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Subject: IS THERE A "PROPER" CHEWING PATTERN?

BACKGROUND: If you have some free time and want to have some fun, try Googling *chewing pattern*. You will find a variety of opinions, study methods, and conclusions that will affirm almost any idea you may have about chewing. If you feel that children chew in a different manner from adults, or not, both conclusions can be easily found. It will become quickly obvious to you that the physiology of mastication has been a topic of considerable dispute.

Some groups of clinicians/researchers discuss and explain the movement patterns of the mandible in chewing as related to a neuromuscular phenomenon, while other groups focus on the temporomandibular joint apparatus as the end point of discussions.

No matter the philosophy, mastication can be divided into three steps:
1) incision of food, 2) mastication of the bolus, and 3) swallowing. The mastication of the bolus, or chewing, is the issue at hand in this memo.

Chewing can be discussed with regard to the opening or closing strokes: whether they are vertical, rotational (with lateralized movements), one-sided in preference, or even "reverse-sequence" chewing patterns associated with adaptations to crossbite interferences during the chewing process.

With regard to the dentition, chewing patterns may change by virtue of the morphology of the deciduous dentition, changes that occur during the mixed dentition period, and further differences that occur in an adult dentition.

Studies of chewing have basically involved use of EMG and a variety of kinesiographic instrumentation to either record specific muscles or muscle groups participating in the chewing process, or to track the mandible in the vertical, horizontal, transverse and rotational movements associated with chewing. With the exception of biting/incision of food, little horizontal movement of the mandible would be expected in normal chewing,

Additional variables involved in the chewing process include the size and texture of the bolus. It is well known and accepted that individuals vary widely in their preferences for textures, and even colors. As you will recall, and for some unknown reason, it is common for young children to avoid any foods that are green in color. To many children, asparagus and other "green things" are a big yuk, but to adults, the nutritional value of many green edibles is a welcome opportunity to practice good nutrition.

DENTAL DIFFERENCES RELATED TO CHEWING
The Primary Dentition: By virtue of the shape of the deciduous dental arches, children have a greater opportunity to use lateral movements in the chewing process. The occlusal table is flat, lacking the Curve of Spee found in the adult dentition, and the cusps of primary molars are flat and thus, compatible with lateralized movements. So for the primary dentition, lateralization movements during the chewing process should be accepted as a normal finding.

But what about the role of the tongue? As any orofacial mycologist knows, one of the consequences of a short lingual frenum is the inability to sweep the vestibule in the process of chewing and swallowing. The chewing process in a child with a primary dentition involves lingual manipulations that can further encourage lateral movements of the mandible during this process of collecting and placing food into areas where chewing can take place. For some foods, the tongue exerts a direct crushing affect against the hard palate. Many foods need no additional mastication and are ready for deglutition, while others are formed into a compact bolus by the tongue and placed on the occlusal platform for teeth action in chewing to further crush the bolus and make it easier to swallow.

Saliva is another important component of the chewing and swallowing process. Food cannot be swallowed easily when dry. During chewing, food is separated by the teeth and tongue, allowing saliva to lubricate the food. It is recommended that a gum chewer discard gum at least 30 minutes before a meal since considerable saliva is used up and swallowed during gum chewing that would have benefited the chewing and swallowing of food.

A child with poor control over the movements of the tongue during chewing would be expected to exhibit greater randomization of chewing movements, such as lateralization and rotational movements, although the association between tongue maturational development and chewing implied here has not been well documented as yet in the literature. A reasonable way to consider and address such an association in the practice of orofacial myology is to collect data on oral diadochokinetic patterns; as such patterning is a good way to estimate a child's lingual neuromotor maturation level for functional activities such as chewing.

The process of a child's chewing in the primary dentition stage will likely involve considerable lateralization of movements due to the shape of the dental arches and the morphological characteristics of primary teeth. Also, children may experience difficulty adapting to any changes in the oral cavity such as a unilateral or bilateral crossbite, and unusual chewing patterns may follow, such as an increase in horizontal movements of the mandible. As well, differences among children in the size of the bolus, preference for sidedness for chewing, how the tongue prepares the bolus with lateral sweeps, the vertical pushing of food against the palate, and the manipulations of foods according to the texture of foods, may influence the chewing pattern seen.

The Mixed Dentition. In the mixed dentition period, chewing patterns may become further confused as children attempt to adapt to the changes in the dentition. The incision of foods will have changed during the period in which the primary incisors have exfoliated and while the adult incisors are erupting. Also, the eruption of the adult first molars, with prominent cusps and fossae, can help to diminish the amount of lateralized and rotational movements.

Children with untreated crossbites in the mixed dentition are oftenable to adapt by either protruding the mandible during chewing or utilizing more lateral movements. As is well known, a simple grinding down of the cusps of the primary canines is often an easy fix for a dental crossbite, while this would not be an appropriate dental maneuver in the adult dentition. In the mixed dentition stage, the capability of the tongue to participate in the process of chewing should result in a more predictable pattern of chewing, although the size of the bolus, sidedness preferences, and texture variables would again influence the pattern of chewing.

The Adult Dentition: The chewing process in the adult dentition is an important consideration in dental treatment. The normal lateral and rotational aspects of chewing in adults are characterized by either having canine rise or group function as a way of opening the mandible or bite during the process of chewing. Dentists try to set up the dentition so that the canines determine the lateral opening sequence of the jaws for chewing (canine rise), but it is also acceptable for the entire posterior segment of the dental arch (group function) to be involved in the opening sequence. With the addition of the Curve of Spee in the adult dentition, the pronounced cusps on molars and bicuspids, and with larger and wider canines, the chewing pattern of adults is expected to be more predictable and with a reduced lateral range of rotational chewing movements.

CLASS II AND III MALOCCLUSIONS:
An important variable related to chewing that would apply to all stages of dental development is the presence of a malocclusion, whether a crossbite as mentioned above, or a Class II or III dental or skeletal pattern. Any perceived relationship between a pattern of chewing and the position of the jaws and teeth should involve a collaborative assessment with whatever dentist or orthodontist may be involved with the patient. Children and adults will exhibit a wide range of abilities to adapt to any structural change that may involve the oral cavity. The adaptability of each patient's chewing pattern to a dental or skeletal malocclusion will require a detailed assessment of their adaptive capability. While there are no clear-cut methods of evaluation that pertain, the ability of a patient to mimic cues provided by the clinician should help in the evaluation process, much like the speech ***stimulability*** testing in speech-language pathology that involves a correct verbal cue from the examiner. Additional information regarding oral diadochokinetic testing and stimulability testing can be found in an article by Mason et al (1973).

Clinical Implications: The question and answer for whether there is a normal pattern for chewing would differ according to the dental status of the individual. By virtue of the shape of the dentition and the lesser developmental capability of the tongue in the primary dentition, more variations in chewing patterns in all planes of space would be expected. In the mixed dentition, chewing may also show some lack of stability and an increase in lateralized movements, while in the adult, the chewing strokes, both vertically and rotational, should be more controlled and may show a narrower range of lateralized movements.

For any patient whose chewing patterns raise suspicion or questions, an assessment of oral diadochokinesis is suggested. Oral diadochokinetic testing is accepted as a way of assessing the integrity of tongue functions when pressed into a highly repetitive task. The focus of such evaluations should be on the patterning of the tongue, especially with regard to the ability or inability to elevate the tongue tip during the rapid, repeated performances. Children often use the mandible to assist the tongue in vertical repetitions. This becomes a test of the mandible rather than the tongue. If the clinician has the patient bite on a few tongue depressors placed between the molars, or any device or biteblock that you may have available, the mandible can be eliminated from assisting the tongue to perform the requested movements. Such data should be a part of the records of all patients, especially where any OMD issues regarding tongue postures or functions are involved.

How can the chewing pattern be changed/improved in therapy? Orofacial myologists have many opportunities to influence chewing by directing attention to a patient's activities in the three steps of mastication: 1) evaluating and working with the incision of food – especially the size of the bite; 2) mastication of the bolus – manipulating food with the tongue and preparing the food for dental pulverization, and 3) preparing the bolus or liquid for swallowing. The relationship of the tongue to the process of chewing is of paramount importance, and attention to the side chewing preference of each patient, their preference for textures of foods, and the inclusion of saliva into food preparation for swallowing are components of interest in the chewing process.

Is there a "proper" chewing pattern? A practical answer to this question that can be applied to the clinical situation is: Whatever looks abnormal is undesirable, and whatever looks age appropriate is proper, especially if coughing and choking do not follow from

deglutition. An appropriate goal of therapy is to teach patients to chew in a manner that does not call attention to itself. In children, good luck with that!

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