HRVATSKO ERGONOMIJSKO DRUŠTVO
CROATIAN ERGONOMICS SOCIETY

4th International Conference
ERGONOMICS 2010

30. June - 03. July 2010.
Stubicke Toplice/Zagreb-Croatia

ERGONOMIC ASPECT OF VIOLIN PLAYING

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Abstract…

Violin playing can be hard and player frequently suffers. Chinrest and shoulder rest should facilitate the pain and prevent injuries. It is important that they are properly chosen. The most important in choosing chinrest and shoulder rest are player's anthropometric measurements. Furthermore, it is important to adopt playing technique. Movements during playing are crucial, if player do not move properly that will influence on the music and on player physically health.

1. INTRODUCTION

Violin is called the perfect instrument, and learning violin playing requests many hours of practicing. Hours of practicing leave the consequences of physically health of player. Many players suffer of injures that cannot be cured after many hours have been dedicated to playing violin.

Violin accessorize can facilitate playing violin, but they should be properly selected. Chinrest and shoulder rest should be selected in a way playing is more comfortable and is not making injuries. Furthermore, having accessorize would not improve playing if player does not hold violin properly and does not move properly during playing. Therefore, it is necessary to analyze holding the violin and movements during playing.

The violin is string instrument and it is member of string family together with viola, cello and contrabass. It is the smallest and the highest-pitched in this family. Violin has four strings and violinist produces sound by drawing a bow across one or more strings.

The violin, as we know it today, was constructed in Italy in the 16 centaury. Evan today the best violinmakers are in Italy, and the Italian violins are the most expensive (Stradivari and Guarneri violin). Collectors and players consider violin the most perfect instrument that exist.

Violin is made of wood, and its surface is varnished. It is consisted of body, neck, a bridge, a soundpost, four strings, and various fittings. The fittings are the tuning pegs, tailpiece and tailgut, endpin, possibly one or more fine tuners on the tailpiece. (Figure 1) The voice of a violin depends on its shape, the wood it is made from, the graduation (the thickness profile) of both the top and back, and the varnish that coats its outside surface.

Figure 1: Violin parts

2. ERGONOMIC ANALYSIS

2.1. Holding violin

The violin should rest on the collarbone and be supported by the left hand and by the shoulder [1]. Gentle weight from the head, with a relaxed neck, stabilizes the violin on the collarbone. The violin resting lightly on the collarbone and the jaw resting gently on the chin support establish two stable points of contact with the instrument, point 1 and point 2 (Figure 2).

The violin is also supported, but not held tightly, by the left hand. The neck of the violin should rest gently against the base knuckle of the first finger of the left hand. The side of the thumb should lightly contact the neck of the violin across from the first or second finger. The base of the first finger provides most of the support for the neck. The jaw, collarbone, base of the left index finger, point 3, and the side of the left thumb, point 4, establish four contact points with the violin. (Figure 2)

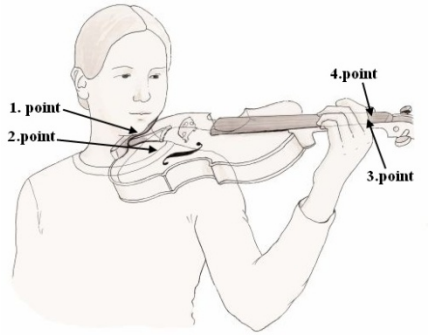


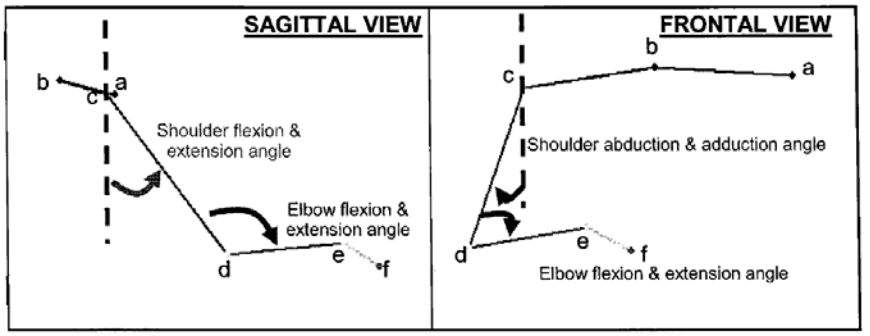
Figure 2: Four contact points important in playing the violin [3]

Using the collarbone, jaw, shoulder support and chin support frees the left hand. Using the collarbone, thumb and base of first finger, frees the head and reliance on the shoulder rest. The violin must always rest on the collarbone, with varying degrees of support from the shoulder rest and the left hand. The roles of the jaw, the shoulder support, chin support and the left hand vary constantly with playing, and without undue reliance on

any one or two of the three contact points the violin can be held comfortably for long periods of playing.

2.2. Movement analysis

Violinist suffer from many injures that occur during the years of playing. Therefore, establishing good technique can avoid some of these problems. Good technique can be learned if violinist establishes correct body movement during playing. There are specific movements, in both hand and arms, which must occur when playing the violin, in order to achieve proper tone, pitch, volume and quality of sound [2]. It is observed that the left arm, holding up the violin, is in nearly static position, and the right arm, used to facilitate the bowing, is more dynamic. In the right arm, there was a greater movement, due to use larger muscle groups, at the shoulder and elbow. Fine movement occurred at the wrist due to use smaller muscle groups. The bowing movement, going from left to right during a down-bow, is not parallel movement with respect to a plane of reference, rather it is angled diagonally downward. This requires shoulder extension and abduction or adduction, and elbow extension during the downward movement (Figure 3).



Legend:
a: Left Acromion Process
b: C7
c: Right Acromion Process
d: Right Lateral Epicondyle
e: Right Ulnar Styloid
f: Right 5th Metacarpophalangeal Joint

Figure 3: Schematic representation of shoulder and elbow extension angle and shoulder abduction and adduction angle [2]

On the up-bow, the opposite movements occur to raise the arm; shoulder flexion and adduction or abduction, and elbow flexion. The left arm remains in the starting position with the fingers flexed in order to depress the strings to achieve the correct accuracy. Movements could be divided into down-bow movement and upper-bow movement [2] (Figure 4).

Down-bow movement requires elbow and shoulder extension with shoulder held in varying degrees of abduction [2]. In down-bow position, elbow angle increases with extension and reaches its maximum (136°), and shoulder extension angle decreases and reaches its minimum (51°). Shoulder abduction angle in down-bow movement is 17°. During this movement, the most involved muscles are deltoid, biceps and triceps brachii.

Elbow flexion and shoulder flexion are required during the up-bow movement. The maximum angle indicates the position of most shoulder flexion at the end of the up-bow movement. The biceps brachii, triceps brachii and deltoid muscles are involved in the up bow movement. The minimum elbow flexion angle during up-bow movement is 68°. The maximum angle playing across the strings for shoulder flexion is 110°. The maximum angle during shoulder abduction is 176°.

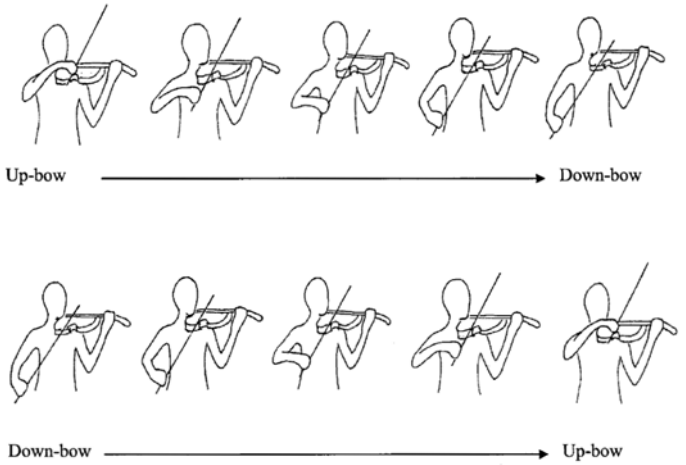


Figure 4: Violin playing position [6]

In addition, differences in elbow and shoulder flexion/extension and shoulder abduction/adduction can occur between strings that violist is playing [2] (Figure 5). Elbow flexion and extension by playing across string is not significantly different as shoulder flexion and extension is. Movements playing across strings are created at the shoulder joint, rather than at the elbow. Shoulder flexion and extension increases across the strings especially on the two upper strings, A and E. This supports the thesis that the shoulder movement differences, particularly flexion and extension, creates the different movement pattern seen on each string. Shoulder abduction angle is the greatest at string G, and the smallest at string E. The right arm needs to be held at different heights to play on various strings, therefore it was expected that the abduction angle would change as the bow moved across strings.

Figure 5: String name with angle needed to play on each string [6]

Gravity has influence on movements during playing violin [2]. When the bow is on the G string, the shoulder is in the most abducted and most flexed position. As progression across the strings occurred, shoulder flexion and abduction maximum angles decreased. This change in arm orientation changes the demands on the muscles moving the shoulder and elbow joints. The muscles have to work harder when contracting to move joints if the movement is occurring against gravity.

(a) (b)

Figure 6: (a) the pelvis and the spine in the centre position, (b) the pelvis and the spine are not in the centre position [3]

During playing violin not only shoulder and elbow moves, the hole player's body moves. Therefore, the violinist's pelvis and spine should be in the centre position, while allowing free movement during playing [3]. Movements start from and end in the centre position. The centre position is the player's basic position to which player always returns. The pelvis and the spine should be in the centre position, and the shoulder blades should be well supported against the rib cage (Figure 6).

During playing, the player's cervical spine rotates to the left and tilts slightly down. Than the chin and shoulder supports enable the correct position of the cervical spine and the head. Chin support should not be to low or poorly fit the shape of chin because it could push the head and neck too far forward or down, and the head tilts excessively to the side. Furthermore, chin support should not hold the violin up to squeeze it against the chin. As well, position of the shoulder blade is important. If the shoulder blade is in a faulty position it tilts forward, causing the collarbone and the acromion (on top of the shoulder joint) to tilt forward, and player slides down.

In the sitting position, the body's centre of mass moves forward so it is more difficult to keep the pelvis in the centre position. When the pelvis tilts back and the lumbar spine straightens, the player is often forced to compensate posture by overextending the

thoracic spine. If the player's centre position is maintained throughout the pelvis, the lumbar spine and the thoracic spine, also the large muscles and the shoulder blade muscles function better, and the hands and fingers are able to move more freely.
When the shoulder blade is not in correct position, the shoulder joint are not able to rotate sufficiently outwards (Figure 7). This affects the muscles and arm is not able to relax and player would not do the right movement.

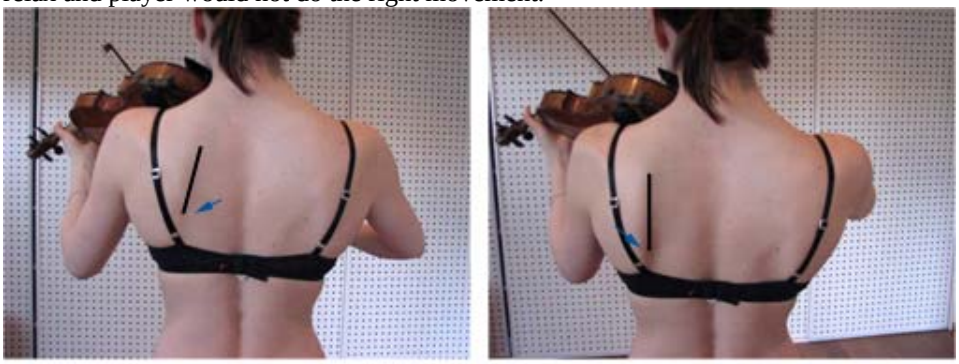


Figure 7: (a) the shoulder blade in correct position, (b) the shoulder blade not in correct position [3]

2.3. Anthopometry

Violin has defined shape and cannot adapt to player. Violin comes in 8 different sizes: 4/4 (also called full size), 3/4, 1/2, 1/4, 1/8, 1/10, 1/16. 4/4 size being the biggest and 1/16 size being the smallest [4].
To measure what size violin best suits player, player need to know the length between neck and the middle of left-hand palm (when hand is fully extended and raised perpendicular to body, just like holding a violin). Sometimes, it is preferred that players use the length from the neck to the wrist for measurement, instead of the neck to mid-palm approach. The violin size determined by the neck/wrist approach would be the size that is more comfortable for players to hold. The violin size determined by the neck/mid-palm approach would be the biggest size player should use. Depending arm length player chooses violin (table 1).

Table 1: Violin size and arm length [4]

Violin size	Arm length [cm]
4/4	58.5
3/4	56
1/2	50.5
1/4	47
1/8	42
1/10	38
1/16	35.5

2.4. Stressed body areas

Violin players are at increased risk for developing repetitive stress injury [5]. Violinists are unique in those injuries on the right and left sides of their body are very different. By the very nature of their instrument, asymmetrical development of the musician's body leads to imbalances in the neck and upper extremity region.

The areas that are indirectly involved in performing include the back, the head and neck, the abdominal muscles and the muscles of respiration (Figure 8). Depending on whether the performer is sitting or standing while playing the lower extremities and the lower back must be considered.

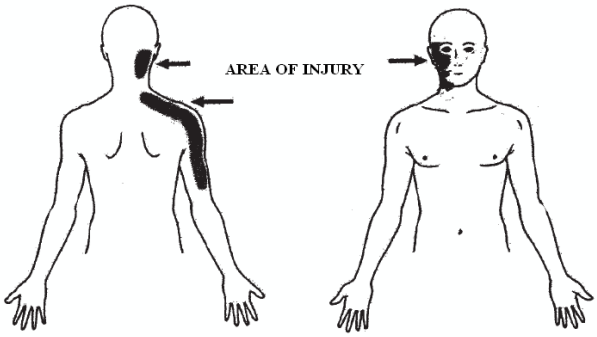


Figure 8: Areas of injury at violinist [6]

The years of playing violin influence developing temporomandibular disorders and carpal tunnel syndrome.

3. DISCUSSION

Although violin with its shape is perfect, it can be very uncomfortable playing hours on it. Therefore, players use chinrest and shoulder rest to facilitate playing violin.

The chin rest protects the top of the violin and adjusts for the length of the player's neck. As the violin strings are held parallel to the floor a shoulder rest is fitted to fill the slight space between the back of the violin and the player's shoulder. Chinrest ensures that the cervical spine and the head can move freely during playing.

A chinrest is shaped piece of wood or plastic attached to the body of violin and it helps position players jaw or chin while playing the instrument. Today there are many types of chinrest, and most of them could be fit in two categories: chinrests that extend over the tailpiece and mount under the button, and chinrests that mount on the side [6]. There is no exact rule which chinrest is better it depends on player. Important is that it does not influence on music that violin produces and that is comfortable for player. The purpose of the chin rest is to protect the varnish, provide a secure and comfortable place for the jaw, and to adjust the distance from the jaw to the collarbone. (Figure 9)

Shoulder rest is made of wood, aluminium, carbon fiber or plastic. Usually, the shoulder rest attaches to the edge of the back of the violin with "feet" padded with rubber tubing or made of soft plastic. The goal of a shoulder rest is to allow a more comfortable attitude while playing by adding height to the shoulder and preventing the instrument from slipping. A shoulder rest generally follows the curve of the shoulder; some shoulder rests are bendable, others are made of sponge-like material, and a few have an extension that hooks further over the shoulder for stability. The shoulder rest should

provide friction so that the violin does not easily slide or rotate off the shoulder. (Figure 10)

Figure 9: Types of chinrest

A shoulder rest eliminates the need to raise the shoulder to bring the instrument closer to the jaw [5]. This, in turn, allows the spine to remain straighter as it goes into the base of the skull, and the muscles in the upper back and shoulder to relax when they need to. Ultimately, the use of a shoulder rest helps ensure that the messaging system of nerves that runs up and down the arms can do its job. In addition, chinrests can be useful ergonomic devices, as they offer greater stability and comfort.

Neck length and shoulder width are not included in determining size of violin. They are included in determining in size, shape and type of chinrests and shoulder rests. Players who have longer neck cannot hold violin properly, string are not parallel to floor. Therefore, players with longer neck should have higher chinrest, respectively. Players, who have shorter neck, if they found properly chinrest, do not need shoulder rest. If player's shoulders are wide, player should use shoulder rest. Player with narrow shoulder can use shoulder rest, but must be careful when choosing, if shoulder rest is too high player could not be enable to perform all movements during playing.

Figure 10: Types of shoulder rest

4. CONCLUSION

With its shape and sound violin is perfect instrument, but not adjustable to player's anthropometry. Players who play many hours a day suffer of many injuries that can decrease their quality of life. Position in which violin is held and moved during playing can seriously stress player's body in way player must quit playing.

Therefore, it is very important for player to adopt technique of movement, right way of holding the violin and corresponding accessorize.

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