to become larger in the transition from mixed to permanent dentition and the position of the tongue tends to be located anteriorly and downward.
4. The vertical height of the face becomes longer (longface syndrome).
5. In proportion to the narrowing of facial width, the disharmony of

muscles around the oral cavity will tend to be more pronounced.

Our inquiries into the familial and hereditary factors of openbite patients in possession of permanent dentition who sought orthodontic treatment in our clinics failed to elicit any causative relationships. From this fact, it is inferred that, aside from familial and hereditary factors, the presence of a tongue-thrusting habit for a prolonged period of time has a clinical bearing on jaw morphology and its change in a skeletal sense. Takeuchi (1978), based on this serial study of cephalograms, gave definite evidence of changes from ordinary to skeletal openbite, even when limiting his efforts to the teeth and alveolar bones in 8 to 10-year-old children. Further, all the published literature leaves no doubt as to an intimate relationship prevailing between morphology and function in various types of malocclusal patients. Along this line of belief, we try to provide some kind of countermeasure to those patients who are in the mixed-dentition period and are relatively free from abnormal changes in the jaw itself, even if their openbite complaints are attended by a tongue-thrusting habit. Such matters as the anterior and downward position of tongue, increase in F.M. angle and extrusion of molars, all intimately associated with the transition to skeletal openbite, are next to be dealt with.

Regarding the anterior and downward positioning of the tongue usually observed with cases of tongue thrusting, opinions of investigators vary not a little. Ricketts (1968) maintained, in his study of the resting position of the mandible, that the mandible is moved to a lower position than that of normal by the manipulations of the thrusting tongue both in the anterior and downward direction. Proffit (1975), on the other hand, held that enlarged tonsils and adenoids are responsible for the anterior tongue placement, and that the F.M. angle will become extended by reason of mouth breathing.

The tongue position tends to be located lower in proportion to an increase in F.M. angle, and Ballard confirmed the relationship between these two factors. In our clinical experience, the majority of bimaxillary protrusion, maxillary protrusion and mandibular protrusion are found to have a larger F.M. angle attended by the downward and lower position of tongue. At the same time, though not a desirable phenomenon, use of a full-

banded system sometimes results in an increase of F.M. angle during treatment and, because of this, some sort of tongue thrusting-habit will occur during and after orthodontic treatment.

In the case of convenient extractions, of course, the intraoral volume is reduced through the recession of anteriors, which may prove to be one of the causative factors of tongue-thrusting habits. An abnormal attachment of the lingual frenulum, often seen in patients with tongue-thrusting habits, is held by Horton (1969) to promote the anterior protrusion of the tongue and, thus, aid in the growth of the mandible in an anterior direction. It is inferred that, through a combination of factors inherent in a patient with some degree of tongue protrusion, the duration and frequency of swallowing, and other external factors, an imbalance peculiar to patients with openbite will be gradually created in the facial expression as well as in muscles associated with the oral cavity.

4. Can Tongue-Thrusting Habits Be Cured by Use of Habit Appliances?

Our therapeutic measures for openbite cases are routinely as follows, depending on the morphology of tongue and the age at initiation of treatment:

- 1) Application of a habit appliance.
- 2) Myofunctional therapy.

- 3) An inhibition of vertical growth of the maxilla in the maxillary molar region by use of a high pull headgear.
- 4) A mesial movement of molars by extending $\frac{5}{5}$ or $\frac{6}{6}$ by an application of a full-banded system in an effort to reduce the vertical height.
- 5) Surgical method.

Of the above-mentioned measures, 1) and 2) are measures directed to the treatment of tongue-thrusting habits themselves, while 3), 4), and 5) are the approaches to change in the morphology of jaws. Our questions here are: to what extent tongue-thrusting habits can be cured by a habit appliance, and how much MFT would contribute to changing the previous behavior pattern of the tongue. These are the questions that have been discussed by many orthodontists and speech-therapy specialists. Those of the orthodontists who are skeptical of MFT are in favor of habit appliances as well as full-banded systems, advocating that a new function can be evolved in the tongue by mechanically changing the dentition and jaw morphology. It was stated by Subtelny (1970) as a fact that tongue function will adapt itself to the result brought about by an orthodontic appliance, the fact being also supported by radiography. Thus, orthodontists have reported many dramatic cures of

Table 1.

openbite patients by use of habit appliances but, on the other hand, there are many known cases in which clinical effects are absent altogether. At the same time, as advocated by Ricketts (1968), Shia, and others, it is true that, the surgical excision of enlarged tonsils and adenoids have contributed to an improvement of the anterior and downward position of tongue gradually without any recourse to MFT. Again, it is true that what is maintained by Barrett (1978) and other oral myologists can bring about a dramatic change in tongue-thrusting habits.

The use of habit or other orthodontic appliances, the removal of causative factors, or MFT training; tongue-thrusting habits can be cured by any one of these methods, and it is a dangerous conclusion to maintain that MFT does not furnish an effective choice in this service. What is said above does not imply that one and the same method should be invariably employed for the treatment of tongue-thrusting patients but, instead, the indications of a given case should determine the choice of a method.

Our approach to tongue-thrusting patients can be schematically shown (Table 1).

As illustrated by the schme, in Table 1, our treatment approach is changed accordingly as to whether a patient is diagnosed as a case of skeletal openbite or as that of dento-alveolar openbite. The opposing opinion of Haas (1975) to MFT and a refutation of this by Barrett (1978) are of much interest to us. As Haas maintained, when a spur is welded on the mandibular anterior band on the lingual surface (Figure 6), subconsciousness is stimulated, and correct deglutition (which is a reflex) can be restored without anterior protrusion of the tongue. He gave the percentages of success as 90% for those under 12 years of age, 85% for those from 12 to 15 years of age and 75% for those over 15 years of age. In refutation of Haas's position, Barrett maintained that a spur welded on the lingual surface of mandibular anteriors is nothing less than a sadistic method that gives pain to the patient, and, when this kind of spur is used for the types of tongue-trusting habits where the tongue protrudes anteriorly, there is a possibility of the tongue spreading laterally, changing its original direction.

We have encountered similar situations in which the use of a habit appliance succeeded in moving the tip of

Figure 6. A spur welded to the mandibular anterior band devised by Haas and held to be clinically effective.

the tongue back but, as a counterbalance, the center of the tongue protruded laterally. As we see it, the basic difference between these two specialists lies in their concepts of what is involved in deglutition. Haas maintained that swallowing activity is a reflex, while Barrett's stand was that swallowing activity is not a reflex in its first phase but a voluntary movement; therefore, the tongue is capable of being retrained. At any rate, it is certainly true that, in a clinical environment, the use of a habit appliance equipped with a sharp spur cannot solve all the problems involved in tongue-trusting habits.

According to a comparison between MFT and habit appliances in terms of cephalograms carried out by Rothstein (1974), treatment effects by the former are given to be 50% and the latter to be 60%. The cases that scored these high percentages of success were ones with Class II malocclusion, having favorable skeletal patterns from a treatment point of view. What is of particular interest is that MFT was found to be more effective than habit appliances for the improvement of overbite cases. However, a similar study by Cooper (1977), based on cephalograms, did not confirm much difference between the two. We also note that none of these studies verify the type of MFT program used or the effectiveness of the person using it. It seems that these can differ greatly. Good results from MFT should not be expected when either the method or the therapist is lacking in competence.

5. Actual Application of Habit Appliances

A variety of habit appliances exist, equipped with cribs, fences, rakes, hoes or spikes; they are also called tongue guards. When one of these habit appliances is embedded in an orthodontic appliance, it is apt to give

an unpleasant stimulus to the tongue, it often hinders proper pronunciation, and the patients tend to remove it. Since we have not invariably used the habit appliances in our routine orthodontic practice, the clinical cases that are reported in this article are those treated before the introduction of MFT into our practice. Graber (1972), who used a modified form of a finger-sucking preventive apparatus as a tongue guard, advocated that it is effective for tongue protrusion when it is bent downward in the posterior region of maxillary anteriors, the required period for the improvement of openbite being anywhere from 4 to 9 months. Symmetrically opposed to his view, Moyers (1972) insisted that, instead of preventing tongue thrusting by a mechanical means, a spur should be welded on the mandibular lingual arch so that an unpleasantness or pain will act on the neuromuscular system. It is also maintained that this kind of spur needs no large screen or rake form. Use of habit appliances is found to be effective for the improvement of junctional openbite cases but, on the other hand, cases are observed in which a heavy emotional burden is suffered by the patients, there is interference with ordinary enunciation and traumata by the spikes, with traces of scars found on their tongue. Our clinical findings are that, depending upon the height and composition of fences and spikes, there seems to be a certain amount of difference in the movement of teeth. The habit appliances change the oral environment mechanically and thus prevent anterior thrusting of the tongue, but we consider the pressure exerted by the tongue on these mechanical devices to have an adverse effect in that the arch tends to be moved forward. For this reason, it requires deliberate thinking to decide whether a habit appliance is to be placed on the maxillary or mandibular arch. In consideration of the possible effect of pressure by the tongue, we believe that for cases of Class III openbite tendency the maxilla should be chosen. In pseudo anterior crossbite cases with some kind of tongue thrusting habit, use of a habit appliance on the maxillary arch may result in the correction of openbite together with improvement of anterior crossbite conditions.

Case 1

A girl of 8 years of age. She was in the habit of sucking her fingers in bed, and enlarged tonsils and mouth breathing were observed. With 5mm overjet and -1.8mm overbite, an im-

pression of mouth protrusion and lax conditions of the lips through mouth breathing were noted (Figure 7-A). Since this case showed a tendency toward maxillary protrusion, we tried a simple MFT Program for 3 months prior to our training by Mr. Barrett, but our effort was not rewarded. As stated earlier in the article, we put a habit appliance on her mandibular arch to take advantage of pressure by the tongue (Figure 7-B). After about 1 year, both overjet and overbite were improved (Figure 7-C) and a superimposition of cephalograms revealed the lingual recession and extrusion of maxillary and mandibular anteriors. From the fact that the position of tongue, both pre-and postoperatively, moved in the posterior-downward

Figure 7-A. An openbite case with 5mm overjet and -1.8 mm openbite (8-year-old girl).

Figure 7-B. Installation of a habit appliance on the mandibular arch in conjunction with 3-month simple MFT.

Figure 7-C. An improvement of openbite after 12 months.

Figure 7-D. Finishing by a full-banded system upon completion of the permanent dentition (no tongue habit and the arch stabilized).

Figure 8. The profile has been improved in morphology by use of a habit appliance. Right: preoperative. Left: Postoperative.

direction, it was assumed the position of the tongue was favorably changed in the oral cavity, indicative of an improvement of her tongue habit. With this case, a full-banded system was put in place after extraction of $\frac{4}{4}$ upon completion of the permanent dentition, and through the duration of orthodontic treatment there was seen no relapse of the tongue habit. Her occlusion is quite stable at present (Figures 7D and 8).

Our evaluation of the degree of tongue adaptability in this case is based on x-ray photography by Cuozzo (1975) regarding the position of the hyoid bone and change in the position of tongue. As the result of a similar study, Gobeille (1976) reported that, in patients wearing habit appliances, the hyoid bone moves in the posterior-downward direction when the tongue becomes well adapted to a new environment. In the cases whose treatment results are not favorable, there is seen no posterior downward movement of the hyoid. On the other hand,

a study by Subtelny and Sakuda (1970) concluded that there was no positional difference of the hyoid bone between the cases of openbite and normal occlusal subjects. Because of the fact that there exist many individual variations regarding the position of the hyoid, we are obliged to infer the degree of tongue adaptability to a new environment by a comparison of pre-operative and post-operative findings (Figure 9).

Figure 9. A superimposition of cephalograms at palatal plane for the maxilla and at mandibular lower rim plane for the mandible. Openbite conditions have been improved through the lingual inclination and extrusion of maxillary and mandibular anteriors. The position of the hyoid bone move downward.

————— Preoperative
----- at removal of habit appliance (after 12 months)

6. Our Approach to High-Pull Headgear for Openbite Cases

The openbite cases are twofold: Those of dentoalveolar openbite whose vertical growth of anterior alveolar bones and eruption of anteriors are hindered by reason of finger sucking, etc., and those of skeletal openbite attended by morphological abnormality of the jaws. The former, called functional openbite cases, lend themselves to MFT with favorable results and corresponding good prognoses. According to Takeuchi (1978), who studied openbite cases longitudinally, the majority transfer to cases of skeletal openbite from 8 to 10 years. The age of 10, in particular, is a transitional period from an openbite restricted to the teeth and alveolar region, to that of skeletal character. Because of this, we deem it necessary to treat an openbite case attended by a tongue-thrusting habit in the stage of mixed dentition, before it transfers to a skeletal open-

bite. Therefore, high-pull headgear should be positively utilized for the openbite cases attended by some jaw abnormality or maxillary protrusion trend, even in the stage of mixed dentition, in an attempt to inhibit the vertical growth of maxillary molars. In terms of the orthodontic mechanism, the objective is to inhibit the vertical growth downward in the posterior portion of the nasal floor and, as for the anteriors, to act on the downward direction in a clockwise fashion. These two forces in a favorable combination with natural growth will work toward closing an openbite.

Case 2

A girl of 10 years of age. After an application of high-pull headgear for 16 months, the previous overjet of 7mm (Figure 10A) became improved to 1.5mm and -2mm overbite to +3mm (Figure 10-B). A superimposi-

Figure 10-A. An openbite case with 7mm overjet and -2mm overbite (10-year-old girl).

Figure 10-B. After use of a high pull headgear for 16 months, her openbite conditions were improved.

tion of pre and postoperative cephalograms (Figures 11, 12, 13) shows an extrusion of the maxillary anteriors as well as recession through an inhibition of vertical growth of molars and, at the same time, promotion of vertical development in the middle facial region, the result being a closure of the space between the maxillary and mandibular anteriors attended by the disappearance of the tongue habit. The position of the hyoid bone, postoperatively, trans-

Figure 11. The downward movement and lingual inclination of maxillary anteriors took place by inhibiting the vertical growth of maxillary molars and inducing that of facial region.

————— Preoperative
----- Postoperative

Figure 12. A superimposition of palatal plane on ANS. The recession of maxillary anteriors and distal movement of maxillary molars are noted.

Figure 13. A superimposition of the mandibular lower rim on menton. A slight posterior downward movement of the hyoid is noted.

ferred in a posterior-downward direction by adapting to changes in the jaw morphology and environment as well. From these findings, we can confirm

the disappearance of the tongue habit. In dealing with this kind of a case, full cooperation on the part of the patient is a prerequisite, since a long time is required to promote the natural growth of her midface region, particularly the anterior alveolar region in a vertical direction, before the treatment effect for anterior openbite can be apparent. Unlike a habit appliance, the use of a high-pull headgear is directed not toward improvement of openbite cases owing to changes in the teeth and alveolar region, but is rather directed to correct changes in the middle facial region and skeletal pattern, i.e., cases for which an orthopedic effect is expected. We consider a high-pull headgear to be a favorable approach to cases of skeletal openbite.

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