

Tutorial

Orofacial myofunctional disorders: Guidelines for assessment and treatment

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OROFACIAL MYOFUNCTIONAL DISORDERS: GUIDELINES FOR ASSESSMENT AND TREATMENT

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ASSESSMENT Philosophy

A concept that, fortunately, survives eras of attention to less thoughtful approaches to the modification of human behavior is the "First as a Person" philosophy. The essence of the concept is: When you see a patient for the first time and are faced with the challenge of learning something that will enable you to contribute importantly to his or her future well-being, see the patient first as a person, then as a person with a problem and, finally, as a person with a specific type of problem. The easier approach is the reverse: In the case of orofacial muscle pattern abnormalities, to look anxiously first at the teeth, then the tongue, then the lips, then the vegetative and communicative functions of those structures, then perhaps the cosmetic aspects of the behaviors. The benefits of the "First as a Person" approach seem obvious, and we subscribe to that approach in assessment.

Without seeking to make everyone a clone of the perfect facial profile, orthodontists try, with help from clinicians, general dentists and oral surgeons, to provide each patient they treat with optimal functional and cosmetic occlusion. The contribution of the orofacial myologist to this task is to train that whole person to adapt and adopt: To adapt to whatever temporary or permanent conditions that may preclude or impede strictly normal functioning, and to adopt new oral behavior patterns. As a first step in this training, the clinician must determine what behaviors need to be changed and what may be the structural, physiological and behavioral barriers to change. In other words, assessment is a *subtractive* process; an attempt is made to identify factors that contribute to normal functioning that are not present in the individual. These structural, physiological and behavioral factors are interrelated. All must be examined as possible contributors to the problem.

When assessment determines that therapy is indicated, it must provide direction for that therapy. If therapy is to be successful, it must be individualized. The basis for that individualization is a thorough evaluation of structures and functions.

Everyone starts out life as a "tongue thruster." Even in utero, the tongue pushes forward. At some time between birth and the age of five years, most children replace an anterior tongue-gums or tongue-teeth seal during swallowing with a superior tongue-palate seal. Those who do not make this change fail to do so for some reason or reasons. The diagnostician's responsibility is to search for those conditions that maybe prompting the

continuation of the anterior positioning of the tongue, at rest and during function. If any of them can be removed or reduced, either by training or by medical or dental procedures, therapy will be more productive.

Diagnostic Questions

Some important questions to be answered in the initial evaluation include:

1. Why is this patient here?
2. Is the patient aware of the reason for being here?
3. Are there any fears or misconceptions in the mind of the patient that should be addressed?
4. Is there really an "abnormal" orofacial muscle pattern present?
5. If so, is it doing any harm, or is it likely to do any harm in the future?
6. Which components of the total system of patterns are normal and need no attention?
7. Are abnormal behavioral patterns consistent?
8. Is intervention warranted? At this time? If not now, when?
9. What orthodontic or surgical treatment is being considered or planned? What effects might these procedures have on the orofacial myofunctional therapy?
10. What factors are present that might mitigate against a favorable prognosis for treatment?

Observations

The orthodontist or other specialist who referred the patient for examination may have explained some basic principles to the patient at the time of the referral, such as the importance of keeping the lips closed at rest, or how to swallow food without the tongue touching the front teeth. The conscientious patient may reach your office or treatment room primed to display normal tongue behavior. The receptionist or secretary can be of help in this situation by observing the patient as she or he enters the waiting room, or during communication between child and parent or child and sibling. Particularly important are the resting postures of the body and of the lips and tongue. The clinician, throughout the treatment process as well as during the initial consultation, must become skilled at catching the patient off-guard. When, for example, the clinician has checked a food swallow,

and instructs the patient to finish the cookie or cracker, the clinician, while pretending to be busy doing something else glances at the patient as she or he continues to chew and swallow. The general rule about tongue function is: *The only time the tongue should be visible in normal functioning is in speech during the production of the /th/ sounds.* At all other times, it should not be seen.

Examination

There are many procedures reported in the literature for examining patients. Some general procedures of special use in describing oral behaviors and postures are offered here.

Structures

Structures should be examined before functions, because knowledge of the former gives direction to the latter. If, for example, there is a unilateral open bite extending from the maxillary cuspid on the right side to the first molar on the same side, the function of swallowing saliva or food would best be seen by breaking the labial seal on that same side, rather than by breaking the seal in the incisal area.

Moving, as is customary in oral examinations, from outside to inside, the clinician can attend to the following:

Lips. Are they symmetrical at rest and in function? Is either one unusually large, everted, small, tense, or short? Do the lips have difficulty approximating at rest? Does the lower lip rest against or under the biting edge of the upper incisors? Does the mentalis muscle appear to be overdeveloped? Does it contract noticeably during saliva swallows?

Upper Labial frenum. Does it appear to restrict the movement of the upper lip over the front upper teeth? Is it unusually thick or tight? Does its lower attachment separate the central incisors?

Dentition. Check all the way around both upper and lower arches for any intra or inter-arch abnormalities. Do upper and lower first molars articulate normally? Are the upper molars lingual to the lowers? Is the relationship of the upper to lower molar different on opposite sides of the mouth?

Note any deviation of individual or groups of teeth in any direction. Are the spaces between the teeth within an arch larger than normal for the age of the patient? Is there crowding? Have any of the teeth erupted out of normal position? Are there rotations? When the patient bites down firmly, does the masseter muscle on one side contract more forcefully than the other?

Anteriorly, check vertical and horizontal relationships between upper and lower teeth. Measure any overjet, openbite or overbite, and clearly describe the location and manner of the measurement. If the open bite is variable, measure it in more than one location. Many orofacial myologists take intraoral photographs at various treatment intervals. If you choose to do so, carefully maintain lens-to-mouth distance and angle (See articles by Case and Zimmerman elsewhere in this journal special issue).

Lingual Frenum. Have the patient lift the tongue tip to

the alveolar ridge with the teeth about 5/8 inch apart (distance varies with age or size of patient), or separating the teeth with a tongue depressor placed edgewise between the upper and lower cuspids, ask the patient to say some words beginning with /t/, /d/ or /n/. If the tongue reaches the alveolar ridge without undue difficulty, the frenum is elastic enough to permit normal movement of the tongue for speech.

The Tongue. Have the patient imitate tongue movements. Assess movements actually involved in normal lingual functions: Lifting the tip, moving the tongue from side to side within the oral cavity, sucking the tongue up against the palate as though the tongue were about to "pop," or release quickly, and saying a /k/ sound to lift the back of the tongue. To check for symmetry, the patient is asked to protrude the tongue maximally to touch a tongue depressor held in front of the middle of the mouth.

The tongue of a thruster often appears too large for the oral cavity. To assess this subjectively, the patient is instructed to place the tongue tip against the upper anterior alveolar ridge, with the teeth held apart, about the width of a tongue depressor. When the patient bites down slowly, observe the tongue as the upper and lower teeth approximate. The tongue will normally fit comfortably within the upper arch. If it appears to be unable to do so with ease, tongue-narrowing exercises employed for three to four weeks are often very useful. Later retesting should be done following such treatment.

Functions

A thorough assessment of function is critical. Resting postures, eating, drinking, saliva management and speech should each be assessed.

Resting Postures. Observe the body posture. Does the patient slouch? Is the head perched anterior to a perpendicular plane from the upper back to the lower back? Is the head tipped back at rest? If the lips are resting apart, ask the patient whether nose breathing would be difficult if the lips were kept closed for a few minutes. Have the patient attempt this for a while. Do the lips have to strain to approximate one another? Does the lower lip have to stretch considerably to reach out over the upper anterior teeth? If the lips rest apart, observe tongue-resting posture. If not, try to determine the resting posture of the tongue as the mouth opens for speech. Adults are often aware of habitual tongue-resting positions. Ask the patient where the tongue usually rests.

Eating. Provide the patient with a cracker or wafer that is somewhat dry. Watch closely all phases of eating: Does the tongue reach forward as the food approaches the mouth? Is bite size unusually large or small? Are the lips apart during chewing? If they are together, do they protrude during chewing? Does the chewing seem to be accomplished by the anterior, rather than the posterior teeth? Is the food chewed for too short or too long a time? Before swallowing, does the patient gather the food by thrusting the tongue? Do the molars occlude during swallowing? (Check by palpating the masseters.) Break the labial seal as the larynx begins to ascend in a swallow

and notice the extent and location of tongue-teeth contact. Does one swallow suffice, or are two in a row required for each mouthful of food? After swallowing, are many crumbs left on the tongue? Does the tongue "clean up" food left at the front of the mouth following a swallow?

Drinking. The following are common tongue thrust behaviors: The tongue reaches out to welcome the glass to the lips. The head tips forward at the beginning of the drink and tips backward as the glass is emptied. There is considerable in-and-out movement of the lips during drinking. As the glass leaves the lips at the end of the drink, the tongue can be seen retreating into the mouth. Often, the lips are licked after the drink is completed.

Saliva. Ordinarily, the process of collecting saliva, moving it posteriorly in the mouth, and swallowing it is done unceremoniously. No one is aware that someone in their company is swallowing saliva. Yet, it occurs every two minutes or so. When there is tongue thrust, the saliva is managed with varying degrees of circumoral muscle contraction and may include depression of the mandible to create suction.

Speech. When seated at the side of the patient, the clinician can observe whether the tongue tip contacts the anterior teeth during the production of the lingual-alveolar sounds (/t/, /d/, /n/, /l/, /s/, /z/). It normally should not do so. The stimulus items may be picture cards, an articulation test, conversation or merely having the patient count to 20.

Rating Scale For Muscle Contraction. A 0-1-2 scale suffices. "0" means no muscle contraction; "1" some muscle contraction; "2" considerable contraction. Apply this to tongue protrusion (primarily genioglossus contraction), "0" means the tongue does not touch the anterior teeth during swallowing; "1," the tongue does touch at least half the lingual surface area of the upper or lower anterior teeth; and "2" the tongue protrudes beyond the cutting edge of the upper or lower anterior teeth during swallowing. Applying the scale to circumoral muscle contraction, the three digits refer to no visible lip muscle activity, some tightening and strong contractions, respectively. The same scale is used for determining masseter activity during swallowing.

Assessing Muscle Strength. No current instrumentation clearly demonstrates a relationship of any specific muscle strength measure and treatment modality. Accordingly, many clinicians prefer not to be concerned with measurements of muscle strength; however, some clinicians routinely test lip and tongue strengths. Garliner (1975) describes equipment used for that purpose. The simpler device is a pull-type scale. The hook attachment at the end of the scale is connected to a six-inch string, in turn attached to a one-inch button. The button is placed anterior to the incisors and posterior to the lips. The clinician pulls the scale until the button is ejected, and the dial on the scale is read. Normal range for lip strength is listed by Garliner as three to five pounds, although the validity of such testing and treatment planning remains in question.

The more complex instrument for measuring oral muscle strength is the Bio-My Master. This is a biofeedback device. Extraoral probes measure electrical activity dur-

ing function of the masseter and lip muscles. Intraoral probes locate tongue contact during swallows but do not measure the force of the tongue pressures. The therapeutic value of data obtained by such testing is also in question.

Prognosis. Two types of questions may be posed concerning prognosis: (a) Is this patient likely to "outgrow" the tongue thrust or postural variation without intervention? (b) How successful is therapy likely to be? Most of the answers are common to both questions. Any factors that tend to crowd the tongue in any direction (i.e., vertically, anteroposteriorly, or horizontally) mitigate against a favorable prognosis. These include grossly enlarged tonsils, lingually inclined anterior teeth, lingual crossbite, ectopically erupted teeth that make tongue-palate seals difficult, a narrow palatal arch, (either along the entire arch or just anteriorly), a habitually forward-resting tongue due to a nasal breathing difficulty, or a deep overbite (restricting the vertical dimension). Additional prognostic factors for those patients being considered for intervention are motivation, interest and cooperation of parents, activity schedules (time available for practice) and maturity level of the child. Few people who are tongue thrusting at the age of 8 years stop doing so during the following 10 years (Hanson and Andrianopoulos, 1982). Research has also revealed that from 80 to 90 percent of all patients who receive therapy correct adverse patterns and retain the corrected patterns for several years following completion of orthodontic work (Christofferson, 1970; Overstake, 1975; Toronto, 1975).

Treatment

An attempt will be made in this section to present consensus principles concerning treatment along with some specific recommendations. Several questions will be addressed: (1) What is the purpose of treatment? (2) When should treatment begin? (3) How long does treatment typically take? (4) What are some important principles in planning and conducting treatment? (5) What specific exercises and assignments should be utilized? (6) How is "carry-over" achieved?

Purpose Of Treatment

The purpose of treatment should be to replace behaviors that appear to be harmful to the teeth or appearance, or both, with alternative behaviors that are neutral or beneficial in their effects and to make those alternative behaviors automatic and permanent.

When Should Treatment Begin?

This question can be answered in two ways: According to the chronological or developmental age of the patient, and according to anticipated orthodontic treatment timing.

It is convenient to divide patients into four developmental groups: A primary dentition group, a mixed dentition group, a pre-adult group, and an adult group.

The youngest group, usually consisting of four and five-year old children, benefit from partial therapy. Specific

guidelines and recommendations are discussed by Pierce in this issue. If there is a worsening malocclusion, or a severe, stable one, or a lips apart posture, or a severe related speech disorder, or if the child is unusually intelligent and cooperative, she or he is probably a good candidate for treatment. The child should be seen for a consultation, at least, in order to determine whether help is needed from any specialist, such as an ear-nose-throat physician, an oral surgeon or an allergist. Sometimes young patients do better than their older siblings in therapy.

The same considerations may be applied to children in mixed dentition: These are patients from 6- to 9-years old (the true mixed dentition period ends around age 11 or 12 years when all primary teeth have exfoliated). Maturity and attitudes vary greatly in this age group. Some are not yet ready to accept any responsibility for practicing, whereas others are more receptive than patients in any other age group. These children should be accepted for treatment unless they have no significant malocclusion or speech problem, or unless they demonstrate an unwillingness to carry-out practice assignments.

The 10 to 17-year old group constitutes 75 percent or more of the practices of orofacial myologists. By this time, most of them have become quite conscious of their physical appearance; motivation to have straight teeth is generally good. They sometimes rebel against practice requirements, or against having to be monitored by a parent as they practice. A great motivating influence is the requirement that therapy be successfully completed, or at least far enough along to permit the clinician to send a "go ahead" to the orthodontist, before orthodontic treatment begins. Zimmerman considers motivational factors elsewhere in this issue.

Adults are usually well-motivated, faithful practitioners and make good progress. Many are apprehensive about their own ability to modify habits of long standing and need frequent encouragement until they begin to see evidence of habituation.

The second consideration, after chronological or developmental age, is the timing of the various elements of the total treatment process. Should therapy be given before, during or after orthodontic treatment? Each decision, of course, is individual. Each alternative has advantages and disadvantages.

Most clinicians prefer to see the majority of their patients *before* orthodontic work begins. The orthodontist who begins treatment after being notified by the clinician that patterns are corrected has some assurance that the patient is cooperative and that the work will not be hampered by negative orofacial muscle activity. Good clinicians motivate the patients not only for therapy but also for orthodontic treatment. Finally, establishing corrected patterns in an oral cavity fitted with orthodontic appliances (supplied with extraneous materials) may be partially dependent on these materials. When they are removed, there is some danger that the patterns may revert to preorthodontic states.

Some dentists, however, prefer that orthodontic and muscle retraining proceed concurrently. One reservation

concerning this has to do with the obtrusiveness of the headgear, neckgear, or palatal arch expander often used in the early phases of orthodontic treatment. Often the metal bar on the labial surfaces of the anterior teeth in headgear and neckgear is unstable vertically, and drops to a position that makes a proper lip resting posture difficult for the patient to maintain. The arch expander usually makes it difficult to keep the tongue in the proper rest and swallow positions. Whenever possible, the placement of these appliances should be timed to not coincide with the early part of therapy.

The important advantage of the third alternative to treatment planning, that of postponing therapy until *after* braces have been removed, is that therapy is never carried out unnecessarily. Also, the patient who sees the beginnings of orthodontic relapse is well-motivated to complete therapy assignments. The presence of the retainer in the upper arch, though, diminishes important kinesthetic cues. In addition, tongue thrust or posture variations often go undetected until the teeth have moved beyond the ability of a retainer or positioner to restore them to their correct position.

Altogether, the preferred timing for therapy, in most cases, is *before orthodontic treatment begins*, or *after palatal expansion* when that procedure is a part of the treatment.

How Long Does Treatment Typically Take?

Most clinicians see their orofacial myofunctional patients from 15 to 25 times, including recheck visits. These visits are spread out over variable periods of time. A typical therapy schedule may be as follows: A consultation; five weekly visits; two visits two weeks apart; two visits three weeks apart; two visits four weeks apart; one visit six weeks later, another eight weeks later, and another three months later. Subsequent visits may depend on whether orthodontic treatment occurs. If it does not, the clinician may elect to see the patient every six months for two years. If orthodontic treatment is scheduled, the patient may be seen before braces are affixed, before they are removed, after the retainer has been working a couple of weeks and before the upper arch retainer is removed permanently.

What Are Some Important Treatment Principles?

Some selected principles will be presented with little elaboration. Therapy should be: (1) Preventive, whenever possible; (2) individualized; (3) holistic, rather than strictly behavioral; (4) directed toward automatic, subconscious habituation; (5) prioritized — most important are tongue and lip resting postures; (6) motivational; (7) enjoyable; (8) flexible; (9) based on what is known from research and from clinical experience; (10) home-based — parents should participate by observing practice sessions and nonpractice time behaviors; (11) eclectic — clinicians should learn as much as they can from as many sources as possible; (12) directed toward modifying muscle patterns, rather than toward moving teeth; (13) specifically purposeful — every exercise and assignment should have a purpose, and the patient and parents should understand that purpose; (14) attentive to preparatory patterns — chewing and collecting food,

moving liquids and saliva posteriorly in the mouth; (15) carefully structured throughout the carry-over or generalization phase; (16) team-oriented — communication with other involved specialists is important; and (17) structured around consistent practice.

What Is A Typical Sequence Of Treatment Sessions In Training Programs?

An individualized program may consist of three phases, each of which may receive about equal time: Training muscle patterns; strengthening those patterns; and maintaining them. Any attempts to skip over any of the three phases threatens the integrity of the program and the permanence of results. Because tongue and lip-resting postures are basic to the development and retention of correct function patterns, therapy usually begins with instruction and assignments dealing with postures. Some manner of tabulating incorrect resting postures is utilized, and appropriate reminders and signals are provided. If lip approximation at rest is difficult for the patient due to a shortness of the upper lip, stretching exercises may be assigned.

A series of treatment sessions follow during which the patient is taught various exercises designed to prepare tongue and lip muscles to perform the movements required for correct eating, drinking, saliva swallowing and, where appropriate, for correct anterior tongue placement for speech. Attention to resting postures continues during these weeks. Sessions are typically held weekly. When the basic movements are learned, the next phase begins, wherein those movements are incorporated into vegetative functions. Preparatory movements receive attention, such as taking reasonable bites, chewing without tongue pressure against anterior teeth, collecting food using lip and cheek muscles, swallowing correctly and avoiding tongue pressures against teeth after the swallowing occurs. Finally, assignments are given to strengthen corrected patterns to an automatic level and maintain them. When orthodontic treatment is administered, the patient is seen periodically throughout that treatment to ensure permanence of therapy results.

Alternative And Supplementary Procedures **Appliances**

Orthodontists often choose between the use of reminder appliances, and referral for therapy, for their patients who have orofacial myofunctional disorders. Sometimes, clinicians inappropriately consider appliances to be their adversaries. The two procedures need not be mutually exclusive. When reminder appliances are used, however, the following principles should be kept in mind.

The use of the orthodontic appliance may bring about other unwanted behaviors. These include articulatory disturbances, difficulty in maintaining lips-closed resting posture, reduction of sensory feedback to the tongue, and even bedwetting and nightmares in children (Haryett et al., 1967). Any type of appliance that alters the configuration of the upper anterior palate has a potential for causing sibilant sound (/s/, /z/, /sh/, /zh/) distortion. The Hawley retainer is usually sufficiently thin that this effect

is only temporary. Many reminder appliances, with or without prongs, are shaped in such a way that the creation of the narrow aperture at the tip of the tongue required for sibilant sounds is rendered extremely difficult. Attempts to compensate are often unsuccessful. Reminder appliances that increase the resting distance between the upper and lower teeth usually make it more difficult to keep the lips together at rest.

If a reminder appliance is successful in retraining postures or movements, it creates new patterns that may be dependent on the presence of the appliance. Once the appliance is removed, a serious problem arises concerning habituation. One way to solve this problem is to remove the appliance in stages, systematically reducing its size or shape. Another way is to introduce some behavioral therapy, transferring dependence on the appliance to other cues or stimuli.

Reminder appliances are often uncomfortable to wear and inconvenient to use. Many times, younger patients who have previously cooperated poorly in therapy are motivated to practice assignments more faithfully once they have completed a trial period with an uncomfortable appliance.

Appliance Therapy

There are two general types of appliances used in "habit retraining." They are those that forcibly restrict lip or tongue postures or movements, and those that, to varying degrees, just provide reminders to the patient.

The Hay Rake

This device, probably the most common type used by orthodontists, consists of a metal bar attached to the lingual surface of either the maxillary or mandibular incisors, and four or five prongs welded to the bar and angling vertically and distally from it. The purpose of the appliance is to make tongue thrusting unpleasant, in the least, or painful, depending on the sharpness of the prongs. One way to "beat" the prongs is to keep the tongue back and away from them, either on the floor or roof of the mouth. Unfortunately, another way is to keep the jaw depressed and the lips far apart. This results in an habitual open-mouth resting posture. Many patients simply toughen up the tongue in time, and find the "crib" to be an interesting object of exploration.

Appliances that attempt to force the tongue into a specified area or away from the anterior teeth take several forms. In addition to the rake, there are cages, fences, and curtains. Generally, the more they try to restrain the tongue forcibly and the greater the chance of their inflicting pain, the less desirable and effective they become.

The other type of appliance reminds more than it distresses. A simple wire distal to the upper incisors is an example. The wire may have another wire, parallel to the first and distal to it, which may be removed after a few weeks, leaving the patient with the single wire. Another is a kind of hollowed-out U-shaped retainer. Such reminder appliances are certainly preferable to those that would *force* the tongue into a desired resting and functioning position. A conservative approach always

is to first attempt to retrain tongue and lips without the use of any foreign device; if that attempt fails (and this happens rarely), the orthodontist may attach a minimal reminder appliance. This occurs in approximately one percent of patients. If a patient is referred for therapy who already has a crib or similar device in place, it should probably be removed before effective therapy can begin.

Keeping Records

We are in the age of accountability. Records need not just be adequate, but be complete *and* accurate. Whenever possible, data recorded should be objective — the results of repeatable measurements. Most information to be recorded, nonetheless, will be largely subjective. Videotapes of chewing, swallowing and speaking at various stages of treatment provide evidence of changes in patterns. Comments should be written at each treatment session regarding details of assignments given and of compliance with the previous assignment.

Keeping good records enables the clinician to write meaningful progress reports to referral sources. If, for example, the written notes indicate repeated failure to practice regularly, or an uncooperative attitude on the patient or parents, or frequently missed or canceled appointments, reports warn the orthodontist of potential barriers to progress in the treatment to be provided.

Summary

The approach to assessment and treatment advocated in this article stresses individualization and completeness. The field of orofacial myology provides many opportunities for budding clinicians to latch onto a particular program of treatment and apply it wholesale to patients of all types and ages. The temptation to do so should be resisted vigorously. The purpose of all procedures should be to help the patient eliminate postural or movement patterns that create undesirable pressures against teeth or unfortunate cosmetic results. Since tongue and lip-resting postures have the greatest potential of all patterns for interfering with proper dental development and orthodontic treatment, they should receive early and pervasive attention during treatment. Conceptually, therapy may be divided into three phases: Learning new patterns, incorporating those patterns into everyday activities until they become automatic, and maintaining them. Patients should be seen for rechecks for at least two years, or until all orthodontic work is completed. Treatment for orofacial myofunctional disorders is most successful, when the clinician, child, parents and dental specialist work in close cooperation.

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