Tutorial

Promoting health literacy with orofacial myofunctional patients

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EDITOR'S CORNER

Book Review: The Little Bear Who Sucked His Thumb

Written in a warm tone, this book introduces the child to loveable Oliver – The Little Bear Who Sucked His Thumb written by Dr. Dragan G. Antolos, a dentist. So often, children's books addressing behaviors tend to be didactic. This thoughtfully written narrative carefully sidesteps that approach allowing the child with a digit habit to uncover Oliver's powerful message.

Oliver experiences all the emotions and frustration that children experience when they have a digit habit. Dr. Antolos, does an outstanding job of taking a very complex behavior and weaving it into a tale that children embrace. He also models responses for parents.

Dr. Antolos also did the illustrations which are equally intriguing and inviting. Both the text and the artwork combine to bring to life the story of a bear who has determination and is successful in achieving his goal.

In this story, Oliver goes to find the dragon who places the responsibility for giving up the habit squarely on Oliver's shoulders when he says "Are you really, really ready to give up sucking your thumb?" Oliver discovers a powerful and poignant truth - only Oliver can keep his thumb from going into his mouth. The dragon presents a solution to Oliver and explains the need for a reminder (band-aid), and tells Oliver "...the rest is up to you." The dragon presents Oliver with a bag of stars and a small book.

With its affirming story line, this is one book that deserves a place on your therapy bookshelf. Dr. Antolos' insight into habit cessation and this positive approach is woven into this story. And... if you order this book from Dr. Antolos for your client, it will come with a bag of stars, just like the one the dragon gave to Oliver. For additional information go to: www.oliverthebear.com

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TONGUE CONTROL FOR SPEECH AND SWALLOWING IN HEALTHY YOUNGER AND OLDER SUBJECTS

**Janice W. Bennett, M.H.Sc., Pascal H.H.M. van Lieshout, Ph.D.,
Catriona M. Steele, Ph.D.**

ABSTRACT: Current literature on oral motor control reports contradictory findings regarding physiological, functional and sensory changes that occur in the muscles of the tongue with normal aging. It has been suggested that the high level of activity required of tongue muscles in mastication and speech may play a role in preserving them when other skeletal muscles are more likely to show functional effects of such changes. To test whether indeed tongue movements remain unaltered in both speech and swallowing tasks as a function of aging, kinematic measures of tongue dorsum movements were taken as 21 healthy young (20-30) and older (65-74) adults performed repeated iterations of speech tasks and a sequential water swallowing task. Tongue motion was recorded using electromagnetic articulography and from these data information was extracted with respect to movement range, duration, and variability. The findings suggest that in general tongue movements for swallowing were slower and more variable than for speech, and most importantly, more variable among older than younger participants. As well, the findings show that aging does influence the nature of tongue motions, in particular by inducing a more extreme distinction in the variability of movements for speech (less variable) and swallowing (more variable) tasks.

Keywords: aging, swallowing, speech, kinematics, tongue control, articulography

INTRODUCTION

The literature reports a wide variety of findings regarding structural, physiological, and sensory changes that occur in the muscles of the tongue with normal aging. However, thus far the evidence that such anatomical and physiological changes manifest themselves in functional consequences for speech or swallowing functions is still limited. If indeed normal aging does not affect speech and swallowing, it could be argued that any speech or swallowing dysfunction in older people must be the sequelae of a disorder. Therefore, understanding the differences between the effects of normal aging and of speech and swallowing disorders has important implications for rehabilitative and compensatory treatments offered by speech-language pathologists and other health care practitioners. In addition, it means that information about speech and swallowing impairments might reliably be used to inform differential diagnoses.

Baum, Caruso, Ship, and Wolff (1991) offered an important caveat in interpreting many of the reports in the literature that attempt to describe age-related changes. They pointed out that many reports are based on patients with diseases and using medications, rather than on healthy aging people. They also noted that the corpus of research studies are cross-sectional rather than longitudinal, which introduces into the equation differences between individuals that cannot be controlled. Although the latter issue is difficult to address, including healthy aging subjects is important if one wishes to investigate in a systematic way the influence of age on the use of articulators in different oral motor functions. It is also important to use objective measures of articulator function in order to be able to quantify subtle changes in their motion patterns. The next sections provide a short overview of physiological and functional changes in the tongue associated with aging.

Changes in tongue tissue due to aging

The tongue is composed of skeletal muscle, which is known to be affected by atrophy and sarcopenia as it ages. Sarcopenia results in reduced muscle strength due to decreases in the size and number of muscle fibres, and an increase in noncontractile tissue. Other reported changes include atrophy of the surface epithelium (Bassler, 1987), degeneration of underlying connective tissue, and thinner, less elastic tongue muscles (Caruso, Mueller, and Shadden, 1995). Neuromuscular changes have been reported in other muscles with age, such as an increase in the number of muscle fibres per motor neuron. This may cause larger regions of muscle to function as a unit, decreasing its "degrees of freedom" (Nicosia et al., 2000). There is some evidence that the muscle atrophy and loss of muscle fibres in sarcopenia can experience some regeneration, however, this is not sufficient to reverse the effects of sarcopenia on functional muscle mass (Edstrom et al., 2007).

Lipomatosis, the narrowing of muscle fibres, and fibrosis of the perimysium of the tongue have been associated with aging (Bassler, 1987). Amyloid deposits, that is, deposits of a hard waxy substance consisting of protein and polysaccharides that result from the degeneration of tissue, have been reported in the tongues of individuals 60 years of age and older (Yamaguchi, Nasu, Esaki, Shimada, and Yoshiki, 1982).

Aging has also been associated with a decrease in tongue thickness (Sonies, Baum, and Shawker, 1984), but others have argued that an increase in fatty tissue due to lipomatosis compensates for the loss of muscle fibres, preserving the form and volume of the tongue in senescence (Bassler, 1987). The tongue, like the outside parts of the nose and ear, continues to grow in later life (Rother, Wohlgemuth, Wolff, and Rebentrost, 2002). Rother et al. hypothesized that skeletal muscle fibres in the tongue decrease in thickness later in life than in other skeletal muscles. He concurred that lipomatosis results in increased fat tissue in the glands and musculature of the tongue.

Changes in tongue function due to aging

Age-related changes in tongue function that have been reported include decreased strength (Crow and Ship, 1996, Price and Darvell, 1981; Robbins, Levine, Wood, Roecker, and Luschei, 1995), and speed, and increased variability in the rhythm of tongue movements (Hirai, Tanaka, Koshino, and Yajima, 1991). Crow and Ship documented greater tongue strength in males than females across the lifespan, and found that tongue strength decreased from age 79. Their study investigated extrinsic tongue muscles using pressure generation with the Iowa Oral Performance Instrument. Although decreased tongue strength did not appear to impact negatively on the speech or swallowing of healthy, aging individuals, they argued that it is possible that such changes, combined with illness or injury, might contribute to functional pathology. If so, age-related changes may be said to decrease the "functional reserve" for these essential life activities. Nicosia et al. (2000) drew similar conclusions in their study of isometric and swallowing pressure generation.

There is evidence that sensory function is also affected by age. The ability to perceive pressure on the tongue may diminish with aging. For example, perception of the intensity of liquids of different viscosities, and perception of local pressure on the tongue may decline with age (Smith, Logemann, Burghardt, Zecker, and Rademaker, 2006; Sonies and Caruso, 1990). The tongue's role in generating swallowing pressures appears to be preserved in normal aging, although it is likely that the pressure reserve - that is the difference between maximum isometric pressure and swallow pressure, is reduced with age (Robbins et al., 1995).

With respect to tongue control in speech tasks, Goozee, Stephenson, Murdoch, Darnell, and Lapointe (2005) found that younger and older adults used the same strategies to increase speech rate; they increased syllable repetition rates by decreasing the distances traveled by the tongue, and thereby decreasing movement duration (that is, the time taken to travel the shorter distances). Although not significant, the older adults did not decrease the

distances traveled by as much as the younger adults. The authors proposed that if, as others have suggested, aging results in reduced neuromotor control of the tongue (Sonies et al., 1984), and if smaller articulatory movements are associated with decreased maintenance of stability in the oromotor system (Van Lieshout, Bose, Square, and Steele, 2007), this might explain why the older adults did not decrease the distances traveled by as much as the younger group. They referred to this compensatory phenomenon as a speed-accuracy trade-off, possibly employed by older adults to maintain stability in the system while increasing speech rate.

Flanagan and Dembowski (2002) found no significant differences in tongue speed and range of motion in diadochokinesis tasks between younger and older subjects. Others have hypothesized that reduced flexibility in fine oral motor control is suggested by increased muscle coupling of the lips as seen in older versus younger women on speech tasks (Wohlert, 1996).

In sum, the functional impact of physiological and structural changes on the speech of aging individuals appears to be small (Bassler, 1987), unless conditions of stress and high demand are present (Caruso et al., 1995). Studies of Caruso and his colleagues found that older speakers lengthened vowel and word durations, and exhibited dysfluencies under conditions described as cognitively stressful. However, they suggested that under normal conditions speech is sufficiently robust to resist the influence of age-related structural and functional changes. Under normal stress conditions, small adjustments in tongue position or movement for speech may be employed to compensate for age-related structural changes (Sonies et al., 1984).

With respect to age-related changes in swallowing, several issues have been documented. These include changes in positioning of the bolus in the oral cavity, the timing of oral-pharyngeal-esophageal stages of swallowing, and swallowing duration (Caruso et al., 1995; Tracy et al., 1989). However, the majority of these changes were pharyngeal and not oral, and hence does not permit us to draw conclusions about tongue

control in swallowing. However, Tracy and colleagues identified a significant oral stage finding: older adults held the bolus more posteriorly on the tongue and oral transit time was consequently faster. In general terms, the oral and pharyngeal stages of the swallow tended to overlap temporally among younger adults, and tended to be more sequential in older adults. However, these observed changes did not result in any instances of penetration or aspiration in the older subjects, suggesting that they represent functional age-related changes that did not impact negatively on swallow function itself.

Nicosia et al. (2000) found that maximum lingual pressure generation decreased with age on an isometric task but not on liquid swallowing tasks. The time required to reach peak pressure decreased with age on both isometric and swallowing tasks. Although not statistically significant, older subjects demonstrated a higher incidence of multiple lingual gestures, termed "pressure building", in order to reach peak pressure on liquid swallows. The authors proposed that these age effects are likely due to factors such as: decreased strength due to sarcopenia, an increase in connective tissue relative to muscle tissue resulting in a "stiffer" tongue, and neuromuscular changes having the effect of decreasing the lingual "degrees of freedom". Multiple tongue gestures during swallowing were also reported in elderly subjects by Sonies, Ship, and Baum (1989), but this did not result in increased oropharyngeal swallow time. Interestingly, tongue base movement has been reported to decrease significantly with age in elderly women, but not in men (Logemann, Pauloski, Rademaker, and Kahrilas, 2002). The issue of gender differences in aging effects has not been studied in great detail thus far.

In a review of the literature at the time, Baum et al. (1991) argued that their interpretation was that there was no evidence to suggest that normal aging substantially alters the functions of speech and swallowing, and that compensatory adjustments are frequently made in response to age-related oral changes. They reported that speech production appears to be the oral motor function most resistant to aging, although

effects on vocal intensity (Baker, Ramig, Sapir, Luschei, and Smith, 2001) and changes in vocal tract resonance (Linville and Rens, 2001) have been noted. Studies of normal aging have produced evidence of slowed oral reaction times, mild reduction of oral neuromotor function, mild muscle atrophy, and tongue weakness, but articulatory compensatory measures appear to occur so that the impact of these phenomena do not interfere with intelligible speech production. This may be due to the nature of speech as "a well-established, overlearned, redundant process" (Sonies and Caruso, 1990). They suggested that the swallowing mechanism may be less able to compensate for age-related changes in muscle tissue, sensory function, salivary flow, and other factors. It is conceivable that the high level of activity required of tongue muscles in mastication, and the abundant blood supply of the tongue, may play a role in preserving them when other skeletal muscles are more affected (Price and Darvell, 1981). In addition to mastication, speech and swallowing also require high levels of tongue activity.

CURRENT INVESTIGATION

Given the existing (but largely untested) claim that aging effects may be different for speech and swallowing functions, the current study investigated the impact of age-related changes on swallowing and motor speech function in the healthy, aging population as evidenced by quantifiable changes in movement range, movement duration, and variability in tongue movements. To address potential gender issues in aging (Logemann et al., 2002), we included both male and female participants. Based on past work on swallowing in our lab it was hypothesized that older participants would show increased movement durations and greater kinematic variability for tongue movements in liquid swallows (Steele and van Lieshout, 2004b). These effects were expected to be stronger in older females than males (Logemann et al.). In addition, gender differences between young males and females were expected in movement range and duration, with young males having larger movement ranges and longer durations (Tasko, Kent, and Westbury, 2002). Based on the current

literature, age effects on speech may be limited to a difference in movement duration, with older adults showing longer durations, perhaps as part of a speech-accuracy trade-off phenomenon to increase speech monitoring time (Goozee et al., 2005).

Methods

Participants

Data will be reported for 21 participants recruited in two age groups, 20 - 30 and 65 - 74 years of age. The younger group was comprised of 5 females and 5 males, and the older group had 6 females and 5 males. Participants were healthy with no reported speech, language, hearing, swallowing or neurological problems and free of any medication that could possibly interfere with motor control functions. A certified speech-language pathologist conducted an oral mechanism exam and clinical swallowing assessment prior to acceptance into the study. These standard clinical speech-language pathology assessments identify signs of possible neurological, speech, and/or swallowing impairments, and the presence of signs resulted in exclusion from the study.

Procedures

Data was collected using the AG100 electromagnetic midsagittal articulograph (EMMA), described below. The EMMA system traces the movement of sensor coils attached to the tongue, face and neck. For the purposes of this study, sensor coils were attached to the tongue midline at tongue blade, body and dorsum, to a dental impression on the lower incisors that captured mandible movement, and over the hyoid bone to capture laryngeal elevation during swallowing. A reference coil was attached to the bridge of the nose (a non-moving structure) that allowed calculation of the distance travelled during palatal approach and release in a two-dimensional space (Van Lieshout et al., 2007). For this study, we will focus on tongue body and tongue dorsum data only.

Instrumentation

The AG100 articulograph (Carstens Medizinelektronik, Germany) with automated calibration (Hasegawa-Johnson, 1998; Schönle et al., 1987) uses a large helmet (62 cm diameter) connected to a smaller inner helmet worn by the subject. Transmitters on

the helmet generate an alternating complex magnetic field which permits computerized tracing of the movements of the sensor coils attached to the articulators. The entire helmet complex moves in unison with head movement(s). Movement data were sampled at 400 Hz, while time-aligned speech data were acquired simultaneously through the AG100 system at 16 kHz (for more details, see Van Lieshout, Alfonso, Hulstijn, and Peters, 1994; Van Lieshout and Moussa, 2000).

Data collection procedures

Once participants were set up in the EMMA system they performed a number of speech and swallowing tasks. Analysis was completed on three speech tasks and two repetitions of a swallowing task. The speech tasks consisted of a 6 second reiteration of /ipa/ (i.e., "ipa ipa ipa") at an habitual speech rate, a 6 second reiteration of /api/ (i.e., "api api api"), and a 6 second reiteration of /patakə/ (i.e., "pataka pataka pataka"), also at habitual rates. The swallowing task was a trial-set of 6 sequential water swallows, with the instruction, "Keep the cup to your lower lip and take 6 sips at a normal speed for you." Each subject performed these three speech tasks (referred to as IPA, API and PTK) and two repetitions of the water swallow task (referred to as SWAL) within a single session. To sample normal variability over time (Alfonso & van Lieshout, 1997), each subject came back for a second session, doing the same trial sets. The trial sets analyzed in this study were mixed with other (swallowing) tasks, not reported here. So, in total there were 6 speech trial sets and 4 water swallow trial sets across two sessions with (at least) 6 repetitions for each task within a trial-set.

Data processing

The procedures described here follow standard methods used in our lab (for more details see Steele & van Lieshout, 2004a; Van Lieshout & Moussa, 2000; Van Lieshout, Rutjens, and Spauwen, 2002). Movement data were imported into MATLAB (Version 6.5, Release 13, The Mathworks, Inc.) and band-pass filtered between 0.1 Hz (removing slow varying baseline drifts) and 6 Hz (all relevant movement frequencies were found below this cut-off point) using a 7th order

Hamming window Butterworth filter. Position signals were transformed to velocity versus time functions using a point differentiation method and the velocity signals thus obtained were band-pass filtered in the same way as the position signals.

An automated peak-picking algorithm was used to detect directional changes in the band-pass filtered position and velocity signals based on specific time interval (1.5 seconds) and amplitude (highest peak/lowest valley in a windowed signal that is within 20% of min/max within-trial value) criteria. The identified peaks and valleys were used to calculate discrete movement parameters and an index of movement cycle variability called cSTI, as detailed next.

Dependent variables

The dependent variables measured were movement range, movement duration, and the variability of individual movement cycle patterns (cyclic Spatio-Temporal Index or cSTI). Movement range was defined as the average distance travelled by the tongue dorsum and tongue body coils during palatal approach and release phases in a 2-dimensional space without subtraction of mandible movement (Van Lieshout et al., 2007). The combined duration of these phases was used as an index of movement cycle duration (see figure 1). Both movement range (RANGE), measured in millimeters, and movement cycle duration (DURATION), measured in milliseconds, were averaged across the corresponding trial sets for each task.

In addition to these two kinematic parameters, we also calculated cSTI values for repeated cycles of tongue dorsum and tongue body movements (Van Lieshout et al., 2002). This measure is based on the STI measure described by Smith and colleagues (Smith, Goffman, Zelaznik, Ying, and McGillem, 1995; Smith & Goffman, 1998). cSTI values capture variability in cyclic patterns beyond (linear) changes in amplitude and duration as a measure for the stability of speech motor execution. Individual movement cycles (as defined above) were amplitude and time normalized and aligned with each other using procedures reported in the literature (Smith et al., 1995; Van Lieshout et al., 2002).

Figure 1. Example of a tongue body gesture position trajectory, illustrating the kinematic measures of movement cycle duration (Duration 1 + Duration 2), and movement range (average of Range 1 + Range 2). See text for more details.

Figure 2. Illustration of cSTI measure for tongue dorsum (TD) and tongue body (TB) signals. The two (overlapping) traces in each of these two panels show the filtered and unfiltered data (the former was used for data analysis). Panels 3 & 4 show individual movement cycles, segmented by the peaks and/or valleys in the two original time series. Panels 5 & 6 show the same cycles, but amplitude normalized. Panels 7 & 8 show the amplitude and time normalized cycles from which the cSTI values were calculated. For these examples cSTI values were 6.4 for TD and 4.9 for TB. See text for more details.

Standard deviations across these overlapping cycles are computed successively at 2% intervals in relative time. Since all movement cycles are time normalized to 1000 points, this yields 1 standard deviation value for every 20 points (total of 50 standard deviations); the sum of all standard deviations gives the cycle-to-cycle combined spatio-temporal variability of the articulatory trajectory for a given trial set. Figure 2 shows an example of the cSTI analysis for tongue dorsum and tongue body movement cycles for the speech task "api".

Together, these variables can provide specific information on the temporal and spatial characteristics of individual tongue motions related to speech and (liquid) swallowing tasks as a function of aging and gender.

Analyses

Table 1 Means and standard deviations (*italics*) for Cohort x Gender (OF = Older Females, OM = Older Males, YF = Younger Females, YM = Younger Males) and Task (API, IPA, PTK, and SWAL), separate for movement range (RANGE), movement duration (DURATION), and cSTI.

	OF	OM	YF	YM	<i>TD</i>	OF	OM	YF	YM	<i>TB</i>
API	12.97	14.01	12.50	14.07		13.46	14.14	13.39	19.23	RANGE (in mm)
	<i>4.78</i>	<i>4.18</i>	<i>2.86</i>	<i>4.85</i>		<i>4.25</i>	<i>2.88</i>	<i>4.03</i>	<i>7.28</i>	
IPA	13.67	15.73	10.09	12.53		13.12	15.16	10.59	17.63	
	<i>3.44</i>	<i>6.09</i>	<i>3.85</i>	<i>4.09</i>		<i>3.19</i>	<i>5.00</i>	<i>4.52</i>	<i>7.46</i>	
PTK	8.87	11.68	9.51	8.65		8.04	11.78	7.35	8.74	
	<i>3.26</i>	<i>3.52</i>	<i>3.73</i>	<i>2.54</i>		<i>2.98</i>	<i>2.53</i>	<i>2.54</i>	<i>2.97</i>	
SWAL	8.83	10.66	7.30	8.56		9.47	9.52	5.44	8.43	
	<i>4.73</i>	<i>5.61</i>	<i>3.91</i>	<i>2.89</i>		<i>5.91</i>	<i>5.73</i>	<i>2.80</i>	<i>3.94</i>	
API	289.11	261.16	256.03	310.50		288.46	260.82	256.19	327.64	DURATION (in msec)
	<i>62.54</i>	<i>37.21</i>	<i>22.24</i>	<i>130.95</i>		<i>62.17</i>	<i>37.20</i>	<i>22.05</i>	<i>180.14</i>	
IPA	307.92	258.87	264.19	272.96		308.39	258.85	258.48	273.42	
	<i>66.33</i>	<i>65.85</i>	<i>33.66</i>	<i>85.95</i>		<i>65.77</i>	<i>65.85</i>	<i>36.51</i>	<i>86.35</i>	
PTK	325.72	289.51	269.58	283.20		349.09	289.00	269.14	276.98	
	<i>50.12</i>	<i>36.60</i>	<i>29.71</i>	<i>111.48</i>		<i>91.52</i>	<i>36.27</i>	<i>29.83</i>	<i>90.67</i>	
SWAL	1100.76	1055.78	1046.16	591.47		1134.87	1088.23	1078.34	634.69	
	<i>359.32</i>	<i>369.97</i>	<i>429.76</i>	<i>169.08</i>		<i>361.21</i>	<i>332.23</i>	<i>635.35</i>	<i>189.07</i>	
API	6.37	5.23	6.10	7.31		4.35	4.37	5.40	6.56	cSTI (a.u.)
	<i>3.35</i>	<i>2.33</i>	<i>2.36</i>	<i>4.56</i>		<i>2.13</i>	<i>1.55</i>	<i>1.63</i>	<i>4.67</i>	
IPA	6.93	6.98	9.84	7.64		6.94	6.57	7.55	6.08	
	<i>3.76</i>	<i>4.00</i>	<i>5.71</i>	<i>3.20</i>		<i>3.75</i>	<i>4.06</i>	<i>3.30</i>	<i>2.90</i>	
PTK	9.55	6.82	10.23	12.29		11.56	5.97	11.14	11.50	
	<i>6.26</i>	<i>2.85</i>	<i>4.09</i>	<i>7.31</i>		<i>8.08</i>	<i>3.14</i>	<i>4.53</i>	<i>5.85</i>	
SWAL	21.09	17.49	18.45	15.43		19.81	20.69	18.00	17.38	
	<i>9.49</i>	<i>5.27</i>	<i>6.62</i>	<i>6.56</i>		<i>7.95</i>	<i>10.93</i>	<i>6.99</i>	<i>10.32</i>	

Statistical comparisons were made using a mixed-design repeated measures ANOVA with age cohort and gender as between-subject factors, and task (speech vs. swallowing) as within-subject factor, separate for tongue body (TB) and tongue dorsum (TD) variables (RANGE, DURATION, cSTI). Tukey-Kramer post-hoc tests were used as appropriate. Level of significance was set at 0.05.

RESULTS

Mean and standard deviation values for movement range, movement duration and cSTI, averaged across age cohort/gender groups and the four tasks, are listed in Table 1 for tongue body and tongue dorsum. The results of the statistical analysis are summarized in table 2.

Table 2. Overview of statistical findings for tongue dorsum (TD) and tongue body (TB), separate for movement range (RANGE), duration (DURATION) and cyclic spatio-temporal variability (cSTI). * $p \leq 0.05$ ** $p \leq 0.01$ * $p \leq 0.001$**

	RANGE			DURATION			cSTI		
TD	df1,df2	F	p-value	df1,df2	F	p-value	df1,df2	F	p-value
AGE COHORT [A]	1,17	1.77	0.201	1,17	2.46	0.135	1,17	0.48	0.499
GENDER [B]	1,17	1.5	0.237	1,17	2	0.175	1,17	0.9	0.356
TASK [C]	3,51	15.12	0.000***	3,51	143.77	0.000***	3,51	65.81	0.000***
A X B	1,17	0.11	0.741	1,17	0.34	0.570	1,17	0.31	0.586
A X C	3,51	1.03	0.389	3,51	4.99	0.004**	3,51	3.06	0.036*
B X C	3,51	0.17	0.917	3,51	4.85	0.005**	3,51	1.31	0.280
A X B X C	3,51	0.54	0.658	3,51	4.54	0.007**	3,51	0.88	0.460
TB									
AGE COHORT [A]	1,17	0.17	0.682	1,17	1.93	0.183	1,17	0.13	0.724
GENDER [B]	1,17	6.57	0.020*	1,17	1.51	0.236	1,17	0.37	0.552
TASK [C]	3,51	26.07	0.000***	3,51	141.22	0.000***	3,51	45.88	0.000***
A X B	1,17	1.34	0.262	1,17	0.15	0.708	1,17	0.23	0.636
A X C	3,51	2.69	0.056	3,51	4.28	0.009**	3,51	1.45	0.240
B X C	3,51	0.91	0.441	3,51	4.17	0.01**	3,51	0.45	0.716
A X B X C	3,51	1.35	0.269	3,51	4.07	0.011*	3,51	0.69	0.564

None of the variables for TB or TD showed a main effect for age cohort or gender, except for TB movement range, where female subjects on average showed smaller values (10.1 mm) compared to males (13.1 mm). Task effects were highly significant for all dependent variables. Based on Tukey-Kramer post-hoc tests, it was found that in general swallowing movements were slower, more variable, and (compared to API and IPA but not PTK), smaller in movement range.

With the exception of cSTI values for TD, significant interactions were limited to duration data. For TD cSTI there was a significant interaction between age cohort and task (figure 3). A Tukey-Kramer multiple-comparison test mainly showed differences for both groups between swallow and speech movements, but the interaction has its origin in the fact that for speech tasks cSTI values were consistently higher for the younger subjects, whereas the reverse occurred for the swallow trial sets. In other words, for TD movements younger subjects were more

variable in speech and less variable during swallowing when compared to older subjects.

For movement duration, both TD and TB movements showed significant cohort by task and gender by task interactions, as well as a significant cohort by gender by task interaction (see Table 2). We ran separate ANOVA's for males and females on cohort and task effects. Female subjects showed no main effects for age, but (as can be expected) a significant difference between speech and water swallow tasks (longer duration for the latter). This is in line with the main task effects reported above. For male subjects however, we found a significant interaction effect for cohort by task in TD [$F(3,57) = 9.61$, $p < .001$] and TB [$F(3,57) = 8.53$, $p < .001$]. This interaction is shown in figure 4 for TD. Whereas younger and older males are virtually identical in movement duration for speech tasks, younger males show a significant shorter duration for water swallows. Again, this age difference in water swallows was not found for female subjects.

Figure 3. Tongue dorsum cSTI values for the speech and swallowing tasks, separated for younger (Y) and older (O) subjects. Error bars indicate standard errors of the mean.

Figure 4. Tongue dorsum cycle duration values for the speech and swallowing tasks separated for younger (Y) and older (O) male subjects. Error bars indicate standard errors of the mean.

DISCUSSION

In summary, tongue movements in swallowing in general were slower and more variable than in speech. We also found smaller movement ranges at both tongue positions in swallowing when compared to speech tasks involving more than one vowel. This is likely due to the mandible and tongue remaining in a relatively stable position (in relation to the palate) during swallowing compared to the bilabial speech tasks where the tongue has to move from an extreme high front position for /i/ to a low back position for /a/ and vice versa. When the speech task contained only one vowel, (i.e., /pəˈtəkə/), movement ranges for speech and swallowing were actually quite similar. Main effects for age or gender were absent, except that males showed significantly larger movement ranges than females for TB. For TD movements, it was found that younger subjects were more variable in speech and less variable during swallowing when compared to older subjects. Finally, based on significant three-way interactions for movement duration, it was found that younger and older males are virtually identical in movement duration for speech tasks, but during swallowing younger males showed shorter durations. A similar effect was not seen for female subjects.

The main purpose of this study was to explore the possible effects of aging on speech and swallowing tasks. Based on the existing literature as discussed in the introduction, we hypothesized that older participants would show increased movement durations and greater kinematic variability for tongue movements in liquid swallows (Steele & van Lieshout, 2004b). We also expected these aging effects to be stronger in females than males (Logemann et al., 2002). Our findings did not uniformly support these claims. It is clear that tongue movements in swallowing are more variable compared to speech. Perhaps a more appropriate way of phrasing this is to say that for swallowing, tongue movements have more flexibility to accommodate bolus flow compared to the more stringent requirements on movement accuracy for speech. Interestingly, our data suggest that

this inherent difference in variability for both tasks may become more extreme when people age, which fits the original hypothesis regarding more variability in swallowing movements for older subjects (regardless of gender). It is possible that this reflects a direct consequence of physiological changes due to aging (see Introduction) but in the absence of corresponding age related changes in movement range or duration, we think it is more likely a characteristic of adaptation allowing older adults to compensate for age-related changes in the tongue or other structures involved in swallowing and speech (see also Baum et al., 1991). For both functions, the basic requirements (flexibility in tongue movements for bolus flow control and precision for speech) seem to be met in older people, although with a more extreme distinction in the variability of movements for speech (less variable) and swallowing (more variable) tasks when compared to the performance of younger people. This suggests that, despite potential age-related changes in tongue strength, impairment in either function is not likely in the absence of a disease process.

Our finding that younger males show shorter movement durations for swallowing compared to older males is not surprising (e.g., Logemann et al., 2000; Steele & van Lieshout, 2004b), but it is surprising that this did not occur for female subjects. We could confirm that males showed larger movements than females during liquid swallowing similar to what was reported by Tasko et al. (2002). Tasko et al. suggested that larger movement ranges of the tongue in males might be a consequence of the larger oral cavities in males, which necessitate larger tongue to palate movements to position the bolus for swallowing. However, unlike their study we did not find longer movement durations for males. In fact, young males showed the shortest duration of all groups (see Table 1). In combination with the larger movement ranges found for young (and older) males, this means an increase in peak movement velocity, which often is associated with more effort (McClean & Tasko, 2003; Perkell, Zandipour, Matthies, and Lane, 2002). These findings suggest a stronger effort in

liquid swallows on part of the young males compared to older males (and females in general).

Limitations of this study are that the sample size was small with 10 younger and 11 older adults, and that only two speech and one swallowing task were used. Data have been collected for a larger group and are presently being analyzed. Future research in this area should include multiple speech and swallowing tasks. Another limitation is the cross-sectional design, which does not allow for the control of differences between individuals.

This study provides corroboration that individuals experiencing normal aging appear to be able to compensate for age-related structural, physiological, and sensory changes that occur in the muscles of the tongue, such that speech and swallowing function are preserved. Although kinematic differences in tongue movement were found between younger and older participants, all participants had normal speech and swallowing function, indicating that the older participants had compensated for changes they may have experienced. For the clinician, this means that speech or swallowing dysfunction in older people can be assumed to be the sequelae of a disorder, and should not be dismissed as impairments that are "only to be expected" with advancing age. Since a speech or swallowing impairment can be the first sign

of the onset of a neurological illness or event, its early identification can contribute to the physician's diagnosis and the timely initiation of pharmacological and therapeutic rehabilitative interventions. Further, identification of different types of speech impairments (e.g., dysarthria type) can be useful to the physician in the differential diagnosis of neurological illness.

CONCLUSIONS

The current study investigated tongue motions in healthy young and older subjects of both genders. The findings show that aging does influence the nature of tongue motions, in particular by inducing a more extreme distinction in the variability of movements for speech (less variable) and swallowing (more variable) tasks. This seems an adequate compensatory mechanism for potential age related structural and physiological changes in the tongue. In general, males tend to make larger movements and especially young males seem prone to make more effortful swallows compared to the other groups. The reason for this difference in the young males is unclear. However, a larger corpus of data has been collected, and its analysis should permit the positing of potential theories to explain this result, if confirmed in the larger scale dataset.

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THE EFFECTS OF OROFACIAL MYOFUNCTIONAL THERAPY COMBINED WITH AN OCCLUSAL SPLINT ON SIGNS AND SYMPTOMS IN A MAN WITH TMD-HYPERMOBILITY: CASE STUDY

**Cláudia Maria de Felício, PhD , Rosana Luiza Rodrigues Gomes Freitas,
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ABSTRACT: Exercise therapy has been indicated for the treatment of temporomandibular disorders (TMD), but few reports are available about the effect of orofacial myofunctional therapy, which includes working with stomatognathic functions, in patients with TMD. A 49-year-old man with a diagnosis of TMD-hypermobility and orofacial myofunctional disorders received combined treatment with orofacial myofunctional therapy and an occlusal splint. Clinical evaluation and the scale of symptom severity after 9 treatment sessions and during follow-up compared to the phase before treatment suggested that treatment was of great benefit. We conclude that the combination of orofacial myofunctional therapy and an occlusal splint can be beneficial for patients with TMD-hypermobility. However, since this was a single case, further studies are needed to confirm these preliminary findings.

Keywords: temporomandibular disorder, orofacial myofunctional therapy, occlusal splint

INTRODUCTION

Exercise therapy has long been indicated for the treatment of temporomandibular disorders (TMD) (Greene, 1979; Funt, Stack & Gelb, 1985) in combination with other therapeutic modalities such as an occlusal splint (Felício, Rodrigues da Silva, Mazzetto, & Centola, 1991; Zeno, Griffin, Boyd, Oladehin & Kasser, 2001), or alone (Au & Klineberg, 1993; Martini, Martini, & Carano, 1996; Magnusson & Syren, 1999; Carlson, Bertrand, Ehrlich, Maxwell, & Burton, 2001; Nicolakis et al., 2001a;b; Nicolakis et al., 2002). Exercise therapy usually consists of passive and active movement of the mandible (Magnusson & Syren, 1999), correction of body posture, and relaxation techniques (Nicolakis et al., 2001a;b; Nicolakis et al., 2002), as well as patient education (Zeno et al., 2001; Dworkin, et al., 1994).

Patients with TMD frequently present orofacial myofunctional disorders, i.e.,

alterations in deglutition (Greene, 1979; Funt et al., 1985; Gelb & Bernstein, 1983; Williamson, Hall & Zwemer, 1990), mastication (Stohler & Ash, 1985; Mongini, Conserva & Tempia-Valenta, 1989; Felício, Mazzetto, & Dos Santos, 2002) and speech (Felício, et al., 1991) patterns which may or may not be the consequence of TMD, but which may aggravate or perpetuate the problem. Changes in mastication as well as in other orofacial behaviors may provoke a significant change in mechanical load on the temporomandibular joint (Hinton & Carlson, 1997).

For these reasons, orofacial myofunctional therapy (OMT), also a modality of exercise therapy whose objectives include the promotion of proprioception, tonicity and mobility, working with the facial and cervical musculature, as well as with stomatognathic functions – respiration, mastication, deglutition and speech (Schievano, Puppini-Rontani & Bérzin, 1999; Cayley, Tindall, Sampson & Butcher, 2000), has also been

suggested for patients with TMD (Greene, 1979; Funt et al., 1985; Weinberg, 1979). However, few reports on the analysis of the effect of OMT are available. It has been previously observed that treatment of patients with TMD—myofascial pain and associated myofunctional orofacial disorders with an occlusal splint in combination with myofunctional therapy yielded better results than the use of the splint alone (Felício, et al., 1991). The purpose of the present report was to describe a case of TMD with clinical signs of hypermobility treated with OMT and an occlusal splint.

CASE PRESENTATION

A 49-year-old man with a diagnosis of TMD, made by a dental specialist in orofacial and occlusal pain at the Nucleus of Occlusion and Dysfunction of the University, was referred for evaluation by a speech pathologist. The patient gave written informed consent to participate in the study. The evaluation consisted of investigation of the symptoms by means of a questionnaire. The patient was also asked to express the severity of symptoms according to specific situations, such as when waking up, during mastication, during speech and at rest, using a printed 11 point numerical scale in which zero was considered to be complete absence of a sign or symptom and 10 was considered to be the highest possible severity. The severity score of each symptom consisted of the sum of the scores attributed to each sign or symptom in the four situations mentioned above, therefore it can vary from zero to 40 (Felício, Mazzetto, Da Silva, Bataglion, Hotta, 2006).

The patient was then submitted to examination of the orofacial structures and stomatognathic functions. The patient complained of fatigue and pain in the face and head, more intense on the right side, since his youth, which had worsened over the last two years. He stated that, because of the symptoms, he had already sought care from a general practitioner, an otorhinolaryngologist, a psychiatrist and, last, a dentist. He reported nocturnal centric and eccentric bruxism and stated that he always felt tired and with no inclination to participate in social activities. According to

severity scores attributed by the patient, the worst symptom was tinnitus (score 17), followed by fatigue (13) and pain (10) in the mandible elevator muscles, pain in the temporomandibular joints (TMJ) (9), and cervical pain (1).

During clinical evaluation, the following myofunctional disorders were observed: facial asymmetry, which was more prominent on the left side, masticatory muscles tender to palpation, the lips remaining separated at rest, and reduced mobility of tongue and lips, especially towards the right side. In addition, there was incoordination of the mandibular movements to the right and deviations of the mandible to the left during speech, mastication was unilateral on the left, and deglutition was performed with notable effort of the perioral and mandible elevator muscles.

The patient wore removable partial dentures, involving the central incisors, the right lateral incisor, right and left first molars, left second molar in the upper arch, and the second left molar and second right premolar in the lower arch. The excursive measurements of the mandible were: buccal opening 67 mm, left laterality 15 mm, right laterality 9 mm, and protrusion 10 mm. Because of the complaint of tinnitus, the patient received an otorhinolaryngologic evaluation and audiologic exams for a differential diagnosis, and the presence of any hearing disease was ruled out.

Treatment Protocol

OMT treatment was initiated, after 60 days an occlusal splint was installed. The OMT treatment schedule consisted of 50 minute sessions every 15 days, including exercises. Each session included counseling about the disorder, instructions for home exercise, as well as instructions about the care needed to avoid luxation, with previous studies being used as reference (Felício, et al., 1991; Zeno et al., 2001; Magnusson & Syren, 1999; Carlson et al., 2001. Nicolakis et al., 2001a).

The purpose of OMT was to optimize the orofacial muscle function, through the development of adequate mobility of the lips

and tongue, symmetry and control of mandibular movements, enhancing the execution of stomatognathic functions in a manner compatible with the occlusal condition. The specific goals were: relieving the pain, stimulating the lubrication of the TMJ, reducing the tension of the mandible elevator muscles, establishing adequate mandibular posture and tongue mobility, and reducing the amplitude of mandibular movements.

The first technique focused on the relaxation of the shoulders and neck (Félício, et al., 1991). Thermotherapy with hot and moist compresses was applied to the jaw muscles and to the shoulder and neck muscles, including the trapezius and sternocleidomastoid muscles, for 20 minutes. Circular massage was then applied to the same muscle groups. To relax the elevator muscles, the patient was also instructed to pass the anterior and upper portion of the tongue along the region of palatine rugosity and of the alveolar papilla in a back and forth movement. The basis of this exercise is the tongue-papilla-mandibular reflex that occurs during mastication, i.e., when the tongue touches the papillae the mandible-lowering muscles are activated, while the mandible-elevating muscles are deactivated (Kawamura & Dubner, 1981). The borders of the tongue were stimulated with two toothbrushes in order to stimulate the contraction of transverse muscles. Next, in order to improve mobility, the patient was asked to protrude his tongue and to move it slowly in a lateral direction towards the left and right lip commissures, repeating this movement 10 times. During this exercise, the buccal opening was approximately 20 mm and the mandible was supported and contained with the thumb and index fingers of the patient, respectively.

Repetitive mandibular mobility exercise was used in order to increase the circulation and to move synovial fluid through the articular surfaces and to provide nutrition and remove metabolites from the articular cartilage (Zeno et al., 2001). During these exercise the opening and closing buccal movements were executed in a slow and controlled manner and the tongue remained coupled to

the palate in order to establish a limit to the opening movement.

Regarding chewing, first, the patient was instructed to masticate simultaneously on both sides in order to divide the masticatory load and to avoid condylar translation in the contralateral joint that occurs during mandibular laterotrusion. He was also supposed to increase the time of mastication so that the food would be sufficiently triturated and moistened to avoid the excessive tension experienced during deglutition due to the effort involved in swallowing a poorly triturated bolus.

The speech therapist modeled each exercise. The patient demonstrated his knowledge of each exercise, and performed a sequence while being observed by the speech therapist. When performance was adequate, the patient was instructed to practice the sequence three times a day at home. Two months after the beginning of treatment, i.e., after 4 sessions, the patient reported improvement of symptoms. During this phase, the occlusal splint was installed and recommended for use at night. This is a conservative treatment with no contraindication in cases of TMD (Ash & Ramfjord, 1998; Kreiner, Betancor & Clark, 2001).

A myorelaxing splint was made and adapted to the upper arch. Periodical adjustments were made on the splint in positions of centric relation (CR), lateralities to the right and left, and protrusion, thus providing bilateral, homogeneous and simultaneous occlusal contacts in addition to canine and functional anterior guides (Okeson, 1993). From then on, the patient started to perform the exercises of mandibular mobility while wearing the occlusal splint. In addition to mouth opening and closing, he performed lateral movements to the right and to the left and protrusion with the application of light counter-resistance. A resistance was applied by the patient with the thumb in contrary direction to the jaw movement.

After the patient had developed better muscle function movements, training for alternate bilateral mastication was initiated. There were no obstacles for this training

since the patient presented occlusion guides, and absence of occlusal interference on the non-working side.

After 5 additional sessions of OMT, the patient was reevaluated. During this reevaluation the patient demonstrated adequate posture, with sealed lips and maintenance of a free functional space, symmetrical mandibular movements, and equilibrated stomatognathic functions. The patient reported comfort both at rest and during functional activities such as mastication and deglutition, with almost full remission of muscle pain and fatigue.

In terms of symptom severity, the patient still reported some mild symptoms such as tinnitus (score 2), pain in the elevator muscles and in the TMJ (2), and muscle fatigue (2). The excursive measurements of the mandible during this final phase were: mouth opening 55 mm, left laterality 9 mm, right laterality 8 mm, and protrusion 9 mm.

In view of the improvement of the general picture and of the overall condition of the patient, who reported better disposition for social activities and for work, treatment was discontinued. However, the patient was instructed to maintain the functional patterns as established during therapy. After 4 months of follow-up, there was maintenance of the excursive measurements of the mandible, and an improved severity score of symptoms such as tinnitus (score 1), TMJ pain (1), and muscle fatigue (1), whose occurrence was reported to be only sporadic.

DISCUSSION

In the case described here, the patient reported a history of symptoms of many years duration without an adequate diagnosis or intervention. The problem had become chronic.

Pain and masticatory difficulties are two of the most common complaints of patients presenting with TMD. There is evidence suggesting that both symptoms are interrelated. Previous studies have demonstrated that many TMD patients present an irregular pattern of masticatory

movements with a unilateral masticatory preference (Stohler & Ash, 1985; Mongini et al., 1989).

The patient reported an ear symptom, specifically tinnitus, characterized as an acute and brief whistle. Investigations on these TMD subjects provide support for the notion that a relationship between TMD and ear symptoms does exist (Felício et al., 2002; Lam, Lawrence & Tenenbaum, 2001). However, further studies are clearly needed to elucidate the mechanism and the role of each particular anatomic structure (Morgan, Goode, Christiansen & Tiner, 1995). Furthermore, the importance of a differential diagnosis between TMD and auditory pathologies, as done in the present case, is obvious. Signs of fatigue and depression have also been associated with chronic pain conditions, among them TMD (Carlson et al, 2001).

The method of orofacial myofunctional diagnosis was the clinical one, complemented with the scale of symptom severity according to patient perception. Both the clinical exam and the scale were also used to evaluate the results of treatment.

Many researchers have investigated TMD signs and symptoms, as well as the treatment's effect, using anamnestic indexes, scales, and questionnaires (Magnusson, List & Helkimo, 1995; Henrikson, Ekberg & Nilner, 1998; Conti, De Azevedo, De Souza & Ferreira, 2001). Previous studies have demonstrated that exercise therapy is effective for the treatment of TMD both when combined with an occlusal splint (Felício, et al., 1991; Zeno et al, 2001) and when applied separately (Magnusson & Syren, 1999; Carlson et al, 2001; Nicolakis et al., 2001a;b; Nicolakis et al., 2002), in cases of myofascial pain dysfunction syndrome (Felício, et al., 1991; Magnusson & Syren, 1999; Carlson et al, 2001; Nicolakis et al., 2002), or in internal disorders of the TMJ (Zeno et al, 2001; Au & Klineberg, 1993; Martini et al, 1996; Nicolakis et al., 2001a;b).

In the present case, special attention was paid to the stomatognathic functions, beginning with the basic conditions for their performance such as control and mobility of

the tongue, lips, cheeks and mandible. The patient was also counseled and trained regarding functions such as respiration, mastication, deglutition and speech. (Funt et al., 1985; Felício, et al., 1991).

In addition, the patient received information about the disorder which included etiologic, predisposing and aggravating factors, the fundamentals of the strategies for symptom control, the importance of integrating the stomatognathic functions, and the need to regularly practice the exercises and the behaviors recommended. Other studies have examined the efficacy of bio-behavioral strategies regarding the administration of the behaviors and the physiological processes associated with TMD (Carlson et al, 2001; Dworkin et al, 1994; Nicolakis et al., 2002; Michelotti, De Wijer, Steenks & Farella, 2005). Since behavioral strategies (Carlson et al, 2001) and therapeutic exercises are very cost effective both for the patient and society (Magnusson & Syren, 1999), this therapy could be recommended for patients with TMD.

CONCLUSIONS

The results suggest that OMT associated with an occlusal splint was effective for the functional improvement of the stomatognathic system and consequently for the treatment of TMD-hypermobility. However, because this was a single case study, additional investigations are needed to verify these preliminary findings.

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APPENDIX

THERAPY PROTOCOL

Goals	Procedures
1. To instruct the patient about the TMJ and about the care needed to avoid luxation	1.1. Provide information on TMJs: etiology, symptoms, treatments. 1.2. Tell patient: Do not open the mouth widely. 1.3. Tell patient: Do not bite large/thick food pieces.
2. Pain relief and relaxation of the jaw muscles, shoulders and neck and adequate mandibular posture	2.1. The patient should apply thermotherapy with hot and moist compresses to the jaw muscles and to the shoulder and neck muscles, for 20 minutes, every day. 2.2. The patient should perform circular massage applied to the same muscle groups, 5-10 min. 2.3. The patient should pass the anterior and upper portion of the tongue along the region of palatine rugosity and of the alveolar papilla in a back and forth movement. (relaxation of the elevator muscles), 5 min, a few times a day.
3. TMJ lubrication and controlled and symmetrical mandibular mobility	3.1. Opening and closing buccal movements executed in a slow and controlled manner for 30 sec. a few times a day. The tongue should remain coupled to the palate in order to establish a limit to the opening movement. 3.2. The patient begins to perform the exercises of mandibular mobility, mouth opening and closing, lateral movements to the right and to the left and protrusion, while wearing the occlusal splint. 3.3. In addition, a light resistance is applied by the patient with the thumb in contrary direction to the jaw movement.
4. Tongue contraction and mobility	4.1. The borders of the tongue should be stimulated with two toothbrushes, 30 sec, 3 times a day. 4.2. The patient is asked to protrude his tongue and to move it slowly in a lateral direction towards the left and right lip commissures, repeating this movement 10 times. During this exercise, the buccal opening should be approximately 20 mm and the mandible supported and contained with the thumb and index fingers, of the patient.
5. Mastication 5.1. to divide the masticatory load and to avoid condylar translation 5.2 to optimize the function	5.1. The patient should be instructed to masticate simultaneously on both sides. 5.2. Training for alternate bilateral mastication should be initiated after the patient develops better muscle function movements.
6. Deglutition To reduce the muscle tension and optimize the function	6.1. The patient should be instructed to increase chewing time to improve particle reduction and lubrication of foods.

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PROMOTING HEALTH LITERACY WITH OROFACIAL MYOFUNCTIONAL PATIENTS

Hope C. Reed, CCC-SLP, COM

ABSTRACT: The definition of health literacy is provided along with information substantiating its importance. Focused initiatives, the consequences of poor health literacy, and at-risk populations are briefly discussed. The focus of this article is the application of health literacy principles to the discipline of orofacial myology and how the promotion of health literacy facilitates positive growth for patients, orofacial myologists, and the professions. The article concludes with a vision for a health literate society.

Key words: health literacy, orofacial myology, clinicians

WHAT IS HEALTH LITERACY?

Health literacy is an issue that is receiving a great deal of attention, and rightly so. Health literacy skills are absent in over half of the United States population (National Institutes of Health, 2007); this is a disturbing fact given that these same skills and strategies often lead to a longer life, improved health, reductions in the consequences of health problems, and cost savings (National Institutes of Health, 2007). The most widely cited definition for health literacy is the degree to which individuals have the ability to acquire, process, and understand basic health information and the services needed to make suitable health decisions (Ratzan & Parker, 2000). Health literacy is not simply an issue of being able to read or being formally educated; rather, it is a more complex process that involves reading, listening, analyzing, making decisions, and applying these skills to individual health care situations (National Network of Libraries of Medicine, 2007). Areas that are typically associated with health literacy include: practitioner-patient communication, instructions to patients, publications provided to patients, consent forms, insurance forms, patient history, and assessments for allied health programs such as speech-language pathology (National Institutes of Health*).

HEALTH LITERACY IN THE FIELDS OF SPEECH-LANGUAGE PATHOLOGY AND DENTISTRY

Health literacy supports improved care and informed decisions among patients as well as enhanced communication between clinicians and patients. Many disciplines, including the fields of speech-language pathology and dentistry, are currently working to advance the issue. The American Speech-Language-Hearing Association (ASHA) has recently taken several steps to educate speech-language pathologists regarding health literacy. ASHA offers a health literacy page on its Web site, which lists data, points for professionals to consider in their daily work, and helpful links to further information (ASHA, 2006). In addition, ASHA has focused on health literacy in two of its electronic newsletters, *Access Audiology* and *Access SLP Care*. In 2006, Hester and Benitez-McCrary discussed research directions for speech-language pathologists relating to health literacy, in light of the fact that their literature review only revealed three studies from this area.

ASHA encourages investigations into the impact of communication disorders on health literacy. The American Dental Association has taken a formal position on

oral health literacy, having passed at least four resolutions on the matter, supporting initiatives to improve provider communication skills and strengthen oral health literacy among all patients to support quality care and improved outcomes (American Dental Association, 2007; Crozier, 2006). Health literacy is a national and global concern. The United States Department of Health and Human Services (2000) highlights health literacy in its *Healthy People 2010* initiative. The National Institutes of Health also recognizes the importance of health literacy and supports research addressing the matter. Furthermore, Canada and numerous other countries also recognize the need to promote health literate societies.

The literature overwhelmingly cites the critical need to address and improve health literacy. Available research includes studies ranging from hypertension to cancer treatment. Over 90 million adults, or nearly one-third of the population, have difficulties understanding and acting upon health information (Institute of Medicine, 2004). The American Medical Association (1999) states that poor health literacy is a stronger predictor of an individual's health than his/her age, income, occupational status, education level, and race. Low health literacy is associated with serious economic consequences. The National Academy on an Aging Society (1999) estimated that additional health care costs of approximately \$73 billion were associated with low health literacy.

WHO IS MOST AT RISK FOR LOW HEALTH LITERACY?

The most vulnerable individuals are the elderly, or those aged 65 and older, minorities, immigrants, persons from low income backgrounds, and those suffering from chronic mental and/or physical conditions (National Network of Libraries of Medicine, 2007). These same individuals are often members of the groups that are at risk for other problems, including poor access to care, higher mortality rates, longer and more costly hospital stays, and decreased screening rates for serious conditions. If health literacy is improved

among these populations, then what are the possibilities for improving other facets of the health care system for them, i.e., quicker resolution of health problems, longer lifespan, shorter and less costly hospital stays, and maybe even prevention of life-threatening illnesses?

APPLYING HEALTH LITERACY PRINCIPLES TO THE FIELD OF OROFACIAL MYOLOGY

Health literacy is a pervasive, significant, and essential topic for all health care professionals. The discipline of orofacial myology, in keeping with its ability to recognize and apply contemporary ideologies, must also appreciate the importance of creating and fostering health literacy within the patients it serves. Specific applications for health literacy in orofacial myology include: (1) clearer written materials for patients and/or parents, (2) better verbal communication and counseling with patients and their families, particularly to enhance assessment and treatment, to promote compliance with homework assignments, to respond to questions and concerns and (3) increasing marketing to and training for the public about the field and the services provided (National Institutes of Health, 2007). Ultimately, health literacy helps clinicians to help their patients by empowering them with knowledge; such knowledge assists patients in making informed decisions about their condition and potential treatment, which will hopefully have a positive impact on their participation and ownership of the recommended therapy program.

Written Materials for Patients

The literature is brimming with information and techniques that the orofacial myologist may use to improve and promote health literacy with patients. The clinician must be mindful of the written materials disseminated to patients and their caregivers. Written materials are essential to proper prevention, diagnosis, and home exercise programs (Vanderhoff, 2005). However, a serious problem with written educational materials, whether clinician-generated or purchased from outside agencies, is that they are often

written at a level far beyond the average person's comprehension (Vanderhoff, 2005). Research suggests that 1 out of 5 American adults reads at the 5th grade level or below, with the average American reading at an 8th to 9th grade level; most health care materials are written above a 10th grade level (Kelly, 2003).

When preparing written materials for parents, orofacial myologists may find adapting Benway's (2005) guidelines useful. Benway offers the following five guidelines. First, start at the beginning, assuming that the patient knows little or nothing about orofacial myofunctional disorders, treatment choices, or the next step. Second, clinicians should literally take the reader by the hand and guide the individual to the next step. Third, focus on the patient's behavior in written materials, since the goal is often to change a behavior. In order to focus on the behavior, the orofacial myologist must focus on the desired action, not on facts or principles. Next, use clear pictures and illustrations, because a well-selected photograph or drawing can accentuate a key point or clarify a difficult concept in the clinician's written material. Illustrations, when chosen carefully, offer a window of understanding, especially for poor readers. Finally, remove the excess in written materials, and with practice, this should become easier.

There are individuals who might argue that simplifying printed materials for patients is a disservice. However, Benway (2005) strongly states that nothing could be less true. In patient education, clear communication is fundamental. Orofacial myologists perform a service to their patients by choosing words carefully and by writing in terms that can be easily understood and acted upon. Provide patients and parents with written materials. However, go beyond simply giving them a piece of paper and allow patients time to look over the information and ask any questions about what was just read (Vanderhoff, 2005). Visuals and written materials should never be the sole means of

communication between clinicians and patients (Dowse, 2004). Likely the best scenario for offering patient information is referring to written materials or visuals while

simultaneously providing a verbal explanation, or the explain-ask-listen approach (Dowse, 2004; Vanderhoff, 2005).

Based on this author's personal experience, training oneself to speak and write in jargon-free language, avoiding medical and technical lingo, is paramount! Clear written communication is important, but the way a clinician speaks to and counsels patients is probably even more critical. During the initial office visit, remember that parents of children with orofacial myofunctional disorders and patients themselves may have already read extensively about a condition, with much of the reading taking place from the Internet (Vanderhoff, 2005). The clinician must then become a filter for faulty data obtained by the parent and provide web sites that offer reputable, accurate, complete, and helpful information (Vanderhoff*, 2005). It is also the clinician's responsibility to go a step further and provide supplemental information to that which the patient has viewed on web sites. Even though Benway (2005) suggests that clinicians should assume that the patient has little or no knowledge about a disorder, Kripalani (2004) offers a different approach when an individual is confronted with a new diagnosis, suggesting that a helpful technique to use during an initial session is to ask the patient or parent, for example, "What do you already know about tongue thrust?"

Communicating Effectively With Patients

Vanderhoff (2005) reminds professionals that effectively communicating with patients is essential to proper diagnosis and assessment. Establish rapport by encouraging a friendly exchange, allowing the patient and parent adequate time to feel comfortable in the new clinical setting (Hardin, 2005). The clinician may need to gently prod the patient or parent for complete information. Remember that children communicate differently, but they also want to be involved in their diagnostic session. Listen and respond to parents, but also afford the same courtesies to children.

Active listening is necessary, in which the clinician maintains eye contact and attention, holds an interested and open body posture, and responds with verbal and

nonverbal cues to the patient, all without seeming wooden or artificial. Questions are always encouraged, as a key component of the clinician's responsibility is to educate and inform, realizing that these actions ultimately help everyone involved. Last, don't forget to smile! This part should be the easiest, especially if the clinician enjoys his/her job.

Demonstration and repetition are critical, especially in treatment sessions (Vanderhoff, 2005). Show patients how to perform their exercises and make sure that you ask them to follow-up by having them do the exercises independently, several times. The clinician may also use the teach-back method. If the patient struggles to teach back something that the clinician feels was clearly covered, then this is a red flag that the patient was simply nodding along without completely understanding what took place during the visit (Kripalani, 2004). The more effectively the clinician communicates during diagnostic and treatment sessions, the more likely it is that home carryover and implementation will be achieved accurately and completely. The key is to find more than one way to connect and explain ideas to patients, because the greater the variety of inputs, be they oral, visual, and/or kinesthetic, the more opportunities for the patient to retain and understand the concepts or activities (Vanderhoff, 2005).

Knowledge about a disorder is not enough for patients and parents, because they also need motivation (Vanderhoff, 2005). Orofacial myologists should not simply teach patients what to do. Instead, clinicians should go one step further and ask patients what they consider the barriers to be in their care, such as not enough time to follow through on exercises, financial factors, and so forth (Vanderhoff, 2005). In doing so, the clinician then has the opportunity to dialogue with patients regarding concerns, frustrations, and the benefits of therapy and exercises. Vanderhoff (2005) further cautions that patients are more receptive when their input is welcomed, when cultural differences are appreciated and considered, and when clinicians do not speak down to them.

There are many useful techniques in the

literature for clinicians to use in communicating with patients. A study by Schwartzberg, Cowett, VanGeest, and Wolf (2007) highlighted communication techniques that were at least 80% effective. However, the authors discovered that the routine use of these techniques by pharmacists, physicians, and nurses was consistently lower than the effectiveness levels. For example, the teach-back method was found to be over 90% effective, yet the technique was routinely used only about 40% of the time. Written instructions yielded somewhat similar findings. The largest disparities in effectiveness versus routine use were found in the use of pictures, models, underlying key points, follow-up staff, and follow-up via telephone. The closest parallel was in using simple language, which was almost 100% effective, and this method is routinely used more than 90% of the time. Therefore, just because a technique is not only suggested for use and found to be effective through research, it does not mean the technique is actually being used on a consistent basis.

The Importance of Marketing Services

Low health literacy often prevents individuals from making full use of the latest treatments and contemporary clinical information (Pirisi, 2000). As a result, patients may never even be aware that they are in need of services or that their condition may be helped by an orofacial myologist. Orofacial myologists, like other health professionals, must also market their services and educate the public about the profession and its members. To accomplish this, use the same principles described earlier for the creation of written patient education materials. Beyond clear communication with consumers, marketing can be very rewarding for professionals and the International Association of Orofacial Myology. When the public is better informed about the discipline of orofacial myology, the greater the opportunities will be for the profession to grow and advance.

CONCLUSIONS

What is the ideal picture for a health literate America? Nielsen-Bohlman, Panzer, and Kindig (as cited by Cutilli, 2005) offer some

inspiration and vision in their objectives: (1) Everyone has the opportunity to expand their health literacy. (2) All individuals have the chance to use reliable, easy-to-understand information that could make a difference in their overall well-being, including their everyday behaviors, such as how they eat and whether they seek professional help for health conditions. (3) Citizens are able to accurately assess the credibility of health information, whether it is provided by a health professional, commercial, web site, or another entity. (4) Culture context is infused into all health information. (5) Health professionals communicate clearly during all interactions with their patients, using everyday

vocabulary. (6) There is ample time for discussions between patients and their health care providers, and patients feel comfortable to ask questions as part of bettering their condition. (7) Patients' rights and responsibilities are presented and written in clear, everyday terms so that people can take needed action. (8) Informed consent documents are developed so that all people can give or withhold consent based on information they need and understand. Orofacial myologists are in a position to help paint this picture for a health literate society, not only for patients and their families, but across disciplines and specialty areas.

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MOTHERS' ATTITUDE TOWARD DIGIT SUCKING HABITS IN CHILDREN OF UNITED ARAB EMIRATES

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ABSTRACT

The purposes of this study were to evaluate maternal attitudes and knowledge towards digit sucking habits and to investigate the association between various factors and the presence of these habits. A cross-sectional sample of 150 mothers of children currently engaged in digit sucking habits were interviewed. The information collected was from a questionnaire completed by the mothers.

The analyzed data regarding the mothers revealed that younger mothers represented 54% of the sample, 47.3% were well-educated and 70.0% were unemployed. Regarding the children, female children (65.3%) practiced digit habits more than males, and 45.3% of the children were younger than 3 years of age. Significant factors associated with maternal attitudes towards digit sucking habit included: 88.6% of mothers never tolerated this habit, 75.0% of the mothers were unemployed and provided instruction to cease the habit, and 89.9% of the mothers never sought advice from a dentist. Overall, mothers did not view digit sucking habits to be an acceptable behavior regardless of their nationality. Mothers indicated that they tried to stop the habit with a variety of techniques but without any professional advice. The study concludes that mothers would benefit from receiving information about a motivational program, professional advice, and suggestions to discourage this habit.

INTRODUCTION

Sucking is a natural reflex practiced by infants and young children. Many infants suck their thumbs and fingers in the womb. This has been documented through ultrasound imaging (Van Norman R.A. 1997). After birth, many babies begin digit sucking behaviors between 3 and 6 months of age when their motor skills are sufficiently developed to effectively bring a thumb or finger to the mouth at will. Many toddlers begin digit sucking by imitating the sucking activity of a sibling or other children at day care or preschool (Bruce & John, 1991). Oral habits may also be acquired through the repetition of actions that serve to calm an emotional need of the child. At each repetition, the habit becomes less conscious and if repeated often enough, it may be relegated to the subconscious (Paredes G. & Paredes C., 2005).

The digit sucking habit is quite normal in infancy and early childhood. It is also the most common oral fixation seen in children. Either the thumb or one or more fingers may be sucked to varying extents (Josell, 1995).

Many activities create changes in mood through increased and decreased neurotransmission and subsequent alterations in brain chemistry. Decreased neurotransmission during digit sucking induces a calming, relaxing sensation that is associated with the production of endorphins; this may also reduce feelings of discomfort or pain. As time passes, children often indulge in the pleasure of the sucking activity subconsciously.

Some situations that stimulate digit sucking are fatigue, boredom, excitement, hunger, fear, physical and emotional stress. Sucking may provide contentment or make the child feel happy. Sucking may also provide a sense of security during difficult times.

However, if these habits persist beyond the preschool age when permanent teeth start to erupt, they may be implicated as an important environmental etiological factor associated with the development of malocclusion. Therefore, the effects of diurnal or nocturnal parafunctional activities may cause damage to dentition, musculature, and joints (Friman, Mcpherson, Warzak, & Evans, 1993). Parafunctional

activities may also negatively impact the emotional and psychological well-being of the child, and may contribute to learning difficulties in the classroom setting.

It is important to understand that digit sucking habits may become excessive over time. The severity of the problem depends on the frequency, intensity, duration, and also the position in which the finger is placed in the mouth. (Van Norman, 1997; 2001). This excessiveness is determined by three factors: Intensity, or how hard the thumb/finger sucked when it is in the mouth; frequency, or how often during the day and night the sucking occurs; duration, or how long the habit has been present (Al-J-Joair & Al-Emran, 2004; Van Norman, 1997). These factors act together to play an important role during the development of the oral and facial structures and can create a disturbance of the relationship between the jaws and teeth.

For example, the upper teeth may be pulled outward and pushed upward by persistent, long-term digit pressure. If severe, the upper jaw can become displaced forward, which may contribute to a poor biting and chewing surface and promotes a "bucked teeth" appearance. In addition, the pressure of the digit resting on the lower front teeth may retard the growth of the lower jaw (Paredes G. V., 2005) and crowd or tip the lower front teeth lingually. The bony support of the upper teeth may be displaced upward, resulting in an "open bite," or, and more likely, the posterior maxillary teeth continue to erupt downward while the freeway space is opened during digit sucking, resulting in an anterior openbite. In addition, the tongue may come forward during the production of certain speech sounds, usually sibilants, to compensate for this digit-induced open bite. A "tongue thrust" swallow may be fostered, which may further contribute to the misalignment of the teeth or malocclusion.

The constant motion of the cheek muscles in the sucking action may begin to narrow the upper dental arch by collapsing it around the digit; this may contribute to a "cross bite" where the upper and lower posterior teeth no longer fit in harmony. With the digit in the mouth the lips remains in an open posture. Over time, this can distort the appearance of the lips and the child may begin to rest with

the lips open most of the time, giving the appearance that the child is a mouth-breather (Al-J-Joair & Al-Emran, 2004; Ayer & Gale, 1970; Van Norman, 2001; Nicholas & Moore, 2002).

It is a common assumption that children with digit sucking habits are emotionally insecure. However, it is often the negative response of others to the habit that leads to emotional and psychological distress. Peer interactions are considered to be important contributing factors to social development. Chronic digit sucking in school-age children may produce potentially harmful peer reactions, which have the potential to negatively affect social and emotional development (Al-J-Joair & Al-Emran, 2004; Van Norman, 1997).

Digit sucking may also have a negative impact on the learning process whether or not the child sucks his/her digit at school. Many children will not suck in front of other children or in the classroom. However, oral fixation, frustration, and the effort not to suck often lead children to chew on pencils, clothing, hair, and fingernails. They may then possess two oral habits instead of one - sucking and chewing (Van Norman, 1997; 2001).

The child who is trying to control sucking activity in the classroom may also exhibit disruptive behavior and have difficulty sitting still. If the child cannot restrain from digit sucking at school, the behavior can induce a trance-like state and inhibit the ability to focus on subject matter. Writing, manipulative skills, general class participation, communication, and interaction may also be limited (Van Norman, 1997; 2001).

The concern about digit sucking habits is evident from the many epidemiological studies which have been performed in different countries throughout the world during the past 50 years. The world-wide prevalence of digit habits is represented in Table 1. These studies indicate that concern about digit habits is global and encompasses a wide age range. However until this current research, no studies had been conducted in United Arab Emirates (UAE).

Prevalence of this habit varies from one population to another. It is influenced by many factors such as gender, birth order, feeding method, and socioeconomic status (Paredes G. & Paredes C., 2005; Friman, Mcpherson, Warzak, & Evans, 1993; Josell, 1995; Najat, Farsi, & Fouad, 1997; Sarkar, Chowdgury, Mukherjee, & Ahmed, 1996; Caglar, Larsson, Andersson, Hauge, Ogaard, Bishara, Warren, Noda, & Dolci 2005; Onyeaso, 2004).

MANAGEMENT OF DIGIT SUCKING HABIT

Over the past 60 years, there have been many different designs for dental appliances used to curtail digit sucking habits. These appliances are called habit breakers which may be removable or fixed. Virtually all fixed habit appliances have been constructed utilizing bands on the upper first molars, to which an arch wire is attached that carries the main element that serves to prevent the digit sucking (Nicholas & Moore, 2002).

Table 1. Prevalence of digit sucking habits

First Author	Year	Sample	Age in years	Digit Habits %
Bliss	1945	300 New Zealander children	2-4	17
Traisman	1958	2,650 U.S. children	under 4	46
Bowden	1966	116 Australian children	0-8	27
Zadik	1977	333 Israeli children	birth-7	23
Melsen	1979	723 Danish children	10-11	8
Svedmyer	1979	462 Swedish children	3-5	16
Cerney	1981	600 Australian children	birth-3	18
Modeer	1982	588 Swedish children	4	10
Larsson	1985	415 Zimbabwean children	1-2	2
Larsson	1992	245 Norwegian children	3	12
Ahmed	1996	2,517 Calcutta children	3-12	18
Andrija	2002	5,554 Delhi children	5-13	20
Kharbanda	2003	1,100 Spain children	4-11	9.36
Paredes	2003	493 Nigerian children	7-10	8.1
Onyeaso	2004	1,025 Croatian children	6-11	18.42

Although the design of fixed habit appliances has changed a great deal since they were first introduced, no consensus has been achieved on the best type to use, or even how long to use them in treatment. There are also indications that appliance therapy is potentially extremely dangerous, yet this appears to be completely ignored by many practitioners.

Many recent reviews recommend that dental appliances should not be used unless all other behavioral methods of deterring the habit fail. In 1997, a program of behavior management for sucking habits was proposed; a motivational program to help children discontinue their digit sucking habits before developing deleterious dental conditions (Van Norman, 2001; Molinari, 1994; Josell, 1995).

Any new approach needs three elements to be successful: children who are willing to stop the habit; a skilled therapist who can bridge the communication gap between the child and parents; parents' role and participation. These elements play an essential role in achieving a successful result in the elimination of an undesired behavior. In UAE society, the mother is designated as the person responsible for child rearing and behavior management, yet, unfortunately, most mothers have not had access to specific guidelines to deal with digit sucking habits (Van Norman, 2001; Josell, 1995).

METHODS

This research protocol approved by the ministry of health of UAE involved a cross-sectional study conducted in primary care clinics in Abu-Dhabi, Dubai, Sharjah, Ajman, Umm al Qaiwain and Fujairah.

There were 900 mothers who visited these centers. They were asked if they had a child who currently practiced digit sucking. One hundred fifty 150 mothers who were found to have one 1 or more children with digit habits were included in this study. These mothers were then interviewed using a questionnaire format designed for this purpose.

The questionnaire consisted of items with more than one answer choice so that the mothers could choose the most appropriate response. General information about the mothers was collected, including: age, nationality, education, occupation, and attitudes and attempts to deal with this habit. The mothers were also asked if they had requested any clinical advice from medical or dental professionals. The data were analyzed using the Chi-square test.

RESULTS

Analysis (Table 2) showed that most mothers belonged to the 20-30 year-old group (54%). Arab mothers represented the highest percentage among the sample size (79.0%), whereas Emirate mothers represent (32.0%). A high percentage of the mothers sampled had a university level of education (47.3%) while those who did not attending school (8.5%), mothers with primary level (30.8%) and with secondary level (13.4%) Most mothers were unemployed (70.0%). The majority of the mothers considered digit sucking habit to be a detrimental habit (86.7%).

In addition most of the mothers indicated concerns about digit habits (80.7%), while some mothers (6.0%) found it acceptable until 2 years of age, and fewer mothers (4.0%) felt it was acceptable up to 4 years of age. The majority of the mothers indicated that they tried to instruct their children to stop this habit (79.3%). Mothers indicated that they never used aggression (such as: castigation, warning, and harming) in dealing with this habit (68.0%). The majority of the mothers had not sought any pediatric advice (81.3%), nor any dental advice (83.3%).

Most of the mothers had one child practicing this habit (70.7%), while the remaining 29.3% had more than one child with this habit. Female children represented the highest percentage (65.3%) of children practicing this habit. Children less than 3 years of age represented the highest percentage in this study with a digit habit (45.3%), while 26.7% of the children with a digit habit belonged to the 4-6 year-old age group (Table 3).

An analysis based on the nationality of the mothers was compared with the methods used to encourage the cessation of digit habits. Results are summarized in Table 4. Half of the mothers (50.0%) regardless of nationality applied a substance with a bitter taste on the digit in an attempt to stop the habit, while 39.3% of the mothers used other materials like henna, or mercurochrome. Some of mothers (36.0%) of children with digit habits applied gloves at night on their child's hand/hands, while other mothers (26.7%) applied tape on their child's digit. Some mothers preferred to construct a taped splint over the digit (20.0%), while other mothers (13.3%) wrapped the hand, and 11.3% of the mothers used nail polish on the digit to stop the habit.

An assessment of the relationships between maternal age, education, employment status

and attitudes towards digit sucking are provided in Tables 5 and 6. Younger mothers were found to have one child practicing this habit (73.4%). Younger mothers also indicated that they had never accepted this behavior (88.6%), and were likely to routinely instruct their children to stop the habit (70.9%). Most of the mothers had not sought professional advice (89.9%).

Overall, 80.3% of educated mothers instructed their children to stop this habit. However, most of the mothers (81.7%) never asked for professional advice from a pediatrician or dentist.

Employed mothers represented the highest percentage (75.2%) of mothers who provided motivation and instructional methods for their child. This was a statistically significant finding.

Table 2. Descriptive analysis of the mothers involved in the present study.

Variable	Number	Percentage %
Age		
20-30		
31-40	79	54.0
41-55	53	34.0
	18	12.0
Nationality		
Emirate	48	16.0
Arab	78	79.0
Non-Arab	24	5.0
Habit acceptance		
Never	130	86.7
Until 2 years of age	9	6.0
Until 4 years of age	6	4.0
Mothers' instruction		
Gave instruction	119	79.3
Didn't instruct	31	20.7
Aggression		
Use aggressive	48	32.0
Don't use aggressive	102	68.0

Table 3. Age and gender distribution of the children currently practicing digit sucking habit

Variable	Number	Percentage %
Age of children currently practicing digit sucking habits		
1	105	70.7
2	33	21.3
3	12	8.0
Child gender		
Female	98	65.3
Male	51	34.0
Child age (years)		
< 3	68	45.3
4-6	40	26.7
7-9	12	8.0
10-12	30	20.0

Table 4. Association between mother's nationality and the techniques used for cessation.

Techniques used	Emirate	Arab	Non Arab
Bitter taste	24 (50.6%)	39 (50.%)	12 (50%)
Tape application	14 (29.2%)	21 (26.9%)	5 (20.8%)
gloves	18 (37.5%)	29 (37.2%)	7 (29.2%)
Nail polish	5 (20.4 %)	9 (11.5%)	3 (12.5%)
Digit splint	10 (20.8%)	18 (23.1%)	2 (8.3%)
Wrapping the hand	7 (14.6 %)	12 (15.4%)	1 (4.2%)
Other	17 (35.4 %)	34 (43.6%)	8 (33.3%)

Table 5. Association between mother's age and attitudes towards digit sucking habits.

Variable	Age of mothers		
	20-30	31-40	41-55
Habit acceptance			
Never	(88.6%)*	(5.1%)	(5.1%)
Until 2 years	(92.5%)	(7.5%)	(0.0%)
Until 4 years	(82.1%)	(5.6%)	(11.1%)
Mother instruction			
Give instruction	(70.9%)*	(90.6%)	(83.3%)
Didn't give instruction	(29.1%)	(9.4%)	(16.7%)
Aggression			
Yes	(30.4%)	(34.%)	(33.3%)
No	(69.6%)	(66.%)	(66.7%)

*p<0.05

Table 6. Association between mothers' education, employment status, and their attitude towards digit sucking

Variable	Education level				Employment status	
	Never attended school	Primary	Secondary	University	Employed	Unemployed
Mother instruction						
Yes	(66.7%)	(80.0%)	(80.8%)	(80.3%)	(88.9%)	(75.2%)*
No	(33.3%)	(20.0%)	(19.2%)	(19.7%)	(11.1%)	(24.8%)
Seeking pediatric advice						
Yes	(8.3%)	(20.0%)	(21.2%)	(18.3%)	(17.1%)	(22.2%)
No	(81.7%)	(91.71%)	(80.0%)	(67.8%)	(82.9%)	(77.8%)
Seeking dentist advice						
Yes	(0%)	(13.3%)	(19.2%)	(18.3%)	(14.3%)	(22.2%)
No	(100%)	(86.7%)	(80.8%)	(81.7%)	(85.7%)	(77.8%)

*p<0.05

DISCUSSION

The marriage of young females is a common event in UAE society. Early marriage may result in having a child in the family when the mother is in her twenties. This finding is not in agreement with what has been reported in other studies and is likely related to differences in societal tendencies/norms.

A digit sucking habit is a normal infant behavior seen commonly in early ages. (6, 7 Al-J-Joair & Al-Emran, 2004; Van Norman, 1997) This explains the current study's finding of a large number of children younger than 3 years of age practicing this habit. It may also be related to the mothers'

feeding choice through the first years of life. Several studies conclude that infants who were breastfed for a reasonably long period of time (1-2 years) are less likely to develop a digit habit than non-breastfed infants. Is this current decline in breast feeding linked to the initiation of an unfavorable digit sucking behavior? This decline in breast feeding is statistically significant and in agreement with several studies (Najat, Farsi, Fouad, 1997; Yarrow, 1954; Larsson & Dahlin, 1985).

A digit sucking habit was not tolerated or accepted by some of the younger mothers in

this study. This finding is in agreement with previous studies which indicate that older mothers, or mothers with older children, tend to be more knowledgeable about health awareness from sources such as care centers and mass media studies (Al-J-Joair & Al-Emran, 2004; Najat, Farsi, Fouad, 1997; Turbenville & Fearnow, 1976).

Female children were found to be practicing digit sucking habits more than males. This result is consistent with conclusions in other studies that families may more readily accept this behavior in girls than boys (Van Norman, 1997; 2001).

In UAE culture many ethnic groups have been living in proximity for a long time. These cultural interactions might affect and influence individuals in many ways. Cultural influences might be the reason that the majority of the mothers, regardless of their nationality, employ similar methods in trying to stop the digit sucking behavior. The methods used may have been transmitted across generations without scientific support for methodology. This is a new finding in our study.

The finding that a majority of mothers were convinced that aggressive techniques might create anxiety and physical distress for such a young child, and therefore did not use aggressive methods to try to stop the digit habit. This statistically significant finding was in agreement with other studies (Van Norman, 1997; 2001).

The results indicate a highly significant relationship between educated unemployed mothers and their attempts to instruct their children to stop the digit habit. This finding is also compatible with other study results (Al-J-Joair & Al-Emran, 2004; Turbenville & Fearnow, 1976; Warren & Levy, 2000). Educated women may develop an increased awareness of the difficulties children with a digit habit may experience through magazine or newspaper articles and social contacts, in comparison to uneducated mothers. However, unemployed mothers would be presumed to spend more time with their children, enabling them to watch observe their children and advise or correct them about undesired behaviors.

A major finding in our study was the need for health literacy, where we can increase health awareness among individuals in different categories. Most of the mothers had not sought out advice about their child's digit sucking habit from a dentist, even though they were visiting the dentist regularly for routine dental treatment for their children. Also, dentists were not providing advice to mothers about the dental effects that could result from a chronic sucking habit, nor providing treatment cessation techniques. This finding, which is statistically significant, suggests that dentists are failing to instruct and motivate the mother and child to stop this habit as early as possible to avoid negative dental effects in the future. This finding highlights the deficiency of dental health awareness in institutions to instruct and motivate individuals to seek out advice from the appropriate sources, as noted in other studies (Al-J-Joair & Al-Emran, 2004; Caglar, Larsson, Andersson, Hauge, Ogaard, Bishara, Warren, Noda & Dolci, 2005). Overall, the outcomes of this study reflect light on environmental factors which may help the implementation of future studies regarding oral habits.

CONCLUSIONS

Many studies have been undertaken to investigate various issues regarding digit sucking habit in children. This study focused on maternal attitudes towards digit sucking habits in children and the maternal role and methodologies used in dealing with this habit cessation.

The results of this study can be summarized as follows:

1. The mothers in UAE did not regard a digit sucking habit to be acceptable, and they utilized a variety of techniques to stop this habit.
2. No differences were found among different nationalities involving the techniques used to stop this habit.

3. No significant relationships were found regarding child gender, age, and maternal attitudes towards this habit, although girls were found practicing this habit more frequently than boys.
4. A significant relationship was found between educated and unemployed mothers and their methods to provide child motivation to discourage this habit.

5. A great need for increased health awareness among mothers in seeking professional advice about digit habits was revealed.

Additional research should focus on the global trends to discourage this behavior among different nations. It is also important to establish the proper age to start this action. Digit habit cessation is a major concern for mothers.

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TWENTY-TWO FUNDAMENTAL METHODS OF JAW, LIP, AND TONGUE FACILITATION

Pam Marshall, MA, CCC-SLP

ABSTRACT: Twenty-two fundamental methods of jaw, lip, and tongue facilitation were derived from a set of 84 textbooks, clinical guidebooks, and conference proceedings. 95.24% of publications reviewed contained one or more of these twenty-two methods. A description of each technique with examples is provided.

INTRODUCTION

The current need for evidence concerning the use of “oral motor” techniques prompted a literature review. A set of 84 textbooks, clinical guidebooks, and conference proceedings were reviewed for their *oral* (jaw, lip, and tongue) *motor* (sensory, motor, and positioning) *techniques*. Publications were selected from the following six treatment areas: articulation, phonology, motor speech, feeding, dysphagia, orofacial myology, and oral motor therapy. Three introductory communication sciences texts, and one speech-language guide for parents, also were included in this set. These publications spanned the years 1912 through 2007 and were written in English. [Please see original article for full list.]

The results of this literature review revealed that *oral* (jaw, lip, and tongue) *motor* (sensory, movement, and positioning) *techniques* have had substantial representation throughout the field of speech-language pathology from 1912 through 2007. These methods were described, discussed or recommended, in part or in whole, in 95.24% of publications reviewed. Detailed analysis, of the techniques discovered in these publications, suggested that there are at least “Twenty-two Fundamental Methods” of jaw, lip, and tongue facilitation that have been described and are in current practice. This article briefly defines and gives two examples of each. [Please see original article for more

detailed explanations and additional examples.]

TWENTY-TWO FACILITATION METHODS

1. Assist Oral Movements

To *assist* is to “help (someone), typically by doing a share of the work” (Jewell & Abate, 2001, p. 96). Speech-language pathologists use their own hands, fingers and other tools to assist clients in their attempts to achieve specific jaw, lip, and tongue movements and positions. Examples:

- To assist tongue back elevation for /r/: “A flat stick or a small rod ... may be put under the tongue to push it back and up” (Scripture, 1912, p. 148).
- To assist tongue tip elevation for lingua-alveolar phonemes: “Sometimes it is helpful to use a tongue depressor or a rounded stick to bring the tongue into the desired position” (Berry & Eisenson, 1956, p. 42).

2. Associate Oral Movements

To *associate* is to “connect (something) with something else because they occur together or one produces another” (Jewell & Abate, 2001, p. 97). Speech-language pathologists use the movements and positions of one phoneme to teach the movements and

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positions of another phoneme. Examples:

- Associating lingua-alveolar position for /t/ with lingua-alveolar position for /s/: "Make [t] ... Make [t] with strong aspiration on the release ... Prolong the strongly aspirated release ... Remove the tip of the tongue slowly during the release from the alveolar ridge to make a [ts] cluster ... Prolong the [s] part of the [ts] cluster in words like *oats* ... Practice prolonging the last portion of the [ts] production ... Practice 'sneaking up quietly' on the [s] (delete /t/) ... Produce [s]" (Bernthal & Bankson, 2004, p. 302).
- Associating tongue-tip protrusion for /th/ with tongue tongue-tip elevation for /l/: "Instruct the client to say /th/. Then tell the client to lower the jaw and draw the tongue tip backward until it contacts the alveolar ridge behind the upper teeth. While maintaining contact with the alveolar ridge, the client says /l/" (Secord *et al*, 2007, p. 90).

3. Contrast Oral Movements

To *contrast* is to "compare in such a way as to emphasize differences" (Jewell & Abate, 2001, p. 373). Speech-language pathologists help clients contrast jaw, lip and tongue positions in order to help them perceive the locations of articulatory contact. Examples:

- Contrasting positions used to teach lip rounding for /w/: "Contrast lip spreading with lip rounding, and a large mouth opening with a small mouth opening" (Hanson, 1983, p. 206).
- Contrasting tongue positions used to eliminate a frontal lisp: "A great way to wake up the tip of the tongue and to get the tip behind the teeth is to have the client say, 'th-s-th-s-th-s-th-s' back and forth in one continuous air stream. This practice stimulates the tip of the tongue through tactile means as it rubs forward and back against the upper central incisors" (Marshalla, 2007, p. 104).

4. Cue Oral Movements

A *cue* is "a signal for action ... a piece of information or circumstance that aids the

memory in retrieving details not recalled spontaneously ... a hint or indication about how to behave in particular circumstances" (Jewell & Abate, 2001, p. 415). Speech-language pathologists provide *visual, auditory, tactile, proprioceptive* and *conceptual* cues about oral movement and position in order to help clients learn to produce specific phonemes, and to sequence phonemes. Examples:

- Visual and tactile cue for production of /st/: "The clinician may draw her finger up the child's bare arm while saying /s/ and tap it lightly as she releases the /t/, thus calling attention to the continuancy of /s/ and the quick burst of /t/" (Hodson & Paden, 1983, p. 51).
- Tactile cue for lingua-velar articulation: "Pressure applied well under the child's chin, upward and toward the base of the tongue, will reinforce back-of-tongue ... productions" (Blakely, 1983, p. 30).

5. Describe Oral Movements

To *describe* is to "give an account in words of (someone or something), including all the relevant characteristics, qualities, or events" (Jewell & Abate, 2001, p. 462). Speech-language pathologists frequently describe the movements or positions of the jaw, lips, and tongue in order to help clients achieve target phonemes and feeding skills. Examples:

- To describe lip position for /v/: "[The client] is told to bite his lower lip" (Scripture, 1912, p.124-125).
- To describe tongue tip placement for lingua-alveolar phonemes: "See the tip of my tongue? I am going to make it real small like this. Then I am going to lift it up. See? Then the tip of my tongue is going to touch this part of my mouth. Did you see that? Can you do it?" (Hegde, 1998, p. 155).

6. Develop Sensory Awareness and Discrimination for Oral Movements

To be *aware* is to have "knowledge or perception of a situation or fact" (Jewell and Abate, 2001, p. 113). To *discriminate* is to

“recognize a distinction” and to “perceive ... the difference in or between” (Jewell & Abate, 2001, p. 488). Speech-language pathologists utilize hands, food and other objects to help a client become more aware of the different parts of his mouth and to help him learn to discriminate different sensory parameters of oral stimuli. Examples:

- To develop general oral sensory awareness: “Learn to recognize the movement as part of some familiar biological movement such as chewing, swallowing, coughing ... chew in an exaggerated fashion ... practice licking the lips and cleaning the tongue and cheeks with the tongue” (Van Riper, 1954, pp. 216-218).
- To develop general oral sensory awareness and discrimination: “Provide many opportunities for the child to engage in generalized mouthing activities of the hands, simple environmental objects, and toys” (Morris & Klein, 2000, p. 411)

7. Direct Oral Movements

To *direct* means to “aim (something) in a particular direction” (Jewell and Abate, 2001, p. 483). Speech-language pathologists direct jaw, lip and tongue movements, as well as phonation and airflow, with their own arms, hands, fingers and other instruments, and with ideas. Examples:

- To direct air stream for /s/: “Have the patient practice emitting expired breath streams thru [the] small hole ... of a hollow, rubber tube” (Borden & Busse, 1929, p. 184).
- To direct tongue elevation for /r/: “Tell the client you are going to pull on an imaginary string attached to the back of his head. As you pull the imaginary string up from the back of the client's head, instruct the client to lift the back of a tensed tongue and say /er/” (Secord et al, 2007, p. 153).

8. Dissociate Oral Movements

To *dissociate* means to “disconnect or separate” (Jewell & Abate, 2001, p. 494).

Speech-language pathologists help clients *dissociate* between movements of the jaw, lips and tongue so that appropriate movements can be made for phoneme production and feeding skills. Examples:

- To dissociate tongue movement from jaw movement for /t/: “The insertion of the broad side of a tongue depressor between the side teeth and holding it steady while repeating *t, t, t*, in rapid succession will assist in securing independent action of the tongue” (Nemoy & Davis, 1937, p. 90).
- To dissociate tongue movement from lip movement for /r/: “The lip retractor is a device designed for use by orthodontists for photographing the teeth. Placed correctly in the mouth, the lip retractor pulls the lips laterally. With the lip retractor in place, most clients will be unable to move the lips at all. This is a great way to help them focus on what their tongues should be doing” (Marshalla, 2004, p. 113).

9. Exaggerate Oral Movements

To *exaggerate* is to “represent (something) as being larger, greater, better, or worse than it really is” (Jewell & Abate, 2001, p. 590). Speech-language pathologists often exaggerate jaw, lip and tongue movements to make them salient for the client. Exaggeration of oral movement also is required of the client himself in order to help him understand his own oral movements, and to make his or her oral movements more precise. Examples:

- To exaggerate as a general articulation method: “When the correct sound has been produced ... the [client] should hold it, increasing its intensity, repeating it, whispering it, exaggerating it, and varying it in as many ways as possible without losing its identity. He should focus his attention on the ‘feel’ of the position in terms of tongue, palate, jaws, lips, and throat” (Van Riper, 1954, p. 239).
- To exaggerate in order to understand incorrect movements: “Encouraging exaggeration of the undesirable movement will make it more obvious to

the child" (McDonald & Chance, 1964, p. 124).

10. Increase or Decrease Muscle Tone for Oral Movements

Muscular tone is "the degree of stiffness" in the musculature "to stabilize or move the skeleton" against gravity (Boehme, 1990, p. 210). Speech-language pathologists use techniques to increase or decrease muscle tone in order to encourage more mature jaw, lip, and tongue movement patterns for speech and feeding. Examples:

- To decrease muscle tone in the tongue for production of lingua phonemes: "Request the patient to protrude the tongue so that it can be grasped gently. Next, pull it forward as completely as possible ... Once fully withdrawn the tongue is slowly pulled to the right corner of the mouth, held there for an out-loud count of 10 seconds, and then smoothly moved across the midline to the left corner of another count of 10 seconds to complete the trial. Although the degree of hypertonicity present will probably produce resistance to these adjustments, maintaining the lateral pulling force along the way usually proves fruitful after 10 or 15 trials with most patients" (Dworkin, 1991, p. 197).
- To decrease muscle tone in the facial muscles: "Use facial molding ... begin with a general massage of the child's body and face ... gently mold or massage the face toward a closed mouth/closed lip position" (Morris & Klein, 2000, p. 415).

11. Increase Range of Motion for Oral Movements

Range is "the area of variation between upper and lower limits on a particular scale" (Jewell & Abate, 2001, p. 1409). Speech-language pathologists utilize techniques to help clients increase range of jaw, lip, and tongue movement so that appropriately graded oral movements can be achieved over time. Examples:

- To increase range of face, lip and jaw movements in speech warm-up

activities: "Imitate the faces of clowns by retracting the lips, protruding the lips, and by dropping the jaw as far down as possible while producing [vowels]" (Berry & Eisenson, 1956, p. 139).

- To increase range of motion of the tongue for eating and swallowing: "The patient should be asked to open his or her mouth as wide as possible, hold it there for 1 second, and release it. Then the patient should elevate the back of the tongue as far as possible, hold it there for 1 second, and release it. This procedure should continue with the patient stretching the tongue to each side as far as possible, extending the tongue out of his or her mouth as far as possible, and pulling it back as far as possible, holding it for 1 second in each direction" (Logemann, 1983, p. 133).

12. Inhibit Oral Movements

To *inhibit* means to "slow down or prevent (a process, reaction, or function)" (Jewell & Abate, 2001, p. 873). Speech-language pathologists use inhibition techniques to prevent habitual, reflexive, tone-based, or undifferentiated movement patterns from overriding a client's attempts at new movement. Examples:

- To inhibit tongue humping or bunching in order to encourage more tongue movement: "Treatment approaches ... often include downward bouncing or patting on the tongue ... The tongue can be stroked to obtain a central grooving or a lateral upward movement ... Brushing the center of the tongue can facilitate flattening and a more central groove" (Morris & Klein, 2000, p. 607).
- To inhibit tip elevation during production of /k/: "Using a tongue depressor, hold the tongue tip down behind the lower teeth to hinder the elevation of the tongue tip" (Secord et al, 2007, p. 30).

13. Maintain Oral Positions

To *maintain* is to "cause or enable (a condition or state of affairs) to continue" (Jewell & Abate, 2001, p. 1030). Speech-

language pathologists encourage clients to maintain oral positions in order to increase awareness, voluntary control, strength and skill of positions. Examples:

- To maintain lip-to-lip articulation for swallowing: "Once the patient is able to obtain lip closure, but has not habituated it, a graduated increase in the time required to maintain closure should be used. The patient may be asked to hold lip closure for 1 minute. This should be repeated 10 times per day" (Logemann, 1983, pp. 145-146).
- To maintain tongue tip elevation to the alveolar ridge: "Hold tip of tongue to the spot for at least 5 seconds, or as long as possible. Increase time to 30 seconds, continuing to press tip into the spot" (Gangale, 1993, p. 103).

14. Mark the Target of Oral Movements

To *mark the target* of oral movement means to indicate, through tactile means, the place where articulation should be made. Speech-language pathologists often use fingers or other tools to touch the place where articulation should occur. Examples:

- To mark the "spot" for tip-to-alveolar contact for correct oral rest posture: "At times we press against the spot with the end of a tongue depressor, then ask the patient to do the same. The parent watches closely, and may be asked to touch the child's 'spot' with a tongue depressor" (Hanson & Barrett, 1988, p. 275).
- To mark the soft palate for production of /k/: "Rub a moist cotton swab on a flavored food, such as a Lifesaver ... Then touch the soft palate near the second molars with the swab and ask the client to raise the back of the tongue to the roof of the mouth to form a seal" (Secord et al, 2007, pp. 30-31).

15. Model Oral Movements

A *model* is "a system or thing used as an example to follow or imitate" (Jewell & Abate, 2001, p. 1096). Speech-language

pathologists model jaw, lip and tongue movements and positions for phoneme production and feeding skills. Live models are made with the therapist's mouth. The hands also can be used to model movement and position. Examples:

- To model oral positions with apraxic patients: "Ordinarily, therapy is best conducted with the clinician and patient seated in front of a large mirror so the patient can watch both the clinician's face as he speaks and his own face as he imitates the clinician's model" (Darley, Aronson & Brown, 1975, p. 282).
- To model tongue tip to the alveolar ridge for /t/: "Use hand gestures to demonstrate how to tap the tongue against the alveolar ridge" (Secord et al, 2007, p. 23).

16. Normalize Oral Tactile Sensitivity for Oral Movements

To *normalize* is to "bring or return to a normal condition or state" (Jewell & Abate, 2001, p. 1167). *Tactile* refers to the sensation of touch perceived through nerve endings in cutaneous tissue (skin). To *normalize oral tactile sensitivity* means to help a client accept, perceive and discriminate oral-tactile experiences in, on and around the mouth. Speech-language pathologists provide techniques to normalize oral-tactile sensitivity so that bi-labial, labio-dental, lingua-dental, lingua-alveolar, lingua-palatal and lingua-velar contact can be explored, utilized and habituated in phoneme production and feeding skills. Examples:

- To normalize the hyper functional gag reflex that interferes with articulatory movement: "To lessen such sensitivity in these patients ... the technique of maintained touch or pressure may be helpful" (Dworkin, 1991, p. 104).
- To normalize oral tactile hypersensitivity for overall oral movement in speech and feeding: "If the child demonstrates atypical oral motor patterns, such as a hyper responsive

gag reflex or tonic bite reaction, massage can be used to bring about an improved response" (Bahr, 2001, p. 115).

17. Practice Oral Movements

To *practice* is to "perform (an activity) or exercise (a skill) repeatedly or regularly in order to improve or maintain one's proficiency" (Jewell & Abate, 2001, p. 1339). Speech-language pathologists use practice to: (1) habituate oral movements, (2) improve muscular strength and endurance for performance of an oral movement, (3) improve motor memory of a performed oral movement, (4) increase volitional control over oral movements, and (5) to make new oral movements automatic. Examples:

- To practice tongue tip elevation for /l/: "Give tongue-lifting and tongue-lowering exercises, first in silence, then while blowing, then while whispering *ah*, then while saying *ah*. Gradually lift the tongue [tip] higher and higher until it finally makes contact at the right place" (Van Riper, 1954, p. 242).
- To practice tongue tip elevation for lingua-alveolar phonemes: "Set the metronome to 30 [beats per minute], and instruct [the client] that the task is to raise and lower the tongue-tip alternately to the respective alveolar ridges according to the beat" (Dworkin, 1991, p. 223).

18. Resist Oral Movements

To *resist* is to "withstand the action or effect of" (Jewell & Abate, 2001, p. 1449). Speech-language pathologists resist jaw, lip and tongue movements in order to develop new movements and to facilitate improved movement of these parts. Examples:

- Use of resistance to facilitate lateral tongue elevation for /s/: "If the elevation is difficult, have him work on lifting the sides of the tongue against resistance. This resistance can be supplied by a pair of swab sticks pushing downward on the sides of the tongue" (Hanson, 1983, p. 228).

- Use of resistance to improve lip function using a quarter-sized button: "Loop the string through two buttonholes and tie a knot at the end. After instructing the patient to close the teeth, position the button against the teeth behind the midline of the lips ... In a tug-of-war fashion, pull on the string with moderate force as the patient is required to resist this effort to dislodge the button by vigorously contracting the circumoral musculature" (Dworkin, 1991, p. 213).

19. Speed Up or Slow Down Oral Movements

Speed refers to the "rapidity of movement or action" (Jewell & Abate, 2001, p. 1639). Speed of oral movement is addressed in therapy with clients who lose precision of movement as they approach the normal articulatory rate involved in connected speech. Examples:

- To increase speed of oral movement: "Chew in an exaggerated fashion ... Do this to a simple rhythm tapped out by the teacher, very slowly at first, then increasing speed" (Van Riper, 1954, p. 217).
- To improve rate and rhythm of chewing: "Increase the timing and coordination of the chewing pattern ... Encourage rhythmic activities during chewing ... Many children will stomp their feet spontaneously or kick rhythmically as they are chewing" (Morris & Klein, 2000, p. 481).

20. Stabilize Oral Movements

To *stabilize* is "to make or become stable" (Jewell & Abate, 2001, p. 1656) or "not likely to change" (p. 1656). Speech-language pathologists utilize techniques to stabilize one part of the oral mechanism in order to encourage more mobility in other parts. Examples:

- To stabilize the lips and facial muscles with low muscle tone: "Play patty-cake, peek-a-boo, and other children's games that incorporate patting, tapping, stroking, and other types of tactile and

proprioceptive stimulation of the cheeks and lips. Tapping can be done directly around the temporomandibular joint to provide better jaw stability for lip and cheek mobility" (Morris & Klein, 2000, p. 445).

- To stabilize the back of the tongue for eliminating a frontal lisp: "We can help our clients keep the tongue inside the mouth by developing [the tongue's] back lateral stability" (Marshalla, 2007, p. 115). Techniques include: "draw a picture," "stroke the zones," "smile," "bite gently on the zones," "establish the butterfly position," "hold the butterfly position," and "spread the back of the tongue" (p. 115-116).

21. Stimulate Reflexive Oral Movements

A *reflexive action* is "a response of some peripheral organ to stimulation of the sensory branch of a reflex arc, the action occurring immediately, without the aid of the will or without even entering consciousness" (Osol, 1973, p. 669). Speech-language pathologists use reflex stimulation to facilitate jaw, lip and tongue movement for phoneme production and feeding skill development. Examples:

- To stimulate tongue cupping: "The purpose of this exercise is to stimulate the involuntary reflex, similar to the grasp reflex, that depresses the middle portion of the tongue in response to a stimulus. ... Tap the middle of the tongue with a tongue depressor ... Continue tapping long enough to demonstrate the proper procedure, then have the patient do so. This is to be continued during each of the three

practices each day for one minute" (Hanson & Barrett, 1988, pp. 278-279).

- To stimulate elevation of the tongue's lateral margins: "Touching or stroking a baby's tongue elicits a spoon-shaped lingual configuration, characterized by an upraised ridge around its outer border ... a similar posture could be elicited in adulthood by repeatedly touching, lightly stroking, or directing a stream of air across the tongue" (Fletcher, 1992, pp. 10-11).

22. Vivify Gross Oral Movements

To *vivify* is to "enlighten or animate" (Jewell & Abate, 2001, p. 1889). Speech-language pathologists use hands, fingers and other objects to *vivify* jaw, lip and tongue movement for feeding and speech.

Examples:

- To facilitate gross movement of the tongue: "Chew gum, rolling it to the side, 'plaster' it against the palate, slowly move the gum back over the palate, etc. Attempt to feel the tongue position with each movement" (Berry & Eisenson, 1956, p. 139).
- To vivify gross oral movement for speech rehabilitation: "In instances of severe involvement ... movement may be so limited that differentiation of the various vowels and consonants is next to impossible. One can try in such a case to help the patient concentrate his energy first on activities preliminary to speech production ... The intent is to help the patient regain some concept of where his articulators are and where he must put them" (Darley, Aronson & Brown, 1975, p. 273-274).

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Book:

Barrett, R. H. & Hanson, M.L. (1978). Oral myofunctional disorders (2nd Ed.). Saint Louis: C.V. Mosby Co.

Journal Article: (name of journal should not be abbreviated)

Gommerman, S. and Hodge, M. (1995). Effects of oral myofunctional therapy on swallowing and sibilant production. International Journal of Orofacial Myology. 21, 9-22.

Goda, S. (1968). The role of the speech pathologist in the correction of tongue thrust. American Journal of Orthodontics. 54(11), 852-859.

Hahn, V., and Hahn, H. (1992). Efficacy of oral myofunctional therapy. International Journal of Orofacial Myology. 18. 18-23.

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