Rhinology, XVI, 191–196, 1978

# The cause and effect of mouth-breathing as related to malocclusion

*Jardon Strnad, Kansas City, U.S.A.*

It is an established fact that every child will use a functional mouth-breathing respiratory pattern sometime during the growth period from birth to facial maturity. The need for this type of respiration usually disappears if a nasal blockage or restriction was of a short duration. Some of the etiologic factors causing a prolonged nasal blockage or restriction that necessitates an oral respiratory function are:

> enlarged adenoids, deviated septa, chronic allergic or inflectious rhinitis, enlarged turbinates, and underdeveloped or abnormal growth of the midface.

Primate studies reported by Harvold and others which artificially produced nasal blockage have demonstrated that growth changes occured in the immature primates' orofacial complex similiar to those observed in children possessing a natural nasal blockage.

These developmental changes include:

1. A distal and rotational repositioning of the mandible.
2. Altered neuromuscular patterns of the tongue and lower face during mastication and deglutition.
3. Concomitant changes occur in the dentition that would be classified as an open-bite malocclusion.

This sequelae of change is often referred to in dental literature as the "Cause and Effect of a Tongue-Thrust Habit Pattern."

A controversy exists among orthodontic research writers concerning cause and effect theories; however, all agree that there is a coexistance between tongue-thrust and malocclusion in children. Some ascribe to the theory that the form of the oral structures determines their function during swallowing, speech and respiration. There are other writers who maintain the orofacial form is influenced by the function of its component structures. Most of the conclusions from studies submitted by both groups are based on clinical judgements and suffer from the lack of control over variables. The primate studies cited previously are the exception. They contained good controls but still used inferred conclusions from data which did not record the human subject response to the experimental procedures.

Assuming that form follows function, then the tongue's posture and function will play an important part in the morphology of the jaws and dental arches during the formative years of any individual. Essential mouthbreathers will routinely rest and function with their tongues in a position that is more forward in the oral cavity than non-mouthbreathers. This protrusive posturing of the tongue, along with the retrussive lowering of the mandible, allows the child to breath through the oral cavity. Many adverse conditions then begin to appear that are detrimental to the oral health of that individual.

The mandible develops a more backward and downward growth pattern as the tongue comes forward and positions itself between the dental arches during the act of swallowing. One has only to place their tongue between their anterior teeth, close the lips to create a vacuum and swallow a bolus of saliva to discover the change in forces that are applied to these teeth during the swallowing act. When this act is repeated at a rate of three times a minute during the waking hours and twice a minute while sleeping, the accumulative perverse pressures applied to the teeth and their investing tissues becomes multitudinous. Forces are generated that far exceel those used by orthodontists to move teeth.

Other muscle pressures besides the tongue can play insidious roles at this time. The buccinators increase their lateral pressures on the buccal surfaces of maxillary posterior teeth and alveolar processes. Normally these pressures would be counterbalanced on the palatal side by a tongue positioned higher in the palatal vault. The obicularis oris and mentalis muscles abnormally constrict the lips against the tip of the tongue and anterior teeth. They are trying to complete the closure of the oral cavity so that a partial vacuum can be generated in the mouth during the initial stage of the swallowing act. Conversely, while at rest, the lips assume flacid positions that will not counterbalance the lingual forces applied to anterior teeth from a protruded tongue. The hyoid bone assumes a more superior and anterior position at rest and deglutition which indicates changes in muscle behavior at the base of the tongue, the infrahyoid musculature and the constrictors. The teeth and alveolar bone begin to seek a balance between these unequal forces, while the jaws continue to grow under the influence of abnormal muscle pressures. The mandible's growth direction carries the lower dentition into a more distal function with the upper dentition.

Meanwhile, the maxillary arch constricts in its buccal segments and protrudes in the premaxillary area to produce an open-bite with overjet. The resulting unilateral or bilateral crossbites in the buccal segments cause the mandible to shift laterally when the teeth are occluded and a marked facial asymmetry can be produced, depending on the severity and type of crossbite present. Some of these same conditions can be created by a child with no apparent nasal insufficiency who continues to practice a pernicious oral habit, such as: finger-sucking, nail-biting, lipbiting or prolonged use of an improperly designed pacifier. An adaptive tongue-thrust to alleviate a chronic sore-throat has been suggested as a possible etiologic factor when no other reason for an open-bite could be ascertained. If the child is a non-complainer with a high pain threshold, he may suffer silently with irritating infections of an oropharynx overfilled with large and cystic palatine tonsils. He then develops a compensating "tongue-thrust and hold" swallowing pattern to prevent the posterior portion of the tongue from contacting these irritated tissues. Traditionally, antibiotic therapy could be used to alleviate the acute condition until the adolescent period when a spontaneous remission occured and the need for a tonsillectomy ceased. However, by having frequent repeated infections, the tongue-thrust habit pattern becomes established and the orofacial structures modified so that mouthbreathing continues even though the original causitive factor was eliminated.

It has been postulated that since memory coding of a body motion is cumulative and is basically non-reversible in mature individuals, it follows that the older the pattern for muscle behavior the more difficult is the retraining process. Retraining procedures instigated in a younger individual would then have a better chance to succeed.

This might explain the higher degree of stable correction of the open-bite when biomechanically treated in the mixed dentition instead of the permanent dentition stage of dental development. Early treatment procedures to correct mouthbreathing in children before the primary neural feedback circuits have developed might cause the patient to acquire a new and more normal pattern of muscle behavior which may not be attainable later.

Many successful results have been documented using this approach. Treatment can be initiated in the early mixed dentition by the use of any one of several intra-oral appliances in conjunction with an extra-oral vertical chin-cup headgear. The intra-oral appliances may consist of: an oral shield, a removable retainer, a fixed palatal expander, a fixed lingual-arch tongue crib, or a combination of banded maxillary molars and incisors with a removable directional force occipital headgear. The intra-oral appliance may vary from time to time, but it should always be supplimented with a vertical chin-cup force for 12-14 hours per day until an ideal overbite and overjet have been established.

This "function following form" approach has advantages in that the detrimental forces that could be influencing growth are cancelled or normalized early; however, successful treatment requires a high degree of patient cooperation that may be hard to elicit in the immature patient. It may become very difficult for a patient in times of respiratory distress to wear an orthodontic appliance that restricts or prevents adequate respiration. Any surgical procedure or medical treatment that minimizes these periods of respiratory distress should promote an earlier response to interceptive orthodontic procedures.

Whatever theory one may ascribe to – both schools of thought agree that the early recognition and treatment of the open-bite problem improves the chance of preventing an unsolvable orthodontic problem in the mature dentition. It behooves every health professional, who examines the oral cavity of a child, to recognize the presence of any one or combination of the "seven" following signs as a potential progenitor of a tongue-thrust behavioral pattern capable of persisting throughout the mixed dentition and into the permanent dentition.

These seven progenitors of tongue-thrust are:

1. mouthbreathing,
2. finger sucking,
3. enlarged tonsils,
4. a high narrow and constricted palatal arch,
5. marked lip strain when swallowing,
6. any malocclusion in the decidious dentition,
7. dentalized speech of the s, z, d, t, l and n sounds
   (using phrases as "Susie loves the dolly").

Population studies show a marked decrease in the frequency of tongue-thrust by age eleven. This decrease is usually attributed to enlargement of the oronasopharnyx, thus allowing the tongue to retract more. The eruption of the permanent incisors often traps and restrains a protrusive tongue. The greatest improvement of tongue-thrust occured in the children who had adenoidectomies which allowed them to switch from mouth to nasal breathing. For those cases that persist into the permanent dentition, the prognosis is very poor for a spontaneous correction of a mouthbreathing habit. Orthodontic intervention is usually required.

When preventative medical and dental procedures can eliminate those "Seven Progenitors" during the mixed dentition, then satisfactory orthodontic results are much easier to obtain and retain.

A good functionally stable occlusion can be expected at facial maturity if a post-treatment retention program is followed using the hinge-axis tooth positioner. This retention appliance is constructed of a flexible plastic or rubber material, similiar to the protective mouth-guards used by professional atheletes. It differs, however, in that is completely matches the anatomy of every tooth and extends into the labial and buccal vestibules. While fitted in the patient's mouth, with the teeth resting in their respective sockets of the appliance, the tongue is further restricted and the oral cavity is sealed. Wearing the tooth positioner, particularly during sleeping hours, will help stabilize the teeth and subliminally reminds the patient to swallow and breath properly. To wear the appliance, the patient must have an adequate nasal airway, especially while reclining during sleep. Therefore, treatment planning must include the establisment of a good nasal airway before the active phase or orthodontics terminates and the retention phase begins.

Any misdirected force during treatment of the open-bite could easily increase the open-bite condition. Therapy then from necessity must be accurately assessed and planned. Active treatment is slower, highly controlled, and methodically followed in a step-wise manner requiring a high degree of patient cooperation.

If a increase does occur in the divergence of the jaws while aligning the dental arches, an otherwise correctable open-bite malocclusion may finish with a soft tissue and skeletal jaw imbalance that requires permanent retention procedures to prevent an almost certain relapse. Some skeletal types of open-bite discrepancies are so severe that only surgical reduction of the bony dysplasia in addition to fixed appliance therapy can produce a balance of the orofacial musclature. Although the surgical approach to orthodontic correction has a high degree of success — cost, time and health factors prevent many patients from qualifying for this mode of treatment. Consequently, that unfortunate group of adults with open-bite malocclusions and established mouthbreathing patterns go through life with little hope of improving their eating, breathing and speaking patterns; even when they possess a high degree of motivation to seek professional help for their oral and respiratory problems.

Since the developing dentition seems to be greatly influenced by the combination of mouthbreathing and nasal obstruction, then the evaluation of these conditions should include an assessment for the presence of an orthodontic problem. The orthodontic evaluation of a mouthbreather should include the referral for an assessment and early treatment of a possible nasal obstruction.

Hopefully, with the mutual exchange of information and ideas between rhinologists and orthodontists and the early recognition of detrimental orofacial conditions of the mouthbreathing patient, his plight can be improved.

REFERENCES

1. Arvystas, M. G., 1977: Treatment of anterior skeletal open-bite deformity. AJ0 72: 147-164.
2. Cuozzo, G. S. and Bowman, D. C., 1975. Hyoid positioning during deglutition following forced positioning of the tongue. AJO 68: 564-570.
3. Falk, M. L., Wells, M. and Toth, S., 1976: A subcortical approach to swallow pattern therapy. AJO 70: 419-427.
4. Hanson, M. L. and Cohen, M. S., 1973: Effects of form and function on swallowing and developing dentition. AJO 64: 63-82.
5. Harvold, E. P., Chierici, G. and Vargervik, K., 1972: Experiments on the development of dental malocclusions. AJO 61: 38-44.
6. Harvold, E. P., Vargervik, K. and Chierici, G., 1973: Primate experiments on oral sensations and dental malocclusions. AJO 63: 494-508.
7. Hershey, H. G., Stewart, B. L. and Warren, D. W., 1976: Changes in nasal airway resistance associated with rapid maxillary expansion. AJO 69: 274-284.
8. Kim, Y. H., 1974: Overbite depth indicator with particular reference to open-bite. AJO 65: 586-611.
9. Koski, K. and Lahdemaki, P., 1975: Adaption of the mandible in children with adenoids. AJO 68: 660-665.
10. Linder-Aronson, S., 1974: Effects of adenoidectomy on dentition and nasopharynx. AJO 65: 1-15.
11. Newman, G. V., 1976: Open-bite relapse. AJO 69: 627-633.
12. Pearson, L. E., 1977: Vertical growth factors and treatment considerations. Bulletin of Chas. H. Tweed Foundation - Vol. V 1: 30-34.
13. Sandusky, W. C. Jr., 1977: Treatment of open-bite malocclusions utilizing the principles fo directional force. Bulletin of Chas. H. Tweed Foundation - Vol. V 1: 25-29.
14. Speidel, T. M., Isaacson, R. S. and Worms, F. W., 1972: Tongue-thrust therapy and anterior dental overbite. AJO 62: 287-295.
15. Subtelny, J. D. and Sakuda, M., 1964: Open-bite: Diagnosis and Treatment. AJO 50: 337-358.
16. Subtelny, J. D. and Sakuda, M., 1966: Muscle function, oral malfunctions and growth changes. AJO 52: 495-517.
17. Subtelny, J. D., 1970: Cephalometric diagnosis, growth and treatment. AJO 57: 262-286.
18. Watson, R. M., Warren, D. W. and Fischer, N. D., 1968: Nasal resistance, skeletal classification and mouth breathing in orthodontic patients. AJO 54: 367-379.

Jardon Strnad, D.D.S.,
1820 West 91st Place,
KANSAS CITY, Missouri 64114, U.S.A.