

Prevalence of Musculoskeletal Disorder in Wrist and Fingers among Amateur Piano Players in Vellore

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Abstract

Background: Now a days the number of students studying piano in tertiary institution is being increasing. The piano player is similar to athletic activity to play the notes accurately. Posture plays a vital role in piano playing. Musicians are prone to injuries due to the nature of musical practice, inappropriate body postures and potentially harmful playing techniques. Majority of amateur players are prone to injuries, the main objective of the study was to find out the prevalence of musculoskeletal discomfort among piano players in three different wrist styles in piano playing. **Methodology:** A total 150 samples of age 8 to 15 years of both gender from Kingsway music academy. who use to play piano minimum 30 mins with minimum 6 months of learning experience were recruited for the study, initially their level of pain and discomfort in hand and wrist was measured using Cornell hand discomfort questionnaire **Conclusion:** The statistical analysis shows that there is pain in fourth and fifth finger in all wrist position and also weight playing method has significant pain among three wrist position. This also study concludes that correct positioning during piano playing can minimize the playing related musculoskeletal disorder.

Keywords: Amateur piano player, Posture, Playing related musculoskeletal disorder, Wrist style

Introduction

Piano is a classical and fascinating instrument. In 18th century Bartolomeo Cristofori invented first generation of piano. By twentieth century piano was highly developed in its quality both in mechanism and sound. Piano is one of the most common musical instrument learned now a days the number of students who study music in tertiary institution is been increasing

The piano has much heavier mechanical action of the hammers¹. Piano also has the capacity to accommodate difficult and complex music. The

touch of each key weights around 52g for present day acoustic piano. Piano needs a application of greater music effort to stabilize the finger joints, when the upper limb exerts force near between 48.26 to 57.28 kg per minute or 168.9 to 201.4 within minutes to play¹. Piano playing is similar to athletic activity due to high demands in practice and the requirements to play musical notes accurately². Posture plays a vital role in piano, correct balance and posture may achieve tension free playing. Biomechanically piano playing requires certain posture which has to be followed to avoid playing related musculoskeletal disorder.

There are two main kinds of motor skills in common use¹. The traditional playing method which is further classified into high wrist playing method and neutral wrist playing method. Second the weight

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playing method¹.

The first is the traditional playing methodology, while adopting high wrist method player hold their wrist area at higher level than the piano. In neutral wrist position the players hold their wrist at the same level of piano, on parallel the players who adopt weight playing methodology hold their wrist mostly rotated while playing.

Musician are prone to injuries due to the nature of musical practice, inappropriate body posture, potentially harmful techniques. Injuries that occur in musician are usually termed as playing related musculoskeletal disorder. Symptoms of playing related musculoskeletal disorder include pain, numbness, swelling, tingling. The occurrence of playing related musculoskeletal disorder is almost unavoidable when a given motion is highly repetitive combined with the prolonged use of body segments and without a proper understanding of the anatomical limits and motion range of the human body. Playing related musculoskeletal disorders was first recorded since 19th century, Robert and Clara Schuman were the first injured pianist, both of them studied under same teacher Frederic weick³. Generally all level of musician from beginners to professional players are suspected to have playing related musculoskeletal disorder, but most of the players are not aware of the playing related musculoskeletal.

Pianists are among the group at high risk for playing related musculoskeletal disorder. Faulty piano techniques are one such reason for the cause of playing related musculoskeletal disorder. The prevalence of playing related musculoskeletal disorder 23% to 93%². The root of playing related musculoskeletal disorder starts when the student begin to learn piano, now days due to multi students with one teacher results in lack of supervisions for proper use of body posture.

Factors that contribute to the incidence of playing related musculoskeletal disorder are biomechanical inefficiency of posture and massive amount of repetitive and sustained movement of hand wrist

and fingers can cause stress and pain. Playing related musculoskeletal disorder can also occur due to inefficient of motor skills. Generally pianist report playing related musculoskeletal disorder occurring at the wrist due to faulty piano playing methodology. Pianist should pay attention to any degree of pain condition in hands that affects playing because the symptoms might be the first sign of developing playing related musculoskeletal disorder. Some of the playing related musculoskeletal disorder were sever enough to threaten and even end musician career and some players even developed physical handicaps that impact all aspect of musician. The main objective of the study was most common musical instrument learned by children is piano off late. There are different styles in playing piano. Many studies show the prevalence of musculoskeletal pain in pianist, but narrowing down the study to particular region will increase the study scope to one area. It can help in understanding the musculoskeletal discomfort in three styles of wrist position and associated risk factors. So that children who start their passion can be given awareness ergonomically. The study will also promote the awareness of playing related musculoskeletal disorder into the curriculum of piano pedagogical program

Materials and Method

It is a cross sectional study conducted in the year (2019-2020) at Kingsway music academy Vellore, Tamil Nadu, India. Totally 150 participants, both gender of age group 8-15 years were selected, Students who learn piano in tertiary institution for minimum 6 months, parallely who practice 30 mins- 45mins a day were recruited for the study. Professional players, students who underwent any orthopedic surgery in upper limb, Students who learn other instrument along with piano, were excluded for the study. Participants were explained about the procedure and informed consent was obtained. To assess their level of pain Cornell Hand Discomfort Questionnaire was used. The participants were explained about the components in Cornell Hand Discomfort Questionnaire, then they were asked to fill The questionnaire consists of 6

shaded figure to analyze the pain in their fingers and wrist and it includes five items about how often they experience pain and three items about symptomology of pain and three items interference of pain in their daily activities , Higher score represent the greater level of pain in particular region .

Results and Discussion

According to table I out of 150 participants 2.7% were 8 years of age, 6% were 9 years of age ,22% were 10 years of age, 12.7% were 11 years of age, 8.7% were 12 years of age.8.7% were 13 years of age,13% were 14 years of age, 25% were 15 years of age,1 % were 16 years of age.

According to table II 61.3% were male and 38.7 % were female

According to table III total 5 participants reported in high wrist method and the intensity of pain in Area A is 12.3%Area B is 38.7%Area C 32.3% Area D 0.0%Area E 10.3%Area F 6.5%.

According to table IV total 66 participants reported in neutral wrist method and the intensity of pain of Area A 15.5%is Area B is 40.8%Area C 10.5%Area D 2.3%Area E 12.7%Area F 18.1%.

According to table V total 79 participants reported in weight playing method and the intensity of pain in Area A 9.9% Area B 39.9%Area C 11.2%Area D 2.5% Area E 7.3%Area F 29.2%.

According to table VI the intensity of pain in High Wrist 38.1% Neutral Wrist 21.3% and weight playing 58.8%

TABLE I: AGE FREQUENCY

		Frequency	Percentage
Age	8	4	2.7
	9	9	6.0
	10	33	22.0
	11	19	12.7
	12	13	8.7
	13	13	8.7
	14	20	13.3
	15	38	25.3
	16	1	.7

TABLE II: GENDER FREQUENCY

		Frequency	Percentage
Gender	Female	58	38.7
	Male	92	61.3
	Total	150	100.0

TABLE III: PREVALENCE OF PAIN IN HIGH WRIST METHOD

High Wrist	Mean	INTENSITY OF PAIN %
Area A	1.9000	12.3%
Area B	6.0000	38.7%
Area C	5.0000	32.3%
Area D	0.0000	0.0%
Area E	1.6000	10.3%
Area F	1.0000	6.5%

TABLE IV: PREVALENCE OF PAIN IN NEUTRAL WRIST METHOD

Neutral	Mean	INTENSITY OF PAIN %
Area A	2.2955	15.5%
Area B	6.0530	40.8%
Area C	1.5530	10.5%
Area D	0.3409	2.3%
Area E	1.8864	12.7%
Area F	2.6894	18.1%

TABLE V: PREVALENCE OF PAIN IN WEIGHT PLAYING METHOD

Weight Playing	Mean	INTENSITY OF PAIN %
Area A	1.8987	9.9%
Area B	7.6203	39.9%
Area C	2.1329	11.2%
Area D	0.4747	2.5%
Area E	1.3987	7.3%
Area F	5.5759	29.2%

.TABLE VI: PREVALENCE OF PAIN IN THREE WIRST METHOD

Method of Playing	Mean	INTENSITY OF PAIN %
High Wrist	2.5833	38.1%
Neutral	2.4697	21.3%
Weight Playing	3.1835	58.8%

Discussion

The children's in this 20th century era are keen to get involved in and eager to acquire skills in recreational activities such as sports, martial arts, dancing and music. The most of the children's are passionate about their recreational activities, few of them are intending to make their passion as their profession from their young age of the life.

With an objective of finding about the prevalence of musculoskeletal discomfort among the amateur young pianist, 150 subjects were selected between the age group of 8 to 15 years, both the male and female genders,

Out of 150 participants, 5 Participants opted high wrist method, 66 participants opted neutral wrist method and 79 participants opted weight playing method. From the above results analyze that In high wrist method the level of pain is higher in Area B (38.7%) and Area C(32.3%).In neutral wrist method the level of pain is recorded high in Area B (40.8%) and Area A (15.5%) .In weight playing method also reported high intensity of pain in Area B(39.90%) and Area F (29.20%).In comparing all three wrist position the participants reported a specific pain in Area B (4th and 5th finger) which has the maximum intensity of pain. The players who adopted High wrist method opted (38.10%) of pain, the players who opted neutral wrist method reported (21.3. %) of pain and players who opted weight playing method reported (58.80%) of pain which is significantly higher among three wrist method

Across the globe many children's are attracted towards learning the musical instruments and it becoming their passionate recreational activity. The piano an acoustical musical instrument from a French origin is attracted and learned by many children's across the globe. When the keys in the piano is pressed the hammer incorporated in the piano strikes the string and produces the sound of musical note, when the key pressed strongly with the fingers, the velocity of hammer striking the string increase and it produces more sound of the musical note.

The all recreational activities are prone for musculoskeletal injuries, the musculoskeletal injuries among musicians are known as Playing Related Musculoskeletal Disorder's (PRMDs). The PRMDs among pianist are pain, muscle fatigue, tendinitis, tenosynovitis, bursitis, nerve entrapment such as carpal tunnel syndrome, numbness and pins & needles.

The PRMDs are common among experienced pianist and amateur pianist, the amateur young pianist are more prone for the PRMDs. The cause for the PRMDs among the amateur young pianist is due to repetitive motion, sustaining the posture for long period of time, long practice hours, lack of frequent rest breaks, wrong body mechanics.

The pianist commonly assumed three wrist postures while playing piano they are high wrist posture, neutral wrist posture and weight on piano. In the high wrist posture the wrist will be high to the keyboard, in the neutral wrist posture the wrist

will correspond to the level of keyboard, in weight on keyboard the weight of the fingers will be on the keyboard.

The posture of fingers can be flat or rounded and the motion can be horizontal or vertical. The posture of the elbow can either flexed or extended but preferably 30 to 40 degree of flexion will be maintained, the shoulders will be either elevated or depressed while playing piano.

While playing piano, the posture which assumed for long time and the repetitive motion acts as precursor for the PRMDs. The fingers and hand region comes first and more vulnerable for PRMDs, the elbow and shoulder regions comes second and third vulnerable region for PRMDs.

The wrist and hand are commonly affected in amateur young pianist, the extrinsic muscular and neuro-vascular structures for the wrist and the hand originates from the elbow and forearm. The elbow joint and forearm influences the wrist mechanics, in the anatomical position the forearm along with hand will be in a fully supinated position, in the neutral position the forearm will be in mid-pronation position, in the functional position forearm will be in a pronated position, concomitantly wrist will also be pronated, volar surface of the hand will be down, the concomitant wrist motion along with forearm is produced by the ligamentous structures of the wrist.

While playing piano, the forearm will be in functional position, in a fully pronated position, in this position the radius twist along the shaft of ulna with an concomitant arthrokinematic changes in superior and inferior radio-ulnar joints, this arthrokinematical changes will have a effect on the volar & dorsal ligamentous complex of carpals and induces arthrokinematic changes in proximal and distal carpal rows. In this situation when wrist is flexed the proximal row slides dorsally and distal row slides volarly, with some contribution to radial and ulna deviation if added to it, reverse of this occurs in wrist extension. The thumb which is an king of the

hand plays an key role while playing piano, major motion occurs on the 1st carpo-metacarpal joint, 1st metacarpal slides on the trapezium, the proximal and distal joints too contribute for manipulation of the keys in keyboard. The 2nd to 5th Meta Carpal Joints flexes & extends and abducts & adducts, the interphalangeal joints flexes and extends while playing piano.

When the wrist and forearm is not in physiological neutral position, the musculoskeletal and neurovascular structures of the hand which transversing the wrist are prone to injuries. Maintaining the forearm and the wrist in a functional pronated position for a long time and performing a repetitive motion in this position causes pain and lose of grip strength of the hand.

The all three wrist positions which used while playing the piano is the functional position fully pronated position, physiologically it is not a neutral position, the neutral wrist position which mentioned in types of wrist position used in playing the piano is not a true neutral position. When using the wrist and hand for playing piano in these position will affect the normal alignment changes in forearm and wrist osseous structures, the change in the alignment of osseous structures can cause mechanical disadvantageous situation to musculo-tendinous structures and makes it prone for injury. The alignment changes in carpal bones due to the pronated position will interfere with the carpal tunnel and prone to produce carpal tunnel syndrome. The repetitive motions of fingers are prone to cause ishaemia in the intrinsic hand muscle, cause fatigue, pain and myofascial trigger points.

Biomechanically the position which assumed while playing piano by pianist is the functional position, fully pronated position, sustaining this position for long periods of hours or performing repetitive motions is vulnerable to cause PMRDs. In the amateur young piano players and students, there will be more flexibility in muscles and laxity in the joints, the young children's are more prone to get PRMDs with the functional position of the wrist and forearm and the PRMDs as consequence of it is inevitable.

This PRMDs had made few young children's to leave their passionate recreational activity from learning it and continuing

Conclusion

This study concludes that there is a prevalence of specific pain in Fourth and Fifth finger among all three wrist position. This study also concludes that weight playing methodology has significant increase in the level of pain among three wrist position.. The PRMDs among young pianist can be minimized and avoided by appropriate flexibility, strengthening and endurance programs and by guiding them with proper body mechanics, important of rest breaks, proper nourishment and hydration. These measures will make them to continue their passionate recreational activity through out their life.

Limitations

Sample size is less.

Limited age group was included.

Specific geographical area was investigated.

Recommendations

Motion Capture Analysis camera can be used.

Interference with large sample.

Research can be conducted in depth interview with players who experienced injury.

Intervention can be given and analysed .

Conflict of Interest- Nil

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Ethical Clearance- Institutional Ethical Committee

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