Diagnosis of temporomandibular joint disorders in wind instrument players

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ABSTRACT
Introduction: Playing certain kinds of musical instruments may cause disturbances around the oral cavity. Blowing activity in wind players involves contractions of the muscles around the mouth. Continuous or repetitive muscle contraction can cause muscle fatigue that triggers the onset of symptoms of temporomandibular joint disorders (TMD). The aim of this study was to determine the description of diagnosis of TMD in wind players. **Method**: The research was conducted to 30 brass instrument players at *Gema Wibawa Mukti* Marching Band Community (22 boys, 8 girls) aged 13-27 who had been actively playing wind instruments in the last 6 months. The research method used was descriptive. Examination and diagnosis were based on physical examination category and the algorithm of DC-TMD Axis I revision of 2014. **Results**: The results showed that for 30 samples of wind players, the number of diagnose of Group Ie (arthralgia) was 4 players, Group IIa (disc displacement with reduction) was 8 players, and Group III (degenerative joint disease) was 4 players. **Conclusion**: The conclusion of this study was 43.33% of wind players at *Gema Wibawa Mukti* MBC suffered from temporomandibular joint disorders, in which the highest diagnosis was disc displacement with reduction, followed by arthralgia and degenerative joint disease.
Keywords: wind instrument, brass instruments, temporomandibular joint disorders, DC-TMD

INTRODUCTION

Playing musical instrument was a hobby for some people because it can give pleasure to the people who play it. Some people also make this activity as a profession. The habit of playing certain musical instrument for some people can cause problems later on.[1] An instrument that can cause abnormalities around mouth cavity is a wind instrument.[2]

Wind instruments are musical instruments played by blowing. One of the basic techniques in playing this instrument is embouchure which is how to put the position of the lips and the teeth on the tool that is called the mouthpiece.[1] This activity involves contracting the muscles around the oral cavity. Muscle contraction as a consequential continuous/repetitive activity can be an initiating factor to trigger an onset of symptoms of temporomandibular joint disorders (TMD).[3]

One of the etiological factors of TMD is trauma. There are two types of trauma, macrotrauma and microtrauma. Macrotrauma is the force that driving directly to TMJ that can cause changes in the structure. Microtrauma is trauma caused by a small force that is continuously applied to the joint.[4] Similar happens to players of wind instruments, their muscle contractions consequential continuously can cause microtrauma which may cause disorders of the TMJ.

According to the research in Japan to 210 students of junior high school following the music club, it is known that the prevalence of TMD in children who play wind instruments is greater than in children who not play; the prevalence is as much as 34.8%.[5] Other studies reveal that the players of wind instruments had a high incidence in disease progression of TMD, indicated by showing almost 100% morbidity related to the parafunction habit and periauricular muscle pain found in male adults who actively play wind instruments.[6]

TMD occurs in the masticatory system which is a very complex system, consisting's of bones, muscles, ligaments, and teeth. The masticatory system in the body is useful for speech, chewing, and ingestion which involve jaw movement.[4] Early diagnose is essential so that therapy and prevention can be done as early as possible, so it does not interfere with the productivity of the wind instrument performers. According to Yeo et al[1], some efforts can be performed by the wind instrument players to overcome the disorders of the TMJ of them by doing physical therapy, relaxation of facial muscles, and reduce frequency of playing. Based on the description above, this study examines the diagnosis of TMD in wind instrument players.

METHODS

This type of research was a descriptive study with primary data collection on wind instrument players. The population of this study was player of the wind instrument in the *Gema Wibawa Mukti* MBC in Bandung. The research sample must meet the population criteria: (1) registered as a permanent member of the MBC and actively playing wind

instruments in the last six months; (2) has never received treatment for TMD; (3) not experiencing symptoms similar to those of TMD; (4) not using fixed or removable orthodontic appliances; and (5) not having systemic disorders such as rheumatoid arthritis.[7]

Procedure

Research stages were as follows: (1) submitting research permits and ethical clearance from Ethics Committee of Universitas Padjadjaran; (2) collecting samples of data that meet the population criteria; (3) explanation and distribution of the informed consent form sheet; (3) completing a symptom questionnaire by the study subjects, then a physical examination of the TMD based on DC-TMD Axis I[7]; (4) physical examination includes confirmation of the location of pain and headache, incisal relationship, mouth opening pattern, vertical opening range of the jaw, lateral and protrusive jaw motion, joint sound when opening and closing the mouth, joint sound during lateral and protrusive motion, examination of pain in muscle and TMJ; (5) collection and analysis of the data results using DC-TMD Axis I algorithms.[7]

RESULTS

The study was conducted on 30 wind instrument players in the *Gema Wibawa Mukti* MBC Bandung consisting of 22 males and 8 females with an average age of 18.37 years, 8 high brass players, 7 middle brass players, and 14 low brass players. The research results are presented in Tables 1 and 2.

DISCUSSION

Based on Table 1, the distribution of TMD in brass instrument players was 43.33%. TMJ problems were more common in brass players because of their protrusive jaw's movement on the process of forming embouchure.[1] Mandibular protrusive movement and constant pressure on the

Table 1 Distribution of diagnosis of TMD in wind instrument players

Variable	**M**	**F**	**Total**
Suffer from TMD	11	2	13
Not suffer from TMD	11	6	17
Total	22	8	30
Based on DC-TMD Axis I			
Grup Ia (myalgia)			0
Grup Ib (local myalgia)			0
Grup Ic (myofacial pain)			0
Grup Id (reffered myofacial pain)			0
Grup Ie (arthralgia)			4
Grup If (headache associated with temporomandibular joint disorders)			0
Grup IIa (disc displacement with reduction)			8
Grup IIb (disc displacement with reduction with intermittent locking)			0
Grup IIc (disc displacement without reduction with limited mouth opening)			0
Grup IId (disc displacement without reduction without limited mouth opening)			0
Grup III (degenerative joint disease)			4
Total			16
Based on the number of diagnoses of TMD and gender			
Number of diagnosis	Male	Female	Total
One	9	1	10
Two	2	1	3
Total	11	2	13
Based on the type of music instrument	**Suffer of TMD**		**Not suffer of TMD**
High brass	8		0
Middle brass	2		6
Low brass	3		11
Total	13		17
Based on duration of playing	**Suffer of TMD**		**Not suffer of TMD**
6 month-1 year	5		10
>1-2 year	4		4
>2-3 year	0		2
>3-4 year	2		1
>4 year	2		0
Total	13		17

Table 2 Distribution of TMD examination

Incisal relationship		**Average value/mm**
Horisontal *overjet*		1.9
Vertical *overbite*		2.7
Opening movement		
Opening movement free of pain		34.63
maximum opening movement without assistant		45.30
maximum opening movement with assistant		48.23
Excursive movement		
Right lateral		5.68
Left lateral		5.73
Protrusive		4.39
Mouth opening pattern	**n**	**%**
Straight	23	76.67
Corrected Deviation	7	23.33
Not corrected Deviation	0	0
Clicking sound	**Right (%)**	**Left (%)**
Open mouth	5 (16.67)	3 (10)
Closed mouth	3 (10)	2 (6.67)
Muscle pain		
Temporalis	8	26.67
Masseter	10	33.33
Lateral pole	4	13.,33
Around lateral pole	3	10
Posterior mandibular	9	30
Submandibular	0	0
Lateral pterygoid	4	13.33
Temporalis Tendon	2	6.67

joints can be one of the factors causing TMD.[8] According to research by Yasuda *et al*.[5] prevalence of TMD in junior high school students who play wind instruments by 34.8%. These differences in numbers can occur because there are differences in the number of samples and the characteristics of the individuals examined.

Various literatures suggested that playing with wind instruments was a factor of initiation, perpetuation, and adverse effects of TMD.[5,9] There was no literature that explicitly stated that playing with a wind instrument directly causes TMD.

Differences in the shape of teeth and faces in wind players can affect the appearance of TMD. In some people who already have an ideal shape, it is not difficult for them to be able to form such an embouchure, unlike what happens to players who do not have this form they have to perform additional compensatory motion in the form of mandibular protrusive motion to be able to form a suitable embouchure formation.[1]

Another factor that may affect the occurrence of TMD in wind player is emotional stress. Emotional stress can lead to psychosocial problems which can lead to bruxism, muscular overuse and joint overload. Based on the results of interviews and objective examinations carried out during the study, at least 5 out of 30 (16.67 %) wind players were known to have parafunctional habits, such as clenching and grinding (bruxism). The existence of *bruxism* or *clenching* can cause microtrauma on the tissue involved (teeth, TMJ, or muscle) that can further cause TMD.[4]

This study cannot conclude that the TMD that arises is purely the result of the habit of playing with a wind instrument. The many factors that can influence TMD cause difficulty in determining which factor is the most important. But among the factors are of course independent from each other to cause symptoms of TMD.

Table 1 shows the distribution of TMD in wind instrument players consisting of arthralgia, disc displacement with reduction, and degenerative joint disease. The most diagnoses of this research is shifting the discus with a reduction of 26.67%, followed by arthralgia and degenerative joint disease of 13.33%. According to Isberg[10], the most common TMD is disc displacement, and in most cases disc dislocations occur in the anteromedial direction. The most common disc displacement is reduction of disc displacement.[11] None of the wind instrument players were diagnosed with myalgia, local myalgia, myofacial pain, referred myofacial pain, headache associated with TMD, disc dis-

placement with reduction with intermittent locking, disc displacement without reduction with limited mouth opening, and disc displacement without reduction without mouth opening limitations.

Wind players who do not have adequate orofacial structures for embossment formation require compensatory movement of the mandible as well as muscles of the neck and head. The compensatory motion that occurs is the protrusive motion of the mandible. In protrusive movement, condyle and disc move forward without down eminence articular (the bone surface is convex which is located on the anterior socket).[12]

The muscles involved in the protrusive motion of the jaw are the medial pterygoid, lateral (inferior) pterygoid, and superficial masseter muscles.[13] When blowing, the mandible moves forward and the protrusive muscles of the jaw contract. Repetitive muscle contraction can cause muscle tension, especially in the lateral pterygoid muscle which is the main muscle in protrusive motion, resulting in muscle hyperactivity. The superior and inferior lateral pterygoid muscles are directly attached to the articular disc and TMJ. In the long term, contraction of the lateral pterygoid muscle can pull on the TMJ and articular disc, causing stretching of the retrodiscal tissue, resulting in a change of the disc position towards the condyle and articular eminence.[11]

In conditions where there is an anterior displacement of the disc, the process of condyles movement when opening the mouth is inhibited. In order to open the mouth wide, the condyle must pass through the back and center of the disc, producing a clicking or popping sound. Upon closing the mouth, the condyle again slides out of the disc so that it is heard as another "click" or "pop" (reciprocal clicking). This condition is called reduction of disc displacement.[4,14]

In the later stages of disc displacement, the condyles can no longer pass through the disk, the condyles are behind the disk all the time, the clicking sounds disappear but the mouth opening becomes limited. This is the stage that most often causes symptoms. This condition causes the jaw to lock, so the patient cannot open his mouth wide. This condition it is referred to as disc displacement without reduction.[4,14]

At the time of disc moving forward, retrodiscal tissue experiencing stretching (elongation) and was piched between two bones (condyles and temporal). This can cause pain because the retrodiscal tissue directly adjacent to the posterior part of the disc is completely supplied by blood vessels and there are many nerve endings.[12]

The largest number of distribution of diagnoses is of two diagnoses. No wind player has more than two diagnoses of TMD. The number of types of disorders suffered depends on the condition of each individual. In this case in the wind player, the shape of the teeth and face can affect the type of disturbance that arises. In addition, everyone has different adaptability. In two different people, when the same force is applied to a certain structure, it can cause different responses. It may or may not cause interference.

Distribution of TMD occurred in the instrument player brass types of high brass (trumpet). Wind instruments classified as high brass are smaller in size compared to middle and low brass, but the resulting tone is higher, requiring more mouth effort. This difference indicates that the higher the resulting tone, the greater the force required to blow. This was in line with the Gotouda *et al*,[12] which stated that the activity of the mastication muscles involved when playing high tone is much greater than the activity of muscle contraction when tuning tone.

According to Yasuda et al,[5] in his study of 82 brass instrument players, the prevalence of TMD in wind player with small mouthpiece size was 31% and in wind player with large mouthpiece size was 12.5%. Small mouthpiece sizes are available in high brass (trumpet) types. Large mouthpiece sizes such as tuba, trombone, baritone are classified into the low brass group. The activity of the masseter, trapezius and sternocleidomastoid muscles in the small mouthpiece is greater than that of the muscle contraction when playing with a large mouthpiece.[5]

Total patients with TMJ are mostly found in the group of brass players who've been playing for 6 months-1 year. There were no disturbances in the blown players who had played for more than 2 years-3 years.

From the results of the incisal relationship examination, it is known that the mean value of overjet was 1.9 mm and overbite was 2.7 mm. The average overjet in wind players are slightly below the normal 2-3 mm overjet value.[15] When blowing on a brass instrument, the mouthpiece is placed on the lips extra orally so that there is pressure on the lips. According to Yeo et al,[1] the average value of the force exerted by brass players was 500 g. This figure was much greater than the optimal force required for tooth movement with orthodontics which is in the range of 35-60 g, so that this force has the potential to cause malocclusion if removed continuously and over a long period of time. The ave-

rage overbite for wind players were still in the normal range of 2-4 mm.[16]

From the results of examining the mouth opening pattern (Table 2) it was found that 76.67% of the wind players had a straight mouth opening pattern. Mandibular deviation when opening the mouth is directly related to impaired TMJ function. Osteoarthritis, dislocation of the disc anteriorly, and unilateral muscle spasm can cause mandibular deviation to the affected side.

Based on the results of the opening movement of the jaw obtained (Table 2) an average range of the maximum incisal opening in wind player were 40-50 mm. Closed locked occurs when the incisal opening ranges in the range of 25-30 mm.[4] In this study, none of the blow players had an incisal opening span of less than 41 mm.

Based on the examination of the jaw excursive movement (Table 2), the mean value of right lateral excursive movement was 5.68 mm and left lateral was 5.73 mm, and protrusive was 4.39 mm. These values were below the normal range for lateral movement of the jaw, which was 7 mm and protrusive was 6 mm.[14] Limitation of jaw excursive movement (lateral and protrusive) can occur in the condition of the disc displacement or fracture of unilateral subcondylaris.[4] This was related to the finding of 26.67% of wind players who experienced disc displacement with reduction in this study.

Based on the results of the joint sound examination, the clicking sound of the wind players when opening the mouth was 16.67% on the right side of the joint and 10% on the left side of the joint. According to Pampel et al,[6] sound clicking on wind players when opening the mouth by 13.5% on the right side of the joint, and 24.3% on the left. This differences occurred due to differences in sample size and sample categories, in Pampel et al,[6] apart from involving brass instrument players, it also involved woodwind instrument players. This study found that the sound of clicking when opening the mouth was 20% and when closing the mouth was 10%. This is in line with the research of Pampel et al,[6] which revealed that the clicking sound of wind musicians was found more when opening than when closing the mouth.

Based on the results of the examination of temporomandibular muscle and joint pain, the location of pain most experienced by brass instrument players was masseter muscle area (33.33%). According to Gotouda et al,[12] with electromyogram (EMG), the muscle activity level of the masseter when playing with the wind instruments is slightly greater than during rest. Maximum voluntary contraction of the masseter muscle brass instrument players with the little size of the mouthpiece was greater compared with musicians who do not play wind instruments.[5] In some of brass instrument players need protrusive movement of mandible as compensation movement in the formation of embouchure. The masseter is one of the muscles involved in the protrusive movement of the mandible.[13]

There was no joint *locking* during the examination. Joints/jaw locking is a common sign found in patients with TMD, namely disc displacement without reduction. This is evidenced by the results of the diagnosis obtained on wind instrument players, that none of the wind instrument players suffer from joint displacement without reduction.

Based on the research conducted, it can be concluded that almost half of the wind instrument players in *Gema Wibawa Mukti* MBC suffered from TMD. Based on DC-TMD Axis I, it was found that the most common diagnosis of joint disorders was disc displacement with reduction, followed by arthralgia and degenerative joint diseases.

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