

## ORIGINAL ARTICLE

# Temporomandibular Disorders in Violinists of Alliance Violin Community Bandung

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## ABSTRACT

**Introduction:** Technique of playing violin requires violinist to adjust the instrument on their left shoulder while the mandible helps holding it. The outcome is continuous mechanical force to area of craniofacial and neck. This force can induce temporomandibular disorders (TMD). The aim of this research was to obtain the description of diagnosis of TMD in violinists of Alliance Violin Community Bandung. **Methods:** This was a descriptive research. The subjects for this research were (n=34) violinists who became the members of Alliance Violin Community Bandung. Purposive sampling was used as sampling technique for this research. The procedure used for this research was referred to Diagnostic Criteria for Temporomandibular Disorders (DC/TMD). **Results:** The result of this research was 30 (16 females and 14 males) violinists with age ranging from 15-30 years old of Alliance Violin Community Bandung were diagnosed with TMD (88.24%). The description of diagnosis of TMD in violinists of Alliance Violin Community Bandung was dominated by disc displacement with reduction with 23 cases (67.65%), arthralgia with 5 cases (14.71%), and myalgia with 4 cases (11.77%). **Conclusion:** TMD were common in violinists of Alliance Violin Community Bandung, thereby we could conclude that violinists had a high risk of suffering from TMD. The method that was used in this study, DC/TMD, provided more detailed diagnosis so the violinists can raise their awareness of TMD to optimize early medical diagnosis and treatment.

**Keywords:** Temporomandibular joint, Temporomandibular disorders, Violinists, Diagnostic criteria for temporomandibular disorders, DC/TMD

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## INTRODUCTION

Violin is one of wooden string music instruments with four strings that can be played using a bow. Generally, violin is a right handed instrument and has been designed only to be used by a right handed person. However, a left handed person can play a specially crafted violin which allows them to hold the bow using their left hand (1). Based on a study that was conducted by Associated Board of the Royal Schools of Music, violin is one of the most popular music instruments in the world (2).

As mentioned before, violins are generally designed for right handed person so the technique of playing violin requires violinists to adjust the instrument on their left clavicle. The technique of playing the violin requires the player to place the instrument parallel to the horizontal plane between the left clavicle (shoulder) and the lower

jaw, but with constant pressure (26). In order to hold the violin in stable position, violinists must tilt their neck and force their mandible on the instrument. The outcome is continuous physical contact and mechanical force to area of craniofacial and neck (3). Continuous mechanical force on craniofacial area and the flexion of shoulder and neck because of holding the violin in a long time can induce contact force within that area, one of them being Temporomandibular Disorders (TMD) (4).

A study on 30 orchestral musicians in Germany showed that violinists were often having pain in the area of shoulder (83%), neck (80%), and Temporomandibular Joint (TMJ) (63%) (5). Similar result can be seen at a study that was conducted on 22 violinists in Symphonic Orchestra of Paraná. The result showed that 18 violinists were having pain on TMJ and 54.54% had a clicking of TMJ (6).

The position and posture of the violin player can be a factor in initiating temporomandibular joint disorders (33), especially joint pain and masticatory muscles (masseter and temporalis muscles due to continuous

clenching when holding instruments (26). In addition, flexion of the shoulders and neck when holding the violin for a long time can cause fatigue of the trapezius and sternocleidomastoid muscles as well as shoulder and neck muscle spasms (4, 26).

Studies concerning the description of TMD diagnosis in violinists have been conducted before but there hasn't been any study based on Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) (7) as the main reference of establishing diagnosis. DC/TMD was issued by The International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. This instrument was the standardized diagnosis of temporomandibular joint disorders that is most commonly used by dental practitioners in examining patients because it has evidence-based and accurate diagnostic criteria. DC/TMD consisted of two parts, namely Axis I and Axis II. Axis I was a clinical examination criteria and Axis II was an assessment of psychosocial status and disability. Because of that reason, the author feels compelled to conduct a research in one of violin community named Alliance Violin Community Bandung.

## MATERIALS AND METHODS

This research was a descriptive study and has been conducted with survey technique using cross-sectional method (8). Population in this research were violinists in one of violin community in Bandung, Indonesia named Alliance Violin Community. Subjects of this study was determined using purposive sampling technique.

The number of subjects in this study was 34 violinist with specific inclusion criteria as follows: Any subject who played violin in the past 6 months and was still playing when the study was conducted; didn't undergo any orthodontic treatment; didn't undergo any TMD treatment; didn't have another disease or disorder with similar symptoms to TMD; and didn't have systemic disease such as rheumatoid arthritis. The exclusion criteria of this study were as follows: Subjects who didn't play violin regularly (at least once a week) or had stopped playing violin in long period of time (more than one year); had played another music instruments that could be a risk factor to induce TMD, such as woodwind or brass instrument. All of violinists who became subjects in this study were right handed violinist.

This study was approved by Ethical Committee for Health Research Padjadjaran University No. 036/UN6.C1.3.2/KEPK/PN/2016. The study protocols were as follows: After permission to conduct research on the Alliance Violin Community was obtained, the research began by listing the members who met the research criteria and were willing to become research subjects. At first, the operator explained the aim and procedures of this study to the research subject. Subjects who agreed to participate in this study were requested to

fill the informed consent. The researchers recorded the identity of the subjects completely, starting from their sociodemographic informations (name, age, sex, address) to their occupational history. The operator did an anamnesis on subjects and wrote down the findings, after that subjects were requested to fill DC/TMD Axis I's Symptoms Questionnaire. The symptoms questionnaire consisted of 14 questions in 5 sections, all of them were in Indonesian language. The subjects were guided by an operator in filling out the questionnaire.

After anamnesis and questionnaire fulfillment, operator performed clinical examination procedure based on DC/TMD Axis I (7). DC/TMD clinical examination procedures were consisted of confirmation of the location of facial pain and headache, examinations of the incisal relationship, the mouth opening pattern, the vertical opening of the jaw, mandibular movements, mandibular joint sound, confirmation of locked joints, palpation of joint pain, palpation of mastication muscle pain, palpation other muscles such as the temporalis tendon, sternocleidomastoid, and trapezius to check for pain, tone, swelling, abnormal size and shape, muscle tension and density.

The results of Symptoms Questionnaire and clinical examination procedure would be inserted into the algorithm of DC/TMD Axis I in order to establish TMD diagnosis. The algorithm of DC/TMD is a chart showing the flow of the diagnosis of TMD. The flow chart was made into a form of schematic diagnostic decision tree in order to summarize the algorithm of diagnostic for TMD.

DC/TMD diagnosis was divided into several groups to establish a TMD diagnosis, namely Group I which was composed of myalgia (Ia); local myalgia (Ib); myofascial pain (Ic); myofascial pain with referral (Id); arthralgia (Ie); or headache attributed to TMD (If). Grup II was composed of disc displacement with reduction (IIa); disc displacement with reduction with intermittent locking (IIb); disc displacement without reduction with limited opening (IIc); or disc displacement without reduction without limited opening (IId); and Grup III which was composed of degenerative joint disease. The findings were recorded in clinical examination form.

## RESULTS

The total amount of subjects in this study were 34 violinists who were registered as members of the Bandung Violin Community Alliance. Based on Table I, majority of the subjects were diagnosed with temporomandibular joint disorders, as many as 30 people (88.24%) out of 34 people. There could be multiple TMD diagnoses found in one subject. The most number of diagnoses of temporomandibular joint disorders in all subjects was one diagnosis (61.77%). Table I showed that most subjects who experience temporomandibular joint

Table I: Distribution of TMD Diagnosis Based on Gender and Age

Characteristic	TMD Diagnosis <sup>1</sup>			f	%
	1	2	3		
<b>Gender</b>					
Female	9	4	3	16	47.06
Male	12	0	2	14	41.18
Total				30	88.24
<b>Age</b>					
15–20 years old	10	2	4	16	47.06
21–25 years old	9	2	1	12	35.29
26–30 years old	2	0	0	2	5.88

<sup>1</sup>The meaning of TMD diagnosis in this table showed how many TMD diagnosis were found in one person. There could be multiple TMD diagnosis in one person, for example how to read this column: there were four females who were diagnosed with two TMD diagnosis, i.e. arthralgia and disc displacement without reduction without limited opening.

disorders were females (47.06%) and subjects aged 15-20 years (47.06%).

Table II showed that the most common diagnosis of TMD was disc displacement with reduction in both females (n=13) and males (n=10). Disc displacement with reduction was also common in subjects with age ranging from 15-20 years old (n=11) and from 21-25 years old (n=11). Table II also showed that the most common TMD diagnosis were diagnosed in subjects who had played violin between 6 months until less than 1.5 year, with the most common TMD diagnosis was disc displacement with reduction (14.12%, n=15), followed

by myalgia (8.82%, n=3), and arthralgia (11.77%, n=4). Subjects who had played violin between 1 until 5 hours in one week were also diagnosed by disc displacement with reduction (32.35%, n=11) as the most common TMD diagnosis. Interestingly, there was a substantial amount of subjects who did stretching before playing violin that diagnosed with disc displacement with reduction (50%; n=17), followed by myalgia (11.77%; n=4) and arthralgia (11.77%, n=4).

Table III showed that the most common diagnosis of TMD in all subjects were disc displacement with reduction (67.65%), arthralgia (14.71%), and myalgia (11.77%). These showed that 88.24% the members of the Alliance Violin Community of Bandung, were diagnosed with TMD.

Table IV showed that the most common location of pain in masticatory muscles is in temporal muscle (14.71%), followed by masseter muscle and posterior mandibular region muscle (8.82% respectively).

**DISCUSSION**

In this study, among the members of the *Alliance Violin Community* of Bandung, there were 30 (88.24%) people whom were diagnosed with TMD. The findings showed that the number of violin players whom were diagnosed with TMD in this study was greater compared

Table II: Diagnosis of TMD Based on Gender, Age, Duration of playing, Frequency of playing, and Habit of Stretching Before Playing Violin

Characteristic	Diagnosis of TMD										
	Ia <sup>1</sup>	Ib <sup>2</sup>	Ic <sup>3</sup>	Id <sup>4</sup>	Ie <sup>5</sup>	If <sup>6</sup>	Ila <sup>7</sup>	Ilb <sup>8</sup>	Ilc <sup>9</sup>	Ild <sup>10</sup>	III <sup>11</sup>
<b>Gender</b>											
Female	4	1	2	0	3	2	13	0	1	0	0
Male	0	2	0	1	2	0	10	1	1	1	1
<b>Age</b>											
15–20 years old	3	2	1	1	4	2	11	1	1	0	0
21–25 years old	1	1	1	0	1	0	11	0	1	1	0
26–30 years old	0	0	0	0	0	0	1	0	0	0	1
<b>Duration of Playing</b>											
6 months–<1.5 year	3	2	1	0	4	2	15	1	1	1	0
1.5–<5.5 years	0	0	0	1	1	0	2	0	0	0	0
5.5–10 years	1	1	1	0	0	0	5	0	1	0	0
>10 years	0	0	0	0	0	0	1	0	0	0	1
<b>Frequency of Playing</b>											
<1 hour/week	1	0	0	0	1	0	1	0	0	0	0
1–<6 hours/week	2	1	0	1	2	0	11	0	2	1	0
6–10 hours/week	1	2	1	0	2	2	8	1	0	0	0
>10 hours/week	0	0	1	0	0	0	3	0	0	0	1
<b>Stretching Before Playing Violin</b>											
Yes	4	2	1	0	4	2	17	1	1	1	1
No	0	1	1	1	1	0	6	0	1	0	0

<sup>1</sup> Myalgia <sup>2</sup> Local Myalgia <sup>3</sup> Myofascial Pain <sup>4</sup> Myofascial Pain with Referral <sup>5</sup> Arthralgia <sup>6</sup> Headache Attributed to TMD <sup>7</sup> Disc Displacement with Reduction <sup>8</sup> Disc Displacement with Reduction with Intermittent Locking <sup>9</sup> Disc Displacement without Reduction with Limited Opening <sup>10</sup> Disc Displacement without Reduction without Limited Opening <sup>11</sup> Degenerative Joint Disease

**Table III: Diagnosis of TMD Based on DC/TMD Axis I**

The Group of Diagnosis of TMD	Right Side	Left Side	Both Sides	f	%
Ia: Myalgia	0	0	4	4	11.77
Ib: Local Myalgia	0	1	2	3	8.82
Ic: Myofascial Pain	1	0	1	2	5.88
Id: Myofascial Pain with Referral	0	1	0	1	2.94
Ie: Arthralgia	1	3	1	5	14.71
If: Headache Attributed to TMD	0	0	2	2	5.88
Ia: Disc Displacement with Reduction	12	3	8	23	67.65
IIb: Disc Displacement with Reduction with Intermittent Locking	0	0	1	1	2.94
IIc: Disc Displacement without Reduction with Limited Opening	1	0	1	2	5.88
IId: Disc Displacement without Reduction without Limited Opening	0	1	0	1	2.94
III: Degenerative Joint Disease	0	1	0	1	2.94

**Table IV: Location of Pain in Masticatory Muscles**

Pain Location	Right	Left	Both	f	%
Temporal	1	1	3	5	14.71
Masseter	0	3	0	3	8.82
Posterior Mandibular Region	1	1	1	3	8.82
Submandibular Region	0	0	0	0	0
Lateral Pterygoid Area	0	0	0	0	0
Temporalis Tendon	0	0	0	0	0

to Steinmetz *et al.*'s study (5) that showed only 63% violinists had temporomandibular joint problems. This may be due to different methods of diagnosis of TMD.

In this study, most of the violinists with TMD were females (47.06%) and there were only 41.18% found in males. This finding is in line with the results of previous studies in the literature, which showed that TMD were common in adults with age of 20–40 years old and in female (9-10). Some studies mentioned that estrogen in female is a contributing factor of the occurrence of TMD. Estrogen can decrease the pain thresholds, so that females will experience more pain than males (11).

Disc displacement with reduction was the most common TMD diagnosis in this study. The clinical manifestations of this condition is TMJ clicking (13). Several previous studies revealed that the disc displacement with reduction posed high prevalence. The articular disc has limitations in distributing pressure on the joint so that the articular disc is most likely to be traumatized due to excessive pressure, one of which causes disc displacement with reduction (27). Stechman *et al.* (6) and Hirsch's *et al.* (3) research also showed that a lot of clicking were experienced by violinists.

Hirsch *et al.* (3) found that clicking were mostly found on the left TMJ in 15 violinists. Clicking in TMJ frequently happens due to both macro and micro trauma (13). In violinists, microtrauma occurs owing to continuous pressures on the jaw from the instrument (3). Apart from

the right TMJ, disc displacement with reduction were also found in both sides (23.53%) of TMJ in this study. This phenomenon can be initiated by clicking on the one side. According to Isberg (14), TMD that occurs at one site may affect the contra lateral site and this can happen in less than two years. The temporomandibular joint is called as ginglymoarthroidal joint, two joints that are connected by the mandible, both of which move together, so that disturbance in one jaw will cause disturbance in the other jaw over time (21).

Crepitation is usually associated with morphological disorders, osteoarthritis, chronic disc displacement without reduction and systemic arthritides (15). Osteoarthritis is a type of degenerative joint disease and can happen due to various causes, such as trauma, hypermobility, and parafunctional activities (16). Inversely proportional to clicking, crepitation was only found in one case (2.94%) in this study i.e. a male with left sided TMJ.

In a case series by Rieder (17), there was a violinist with 20 year of age who suffered from degenerative joint disease, whereas in case series reported by Kovero (18), the same disease also happened in a young boy of 11 year of age who had played violin since he was 5 years old. In these case series, degenerative joint disease occurred on the right TMJ and were experienced by violinists who had played violin since childhood. In this study we only found degenerative joint disease in violinists who had played violin since 3 years old. This disease occurs in violinist because of trauma on the condyle due to repeated pressures on the jaw in a long term period of time (17).

In our study we also found disc displacement without reduction with limited opening (5.88%), disc displacement with reduction with intermittent locking (2.94%), and disc displacement without reduction without limited opening (2.94%). In these cases, the patient usually suffers from joint locking (19). A study

conducted by Steinmentz *et al.* (20) showed that 25 people (18%) out of 139 violinists suffered from joint locking. This condition is often due to trauma that pushes the condyle posteriorly so that articular disc moves to the anterior position (21).

Arthralgia was the second most common TMD in this study, and occurred in as many as 14.71% of cases. Arthralgia is often found on the left TMJ (8.82%). Steinmentz *et al.* (20) revealed that 41 (30%) people out of 139 violinists experienced arthralgia. In a case series reported by Hirsch *et al.* (3), 73% out of 15 violinists were diagnosed with arthralgia, but they mostly occurred on the right TMJ. This study's finding (arthralgia is often found on left TMJ) showed different result compared to previous study's finding (arthralgia is often found on right TMJ (3)). It may be due to the situation of research's site which was different one from another, but the pathophysiology of this phenomenon is still unknown and needs further research. Arthralgia is mostly associated with injury accompanied by inflammation (21) due to micro trauma from the instrument to the jaw (3).

Masticatory muscle pain was the third most common disorders found in this study. The most common masticatory muscles affected were temporal muscle and masseter muscle. Those facts were in line with Zimmers and Gobetti's (22) research where it was revealed that masticatory muscle pain on temporal and masseter muscles were common among violinists.

Myofascial pain and myofascial pain with referral in our study were found frequently in subjects who had been playing violin for a long time, between 1.5–5 years up to 5.5–10 years. This happens because trigger points of myofascial pain is active, usually due to trauma (23, 24). Mechanical injury in long time period (due to playing violin) is most likely to be the one of the perpetual factors that causes the myofascial trigger points become active (25). Therefore, myofascial pain and myofascial pain with referral in this study mostly occurred in violinists who had been playing violin for long time.

Masticatory muscle pain in violinists occurs because of clenching on masticatory muscles and repeated pressures on the jaw by the instrument (26). Steinmentz *et al.* (20) revealed that 48% out of 139 violinists experienced clenching of the jaw. Apart from clenching, repeated pressures on masticatory muscles can also result in pain at the muscles (27).

There were two female violinists (5.88%) in this study who experienced headache attributed to TMD. They were between 15–20 years old and used to practice playing violin for 6-10 hours per week. This finding has never been found in previous studies, most likely due to difference in diagnosis methods. Headache is often found in patients with TMD (28) but it was uncommon

in young people (24). Myofascial pain at the masticatory muscles may become the initiating or perpetual factor for headache (migraine) (29).

This study showed that TMD, mainly disc displacement with reduction, were mostly found in subjects who had played violin for 6 months–1 year with the frequency of playing violin for 1-5 hours each week. There are differences with previous studies. One of the studies which was conducted in America on 15 violinists showed that TMJ pain, clicking, and mandibula deviation were often found in violinists who played violin more than 20 hours per week (3). Gempita *et al.*'s study (30) at 30 musicians including violinists and violists showed that the earliest time TMD could be found were at violinists who only played violin in roughly one year. The findings showed that TMD were more common in violinists who had the most practice frequency rather than violinists who didn't practice diligently.

Study conducted by Bejjani *et al.* (31) showed that excessive practice time in playing musical instruments could cause disturbances in musculoskeletal system. They mentioned that the earlier the person played music instruments, the symptoms of musculoskeletal disorders would take longer time to manifest. Musculoskeletal alterations in musicians have an adaptive nature so the amount of practice time is one of the most important factor. This statement, especially for violinists, needs further research because as far as we knew there hasn't been any research that addressed this topic specifically on violin players.

Interestingly, in this study TMD were common in subjects who did stretching before playing violin (64.71%) rather than in subjects who did not do stretching (23.53%). The most probable cause of this phenomenon is increased overuse syndrome which happens to musicians (31). Bejjani *et al.*, (31) stated that warming up before exercise can cause overuse syndrome. That statement needs further research because many musicians also suggested warming up before doing the exercise. It was very common for violinists to warm up or stretch before starting the exercise. According to Robinson *et al.*, (32), good stretching technique involves a proper warm-up and slow, controlled stretching of specific muscles. Warm-up should consist of two stages: joint rotation and aerobic warmup. TMJ was not involved directly, but it was possible that violinists usually stretch using their neck muscles which could affect masticatory muscles and thereby affected TMJ as well. That findings were different with Robinson *et al.*'s study (32) which showed that stretching could minimize occurrence of injury in violinists. Those differences could be caused by several factors, mainly bad postures when playing violin (4), increased emotional stress (33), false methods in stretching or lack of rest.

Some of the results of this study were in accordance

with previous studies, but some were not. There were several differences, namely difference of location in disc displacement with reduction, degenerative joint disease, and arthralgia. In this study, disc displacement with reduction mainly occurred in right side, degenerative joint disease occurred in left side, and arthralgia mainly occurred in left side. Previous studies showed inverse results. The findings could happen because of difference in number and characteristic of subjects, diagnosis methods, inaccuracy in using measured instruments, and the author's lack of knowledge and experience in performing TMD clinical examination based on DC/TMD Axis I.

## CONCLUSION

The conclusion of this study was that TMD were common in violinists of Alliance Violin Community Bandung, thereby we could conclude that violinists had a high risk of suffering from TMD. The method that was used in this study, DC/TMD, provided more detailed diagnosis so the violinists can raise their awareness of TMD in order to optimize early medical diagnosis and treatment.

## ACKNOWLEDGEMENTS

The authors would like to give sincere gratitude to staff members of Faculty of Dentistry Universitas Padjadjaran who provided technical help and support to our study and members of Alliance Violin Community who had participated as subjects in this study.

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