

## INTRODUCTION

### Abstract

According to the Office of Disease Prevention and Health Promotion (2010), at least 1 in 6 Americans currently has a communication impairment or disorders. Articulation disorders, also known as speech sound disorders, are among the many areas assessed and treated by Speech-Language Pathologists. Speech sound disorders vary in severity and can be due to motor-based disorders, structurally based disorders and/or conditions, syndrome/condition-related disorders, and sensory-based conditions (ASHA, 2004). Structurally based speech sound disorders and conditions may require treatment from both Speech-Language Pathologists and Orthodontists.

Orthodontists are specialists in preventing and treating dental and facial irregularities such as teeth and jaw alignment. Teeth and jaw alignment assessments are usually the orthodontists first contact experience with clients. It is during this process that orthodontists may informally judge their clients' speech as normal and/or abnormal.

The purpose of this study is to investigate if there is a relationship between speech and orthodontic concerns. This investigation explored the following:

- 1) the incidence and prevalence of individuals with orthodontic disorders and concomitant speech sound disorders;
- 2) the types of malocclusions that have the most speech sound disorders;
- 3) the benefits of establishing collaborations between the disciplines of speech language pathology and orthodontics. Results from this present study will benefit the assessment and treatment of clients seen by both specialty areas. The results will also be used in training programs.

## METHODS

The study consisted of two main components: 1) an orthodontic evaluation to determine an ortho-dental disorder and 2) a chart review. Both the evaluation and chart review were conducted at the Dental Clinic at Howard University. All of the orthodontic evaluations were conducted by Orthodontic Residents.

A randomized chart review was conducted for 200 clients seen between the years of 2013-2016. The chart review conducted consisted of the following notations: Age, Gender, Ethnicity, Malocclusion (Class I, II, III/Mutilated), Habits, Normal/Abnormal Speech, Speech Therapy recommendation, and Bite Pattern.

The chart reviews were completed by 3 orthodontic residents and 2 speech pathology graduate students. Of the total 200 charts that were reviewed, there were 127 females and 73 males. The age of the patients ranged from 8- 65 with a mean of 26.61. 47.5% of the subjects were identified as African Americans, 18% were identified as Hispanics, 9% were Caucasians, and 22% were identified as other. There was no exclusionary criteria in determining the records reviewed.

## HOWARD UNIVERSITY ORTHODONTIC INTAKE FORM

### Malocclusion (Class I, II, III/Mutilated)

According to the U.S National Library of Medicine, an occlusion refers to the alignment of teeth by the way the upper and lower teeth fit together (bite). Malocclusions occur when a patient's occlusion differs from the normal alignment. There are three classes of malocclusions: Class I, II, III/Mutilated.

**Class I:** The upper and lower molars are properly positioned correctly, however the upper teeth slightly overlap the lower teeth (NIH, 2014).

**Class II:** This type of malocclusion is referred to as retrognathism and occurs when the upper jaw and teeth severely overlap the bottom jaw and teeth (NIH, 2014).

**Class III/Mutilated:** This type of malocclusion is referred to as prognathism which occurs when the lower jaw protrudes forward, causing the lower jaw and teeth to overlap the upper jaw and teeth (NIH, 2014).



Image 1: Class I,II, & III malocclusion

### Habits

Habits are defined as fixed or constant practice established by frequent repetition. More so, habits are defined as symptoms that lasted beyond the age of 3 or 4 which could potentially produce harmful effects on the development of maxillofacial structures (Rahman, 2013). For the purpose of the study, the following habits were noted:  
 -Tongue sucking -Mouth breathing  
 -Tongue thrust -Finger sucking  
 -Biting of the nails, lips, or cheeks -Chewing objects  
 --Bruxism, and clenching

### Bite Patterns Noted (Open Bite, Anterior/Posterior Cross bite)

**Open Bite** is defined as an open vertical dimension between the incisal edge of the maxillary and mandibular anterior teeth (Ngan & Fields, 1996).

**Anterior/Posterior Cross bite** is a term used to describe an irregular labiolingual relationship between one or more maxillary and mandibular incisor teeth (Bayrak & Tunc, 2008).



Open bite

Anterior Cross Bite

Posterior Cross Bite

### Normal/Abnormal Speech

Speech was informally judged as normal or abnormal during conversational speech. Additionally, the Orthodontic Residents noted speech sound errors observed based on their personal judgement.

### Speech Therapy Recommendation

The speech therapy recommendations were determined by the Orthodontic Residents who sought speech services based on abnormal speech production noted during ortho dental evaluations.

## Statistical Analysis

Pearson Chi-Square test were conducted to analyze the data. Spearman Rho correlation coefficient were calculated to determine the relationship between different variables.

## RESULTS

### Spearman's Rho Significant Correlation Values

Orthodontic Disorders	Open Bite	Crossbite Anterior	Crossbite Posterior
Malocclusion Type (1234)	P= .000	P=.006	P=.000
Crossbite Anterior	-----	-----	P=.000

### Spearman's Rho Trend Values

Orthodontic Disorders	Crossbite Anterior	Open Bite	Age
Tongue Thrust	P=0.10	-----	-----
Articulation Errors	-----	P=0.12	-----
Open Bite	-----	-----	P=0.06

11.5% of the individuals' charts reviewed were identified as having concomitant speech and orthodontic concerns.

43.4% of the participants were noted as having Type 1 Malocclusion, which was the most prevalent malocclusion observed.

The results indicated a trend between types of malocclusions and articulation errors (p=.014). The likelihood ratio yielded (p=.006) that there is a high probability that individuals with malocclusions will have concomitant articulation errors.

Significant correlations were found between the following:

- A. Types of Malocclusions and Open Bite (p=.000)
- B. Types of Malocclusions and Crossbite Anterior (p=.006)
- C. Types of Malocclusion and Crossbite Posterior (p=.000)
- D. Crossbite Anterior and Crossbite Posterior (p=.000)

The following trends were noted between variables:

- A. Tongue Thrust and Crossbite Anterior (p=0.10)
- B. Articulation Errors and Open Bite (p=0.12).
- C. Open Bite and Age (p=0.06).

\*\*\*While these trends fell slightly above the statistically significant marker, these findings may have implications for further consideration.

## CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

The purpose of this study was to investigate the relationship between speech and orthodontic concerns. Results of the research indicates that there is a trend between types of malocclusions and speech sound errors. Based on the results of the present study, it can be concluded that there is a significant need for Speech-Language Pathologists and Orthodontics to work collaboratively in order to establish both Interprofessional Practice (IPP) and Interprofessional Education (IPE) for both client care and student education. There is a significant need for interdisciplinary work in the areas of assessment and treatment in training programs that can potentially shape the future best practice for client care.

Further research is needed in order to establish the various speech sounds that may be concomitant with orthodontic disorders. Additionally, the need for future research is to determine if client outcomes differ when IPP screenings are implemented.

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