Research Article

Prevalence of oral muscle and speech differences in orthodontic patients

Sue T. Hale (*University of Mississippi*)

Gloria D. Kellum (*University of Mississippi*)

F. Watt Bishop

Suggested Citation

Hale, S. T., et al. (1988). Prevalence of oral muscle and speech differences in orthodontic patients. *International Journal of Orofacial Myology*, 14(2), 6-10.

DOI: <https://doi.org/10.52010/ijom.1988.14.2.2>

This work is licensed under a [Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

The views expressed in this article are those of the authors and do not necessarily reflect the policies or positions of the International Association of Orofacial Myology (IAOM). Identification of specific products, programs, or equipment does not constitute or imply endorsement by the authors or the IAOM. The journal in which this article appears is hosted on [Digital Commons](#), an Elsevier platform.

PREVALENCE OF ORAL MUSCLE AND SPEECH DIFFERENCES IN ORTHODONTIC PATIENTS

Sue T. Hale, M.C.D.
Gloria D. Kellum, Ph.D.

Faculty, Department of Communicative Disorders, The University of Mississippi

F. Watt Bishop, D.D.S., M.S.
Orthodontist, Oxford, Mississippi

Four years of observations of speech and oral muscle patterns in orthodontic patients have led the examiners to expect certain factors to occur frequently. These factors include open-mouth posture, low forward tongue position at rest, linguadental instead of lingualalveolar articulatory placement, linguadental tongue position and lip movement during swallowing, upper lip restriction, mentalis wrinkling, frenum restriction, negative oral habits, and articulation and voice disorders. The emergence of these predictable patterns suggested the need for a systematic study of their occurrence. Thus, the incidences of speech differences, negative oral behaviors, and muscle factors identified as correlates to abnormal oral muscle, skeletal, and dental growth were examined in a retrospective study of the records of 229 orthodontic patients, the entire number of new patients reporting for records appointments to an orthodontic practice within a calendar year.

Data collected on all subjects at the time of their initial evaluations were re-examined in relation to the following research questions: (1) What was the occurrence of structural/functional muscle differences? (2) What negative oral behaviors were observed to occur? and, (3) What was the prevalence of articulation and voice disorders?

Historical controversies have surrounded the question of etiologic impact of oral-motor differences on dentofacial growth. While early studies supported the prominence of genetic factors in craniofacial development (Goldstein, 1953; Lundstrom, 1955), recent animal studies in which negative environmental factors have been induced (e.g., forced mouth breathing due to nasal occlusion) indicate that craniofacial deviations may specifically result from altered environments (Tomer & Harvold, 1982; Vargervik, Miller, Chierici, Harvold, & Tomer, 1984). Similar findings in chronic mouth breathing children have also been obtained (Rubin, 1986; Miller, Vargervik, & Chierici, 1982). A study of twenty-four middle-aged subjects by Hanson and Andrianopoulos (1987) indicated a strong relationship between the existence of malocclusion and the occurrence of tongue thrust (a behavior examined in the current study) but failed to find a relationship between tongue thrust and dental/periodontal health. A comprehensive review of the literature in regard to the definition and reported incidence of tongue thrust and its relationship to post-orthodontic relapse is reported by Andrianopoulos and Hanson (1987).

Muscle risk factors identified as having adverse effects

on oral facial development, and which may be influenced by changes in behavior or structural modification, include: An open-mouth resting posture; a respiratory pattern of mouth breathing; low forward tongue carriage; forward articulatory tongue placement (linguadental/lingualalveolar); abnormal lip, tongue and facial muscle movements during swallowing; reduced upper lip length and mobility; overcontraction of the mentalis muscle; restriction of the labial or lingual frenums; and the presence of negative oral habits such as nailbiting, thumb or finger-sucking, lip biting, and lip licking (Mason & Profitt, 1974; Vig & Cohen, 1979; Garliner, 1980; Andrianopoulos & Hanson, 1987). These behaviors served as a basis for the construction of a checklist (see Appendix) for assessing the occurrence of muscle risk factors and negative oral habits in the subject group. This checklist was used during records appointments during the calendar year prior to the collection and analysis of the summary data reported in this study.

The American Speech-Language-Hearing Association (ASHA) has systematically studied the incidence of speech and language problems in the normal population and levels of occurrence for various age-groups have been identified (Leske, 1981). The ASHA study reported a most-often quoted incidence of communicative disorders of 5% in the general population when factors such as school enrollment, age, etc., are eliminated. A speech screening was provided at the records appointment to each subject in the current study in order to determine the incidence of articulation and voice disorders in the sample in comparison to the ASHA findings.

METHODOLOGY Procedures

Two hundred twenty-nine patients who reported to an orthodontist for complete records appointments during a one-year period served as subjects for this study. A certified speech/language pathologist with over 20 years experience in a variety of clinical settings completed an orofacial checklist and a speech screening for each patient at the initial visit. Disorders in speech and voice were traditionally defined and determined based on developmental norms for actual articulatory deviations (Templin & Darley, 1969) and the Wilson Voice Profile (Wilson & Rice, 1977). Data were compiled from the checklist in regard to the presence or absence of anatomical, physiological or behavioral differences which have been related to dentofacial development. Additionally,

articulation and voice disorders or a combination of the two were counted to determine their occurrence in this population. Fluency and language problems were noted during the initial assessment but were not included in this study since they would appear to be unrelated to oral muscle factors. The retrospective compiling of the data was used in order to eliminate examiner bias in reporting incidences of behaviors or muscle factors.

Subject Profile

Sex:	98 males (42.8%), 131 females (57.2%)
Age:	Pediatric (6 & below) = 8 (3.5%)
	Preadolescent (7-11) = 111 (48.5%)
	Adolescent (12-18) = 82 (35.8%)
	Adult (19 & above) = 28 (12.2%)
Dental Classification:	
	Angle's Class I = 43 (18.8%)
	II = 134 (58.5%)
	III = 52 (22.7%)
Management Phase:	
	1. No previous orthodontic management = 207 (90.4%)
	2. Previous pre-adolescent management = 22 (9.6%)

TABLE 1
Muscle Risk Factors Occurrence

Risk Factor	% of occurrence
Tongue-thrust on swallow	73.3
Low, forward tongue rest posture	71.6
Open-mouth posture	68.6
Reported history of mouthbreathing	63.3
Upper lip restriction	54.5
Lip movement during swallow	50.2
Lingua-dental/lingua-alveolar articulation without acoustic difference from normal production	48.0
Frenum restriction	26.2
Mentalis wrinkle	24.8

RESULTS

A significant number of patients exhibited the risk factors noted in Table 1.

The negative oral habits which occurred are reported in Table 2. Specific habits were reported by the parent, patient or were observed during the records session.

Speech differences occurred in 11.8% of the subjects, a significantly higher incidence than the 5% of the general population reported in the ASHA study (Leske, 1981). The differences measured by the speech screening and included in the current study by percentage and type of occurrence were: Articulation disorders, 81.5%; voice disorders, 7.4%; and, both voice and articulation problems, 11.1%.

CONCLUSIONS

This study suggests that oral muscle factors, negative oral habits, and articulation and voice disorders are found at high incidences in orthodontic patients. A component of the assessment procedure for orthodontic patients should include an evaluation of those factors and behaviors which influence the oral environment into which orthodontic appliances will be inserted. The implications for multidisciplinary treatment programs and retention of orthodontic correction should continue to be the focus of further investigation.

TABLE 2
Negative Oral Habits

Habit Exhibited	% of Sample
Nailbiting	27.0
Thumb/finger sucking	3.0
Lip biting	1.0
Lip licking	2.0
Multiple habits	9.6
Other habits (blanket/pencil sucking, etc.)	3.0
Total exhibiting negative habits	45.6

APPENDIX**ORAL FACIAL EXAMINATION FORM**
For Orthodontic At-Risk Patients

NAME _____ DATE OF BIRTH _____ Date _____
 PARENTS _____ AGE _____
 ADDRESS _____ GRADE _____
 PHONE _____ SCHOOL _____
 REFERRED TO _____

LIP STRUCTURE AND MOBILITY

	upper lip	lower lip	
length _____	_____	_____	
thickness _____	_____	_____	
size _____	_____	_____	
balance _____	_____	_____	mentalis wrinkle
mobility _____	_____	_____	sublabial furrow
tone _____	_____	_____	
symmetry at rest _____	_____	_____	
symmetry of movement _____	_____	_____	

LIP POSTURE

	upper lip	lower lip
at rest _____	_____	_____
(word) _____ (sentence) _____	_____	_____
during speech _____	_____	_____
during swallowing _____	_____	_____
bilabial contact _____	_____	_____
at rest _____	_____	_____
bilabial symmetry _____	_____	_____
of movement _____	_____	_____
(grin & pucker) _____	_____	_____
lip line _____	_____	_____

TONGUE POSITION FOR SWALLOWING

observed _____
 reported _____

TONGUE POSITION AT REST

observed _____
 reported _____

TONGUE POSITION/PLACEMENT DURING SPEECH (ARTICULATION)

t _____	l _____	sh _____
d _____	s _____	ch _____
n _____	z _____	"j" _____
tongue movement patterns (puhtuhkuh) _____		lateral _____

PALATAL WIDTH _____

FRENUM ATTACHMENT

lingual: _____
 labial: inferior _____ superior _____

MUSICAL INSTRUMENT (what) _____ (how long) _____

APPENDIX (Continued)

RESPIRATORY HISTORY (Parent/Patient Report)

Allergies _____ Asthma _____ Sinus _____ Frequent Colds _____
 Other _____ Comments _____

ESTIMATE OF NASAL AIRWAY

Adequate: yes _____ no _____
 Potential blockage: adenoid _____ deviated septum _____ allergies _____

MOUTHBREATHING (Parent/Patient Report)

observed: during day _____ sleeping _____
 history _____
 gingiva _____ chapped lip _____

TONSILS AND ADENOIDS

tonsils intact _____ adenoids intact _____
 tonsils removed _____ adenoids removed _____

ORAL HABITS (frequency, history, posture)

thumb/finger sucking _____ pacifier _____ other _____
 lip biting/sucking _____ clenching _____
 nail biting _____ pencils _____
 comments: _____

CRANIAL FACIAL STRUCTURAL DIFFERENCES

OTHER _____

SPEECH, LANGUAGE, HEARING (note cosmetic differences)

MOTIVATION ASPECTS _____

ORTHODONTIC/DENTAL ASPECTS _____

SUMMARY OF CONCERNS _____

RECOMMENDATIONS

ok _____
 review _____
 re-eval _____ (date) _____
 TCE _____
 TX1 _____
 TX2 _____
 TX3 _____

REFERRAL EVALUATION NEEDED

airway ENT _____
 oral surgeon (frenum) _____
 plastic surgeon (lip) _____
 Sp/L _____
 Other _____

INTERVENTION TARGETS/GOALS

(check appropriate items)

_____ mouth breathing
 _____ mouth posture
 _____ lip approximation
 _____ lip length and mobility
 _____ lip symmetry
 _____ lingual-alveolar postures
 at rest _____ speech _____ swallow _____
 _____ reduce oral habits
 _____ parents monitor night mouth breathing

FINAL REVIEW

of TX sessions _____
 end result _____

Examiner _____

REFERENCES

- Andrianopoulos, M.V. & Hanson, M.L. (1987). Tongue-thrust and the stability of overjet correction. *Angle Orthodontist*, 57(2):121-135.
- Garliner, D. (1980). The modern myofunctional therapeutic concept. *International Journal of Orthodontics*, 18:21-23.
- Goldstein, A. (1953). The dominance of the morphological pattern: Implications for treatment. *The Angle Orthodontist*, 23:187-195.
- Hanson, M.L. & Andrianopoulos, M.V. (1987). Tongue thrust, occlusion and dental health in middle-age subjects: A pilot study. *The International Journal of Orofacial Myology*, 13:3-9.
- Leske, C. (1981). Prevalence estimates of communicative disorders in the U.S.: Speech disorders. *Asha*, 23:217-225.
- Lundstrom, A. (1955). The significance of genetic and non-genetic factors in the profile of the facial skeleton. *American Journal of Orthodontics*, 41:819-826.
- Mason, R.M. & Proffitt, W.R. (1974). The tongue thrust controversy: Background and recommendations. *Journal of Speech and Hearing Disorders*, 39:115-132.
- Miller, A.J., Vargervik, K., & Chierici, G. (1982). Experimentally induced neuromuscular changes during and after nasal airway obstruction. *American Journal of Orthodontics*, 81:99-107.
- Rubin, R.M. (1986). The effects of nasal airway obstruction on facial growth. Presented at the Upper Airway Compromise Dentofacial Development Symposium, Virginia Beach, VA.
- Templin, M.C. & Darley, F.L. (1969). *The Templin-Darley tests of articulation*, 2nd Edition. Iowa City: The University of Iowa Press.
- Tomer, B.S. & Harvold, E.P. (1982). Primate experiments on mandibular growth direction. *American Journal of Orthodontics*, 82:114-119.
- Vargervik, K., Miller, A.J.K., Chierici, G., Harvold, E., & Tomer, B.S. (1984). Morphologic response to changes in neuromuscular patterns experimentally induced by altered modes of respiration. *American Journal of Orthodontics*, 85:115-124.
- Vig, P.S. & Cohen, A.M. (1979). Vertical growth of the lips: A serial cephalometric study. *American Journal of Orthodontics*, 75:405-415.
- Wilson, F.B. & Rice, M. (1977). *A programmed approach to voice therapy*. Hingham, MA: Teaching Resources.