

Wind Instruments and their Influence on Oral Cavity: Systematic Review

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ABSTRACT

Playing wind instruments is causing additional forces that influence dentition and may create malocclusions or escalate existing anomalies in the oral cavity. There are four types of wind instruments grouped according to the structure of the mouthpiece/reed. Each group of wind instruments may influence the health of oral cavity, i.e. change occlusal conditions, irritate oral mucosa and cause temporomandibular joint (TMJ) disorders. Under certain conditions a correctly chosen instrument may support orthodontic treatment, causing a faster correction of the existing disorder.

Aim: The aim of this paper was to assess the influence of playing wind instruments on the oral cavity including the positive effect on the reduction of existing dental disorders. Special attention was paid to changes in teeth alignment measured by overbite and overjet.

Materials and methods: A systematic review was conducted after browsing Medline and Embase data bases.

Results: Seventeen studies proved eligible under the selection criteria. Selected papers included two randomized trials: review articles and case reports.

Summary: Wind instruments may favor the development of malocclusions, changes on oral mucosa and hamper the usage of prostheses. Playing wind instruments may help during orthodontic treatment but there are still no scientific evidence supporting their possible positive effects.

Keywords: Oral cavity, Malocclusions, Wind instruments, Overbite, Overjet.

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INTRODUCTION

Musical instruments may cause different changes in dentition, oral cavity mucosa, muscles and temporomandibular

joint (TMJ). The range and degree of those changes depends mainly on the intensity of play and the type of wind instrument.

Wind instruments are typically grouped into two families:

- Brass instruments, like: trumpet, trombone, French horn and tube.
- Woodwind instruments, like: clarinet, saxophone, oboe, bassoon and flute.

Strayer grouped wind instruments based on the shape of the mouthpiece/reed into four classes:

- *Class A:* Instruments with the mouthpiece shaped like a ‘cup’—trumpet, cornet, horn, trombone, tube, euphonium, French horn.
- *Class B:* Instruments with a single wooden reed: clarinet, saxophone.
- *Class C:* Instruments with a double wooden reed: oboe, bassoon.
- *Class D:* Instruments with a mouthpiece in a shape of a single opening: flute.¹

To produce a sound one has to tightly embrace the mouthpiece/reed with the lips so as to prevent the air from getting outside the oral cavity and then introduce the air stream into the instrument with a blast. The term blast means such lips, tongue, muscle and air formation that enables the production of sound with adequate pitch and acoustic color. The muscles surrounding the rima oris seal the connection between the lips and the mouthpiece/reed. They control the volume of the air stream. Orbicularis oris muscle plays a critical role and fills the lips. Other muscles that play a part in the production of sound include: the buccinator muscle and risorius. The tongue, owing to the contractions of inner and outer muscles controls the air flow and participates in the articulation of sounds. The oral cavity serves as a tunnel through which air from the lungs is transported to the instrument. The teeth, maxilla and the mandible are a framework for the lips, tongue and muscles.²

Correct occlusion enables the best ease of playing a wind instrument. In cases of malocclusion and dental disorders, such as incisor protrusion or crowding, the way of putting lips or tongue against the mouthpiece/reed will be individual. The musician will search for the most comfortable lip arrangement that does not cause any pain or discomfort.³

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The position of teeth is influenced by existing forces and pressures. Harmony between the forces acting from the inside and outside is crucial for a stable teeth position. Playing a wind instrument causes additional pressure applied on teeth and soft tissues, that may change their position in the dental arch and cause malocclusions or enhance existing disorders in the oral cavity.² During exercises, pressure acting on dentition reaches 500 gm.⁴ In comparison forces used during orthodontic treatment are approximately 100 gm.⁵

In some situations, a musical instrument may help in correcting existing dental disorders.⁴ Strayer states that playing a wind instrument might have a positive influence on occlusion under condition, that an instrument is chosen based on the existing type of malocclusion.

MATERIALS AND METHODS

The literature review was conducted using Medline and Embase data base.

The following keywords were used to search the data bases: malocclusion, wind instruments, oral cavity, periodontitis, temporomandibular joint disorders. The inclusion criteria were based on the content related assessment of the article and its publishing date. The search of the data bases resulted in 23 papers published in English between year 1965 and 2013.

DISCUSSION

After analyzing the available articles and considering aforementioned criteria 17 studies were included in this review. Selected papers included mainly review articles, two randomized trials and one case report. All articles found were published in English. The majority of the articles were published in the latter half of the 20th century. Few available randomized trials indicate the need for further studies that may result in clinically useful conclusions.

Orthodontic Implications of Playing Wind Instruments

Strayer divided wind instruments into four classes depending on the shape of the mouthpiece/reed.¹ Based on the shape and size of the mouthpiece/reed, the way of lips and tongue arrangement during wind instrument playing changes.

- Class A instruments (according to Strayer) have a metal mouthpiece shaped like a 'cup' that is positioned close to both lips. Half of upper and lower lip adhere to the mouthpiece. In cases of bigger instruments like tube or trombone the majority of upper lip touches the mouthpiece.² Lips, anterior teeth and mandible are influenced by force acting lingually.

Instruments in this group have a positive impact on the treatment of maxillary anterior teeth protrusion. Forces acting on the lips and the buccal aspects of maxillary incisors are higher than forces generated during swallowing, whistling and finger suction. This explains the positive effect of instruments in this class on protrusion of the maxillary incisors correction and reducing the overjet by 0.36 and 0.75 mm after 1 and 2 years of playing an instrument respectively.^{4,6} Class A instruments are indicated for supporting the treatment of class II division 1 malocclusions.¹ To produce a sound, a musician has to protrude his mandible so as to tightly embrace the mouthpiece with two lips, by doing this he or she induces anterior mandibular growth.² Advanced class II division 1 malocclusions may impede the correct lip arrangement toward the mouthpiece, making the production of sounds impossible.^{7,8} Outer forces acting on lips during brass instruments playing improve the tension of the orbicularis oris and mentalis muscle. This type of miotherapy has a special application when treating muscular hypotonia.⁹ Negative effects of playing brass instruments include increased anterior teeth mobility⁴⁻⁶ which can lead to teeth loss when playing intensively.² Such consequences are often seen in trumpet and trombone players.¹ Should increased mobility of lower incisors occur it can be treated with a lingual arch.¹⁰ Class II division 2 malocclusion is a contraindication in this group of instruments.

- Class B instruments have a single wooden reed put under a certain angle between the upper and lower incisors. The pressure is applied buccally on the upper incisors. On the lower incisors, the force is vectored lingually. Lower lip covers the incisal edges of the anterior teeth in the mandible, anterior teeth in the maxilla contact the outer surface of the reed.

Instruments in this group have a positive influence on class III malocclusions.^{1,2} In class B instrument players, especially among clarinet players lower anterior teeth retrusion is seen twice as often in comparison with other instruments. Pressure applied on lower anterior teeth causes the reduction of the values of reverse overjet and limits anterior movements of the mandible when playing an instrument.² Class II division 1 malocclusions are an absolute contraindication for playing clarinet/saxophone.^{1,2} Class II malocclusions are most frequently seen in individuals playing instruments with a single reed.¹¹ An increase in overjet of 0.5 mm after a year and 0.42 mm after 2 years of playing an instrument is observed.⁶ The mechanism of developing such a disturbance is similar to a parafunction of finger suction.⁵ The increase in the overjet values is more often caused by lingual position of the lower incisors than

the protrusion of the anterior maxillary teeth. This fact is based on the results of studies conducted by Parker. He evaluated the angle between upper incisors and the hard palate plane. Parker demonstrated that there is a slight difference between that angle values among musicians and the control group. Class II division I malocclusions with increased overjet were observed in both the groups. Based on the observations, we can assume that the incorrect position of the lower anterior teeth—not the incisor protrusion in the maxilla is the cause of increased overjet.^{1,10}

- Class C instruments have a double wooden reed positioned between upper and lower incisors. Incisal edges of the anterior teeth in the maxilla and the mandible are covered by lips. Playing instruments with a double reed like bassoon and oboe is indicated for individuals with open bites. An increase in overbite of 2.5 mm observed after 2 years of intensive exercises^{5,6} has a positive impact on reduction of the vertical gap.² The way a musician holds the reed in the oral cavity causes an increased tension of the orbicularis oris muscle. A bassoon or oboe player tightens the lips to cover the labial aspect of the upper and lower incisors with their incisal edges to produce a sound. This way of sound production will help to eliminate muscle hypotonia and short incompetent lips. Complicated cases of class I malocclusions are a contraindicated in this group of instruments.¹
- Class D instruments have a mouthpiece in a shape of a single opening. The lower lip has to be flanged and adjusted to the curvature of the reed, the upper lip is tense and directed downwards.² Instruments in this class are indicated for individuals with class III malocclusions. The contact of the instrument with mandibular alveolar ridge limits its anterior movements while playing. We also observe a tendency toward overjet values decrease of 0.99 mm after 1 year and 0.95 mm after 2 years of playing an instrument (Table 1).⁶ It can be explained by increased pressure applied by the upper lip on anteriorly positioned maxillary incisors, that causes their retrusion and reduces the overjet. Strayer’s class D instruments are highly recommended for individuals

with orbicularis oris and mentalis muscle hypotonia and in cases with short incompetent upper lip. While playing an instrument, the upper lip is tense and directed downwards to the mouthpiece opening. Such lips arrangement increases the tension of the muscles surrounding rima oris.^{1,2} Playing flute may to a certain degree support the treatment of open bites, because it increases the overbite values by 1.08 mm after one year and 0.91 mm after 2 years of playing an instrument.⁶ Cases of class II malocclusions are a contraindicated in this group of instruments.¹

Dental disorders, such as crowding, rotations, diastemata, hyperdontia, ectopic teeth and partial lack of dentition cause difficulties in playing every instrument and cause pain.² This fact is observed especially for instruments with a single or double reeds like bassoon, clarinet and saxophone. The lips have to cover the vestibular aspects and the incisal edges of the teeth to produce a sound which causes irritations, erosions or even ulcerations of the oral mucosa. This fact deteriorates the comfort of playing and in some cases makes the exercises completely impossible.¹²

Crossbite will hamper adaptation while playing every instrument. The asymmetric arrangement of dental arches and the soft-tissues limits the correct lips, teeth with the mouthpiece/reed contact and the adequate muscle control over the air stream. Lack of dentition causes cheek collapse while wind instrument playing.²

Prosthetic Aspects

We observe difficulties in using fixed and removable prostheses among wind instrument players. Additional pressure applied on the artificial dentition leads to their stabilization and retention loss.¹³ Cracks and crackles, decreased degree of mandibular movements, difficulties in relaxing the facial muscles or teeth grinding were observed among brass instruments players.⁵ Similar signs were detected by Gualtieri in a group of woodwind instruments, such as saxophone and clarinet.

Such disorders are treated with splint therapy, muscular exercises and introducing breaks after every 20 minutes of playing an instrument. The correct neck, head and shoulders position that reduces muscular tension is of utmost importance.⁵

Periodontal Aspects

Recurrent herpes labialis of the lower lip, especially among woodwind instrument players might be associated with constant lip irritation caused by the reed during exercises, which makes the tissue prone to infections.^{5,14} Lesions, such as erosions and ulcerations accompanied by severe pain are

Table 1: Orthodontic aspects based on wind instrument class

<i>Instrument class</i>	<i>Orthodontic aspects</i>
A	Overjet reduction, especially in cases of angle class II malocclusions, a tendency to overbite decrease
B	Overjet increase, a tendency to overbite decrease
C	A tendency to overbite reduction, overbite increase
D	Overjet reduction, overbite increase



a consequence of constant and repeating contact between the incisal edges of the upper and lower anterior teeth and the lip mucosa. However, such contact is crucial for holding the reed/mouthpiece in the oral cavity. Thin, dry and tense lips are frequently detected among trumpet and bassoon players, such lesions are caused by contacting the metal mouthpiece with soft-tissues of the oral cavity.^{1,5,13} We often observe cracks on the vermilion zone surface, such lesions are described as Satchmo's syndrome and occur mainly among trumpet players.^{15,16}

SUMMARY

Musical instruments may support malocclusions treatment. There are no studies confirming strictly positive effect of given instrument group on the treatment of malocclusions.⁶ The choice of the instrument in terms of the treatment of a specific malocclusion is based on studies concerning overjet and overbite values measurements among musicians. Dental professionals should be aware of the consequences of playing a certain instrument on the patient's dentition. Such knowledge will help to adjust an instrument that does not increase patient's discomfort, acts prophylactically or even helps in its treatment.¹⁷

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