

Comparison of Pain, Hand Grip and Pinch Strength Between Physical Therapy and Dental Students

Ahmed Fatih DEMIR^{1*}, Ali OKSUZ¹, Canpolat CELIK¹, Elif KOPARIR¹ and Maide TEKIN¹

¹Student of Physical Therapy and Rehabilitation, Sifa University, Turkey

*Corresponding Author: Ahmed Fatih Demir, Physical Therapy and Rehabilitation Student at Sifa University, Turkey.

Received: May 22, 2015; Published: June 25, 2015

Abstract

Purpose: This study has been planned with the aim of identifying and comparing the level of pain, hand grip and pinch strength between physical therapy and dental students.

Materials and Methods: Thirty-two physical therapy and thirty-two dental students were included in the study. Age, height, weight, body mass index and also dominant hands of subjects were recorded. During the activities and resting the subjects were asked if there was any pain in the upper extremities. If there was any pain they were asked to show that on visual body diagram and to point it on the visual analog scale between 0-10. Hand grip strength was measured by Jamar hand dynamometer device and pinch strength was measured by Pinch gauge.

Results: There was a significant difference that is dental students had more pain during activity and right hand pinch strength when elbow was 90° flexed, that showed a significant difference that was statistically significant ($p < 0.05$). However there was no significant difference both hand grip and finger pinch strength when elbow was full extended between physical therapy and dental students ($p > 0.05$).

Conclusion: The present study indicates that dental students feel more pain during activity in their hands than physical therapy students. The data obtained in this study can be used as an indicator of musculoskeletal disorders related to upper limbs for dental students in future.

Keywords: *physical therapy; dental; students; pain; hand grip; pinch*

Abbreviations: PT: Physical Therapy; D: Dental; R: Right; L: Left; CTS: Carpal Tunnel Syndrome; CTD: Cumulative trauma disorders; BMOI: Body Mass Index

Introduction

Background: Hands provide to get in contact with other people and be able to make various tools and use it with visual and tactile senses. Therefore, people's personality and developmental characteristics, race, sex, interests and work, hands which give information about their jobs, has different shapes and sections [1,2]. In developmental progression, hands occur from bones, cartilage and muscle tissue, external factors and occupations affect the structure of the hand [1]. Grip and pinch strength are crucially important attributes and standard parameters related to the functional integrity of the hand [3]. Measuring grip strength can be done quickly and for this reason it is called quick bedside test [4]. Preparing normative data of grip strength is a reliable method for diagnosing the impact of damages to either musculoskeletal or nervous system of hand. This data is usually obtained from healthy people based on factors like age and sex [5,6]. Few studies examined predictors of hand strength itself. Strong predictors are sex, age, body height and mid-forearm circumference

Citation: Ahmed Fatih DEMIR., *et al.* "Comparison of Pain, Hand Grip and Pinch Strength Between Physical Therapy and Dental Students". *EC Orthopaedics* 1.1 (2015): 27-32.

[7,8]. Weaker predictors are body weight and hand size measures [8]. Grip strength has often been taken as surrogate for overall strength but this should be done with caution since correlation of the two strength measures is high in many but also low in few settings [9]. Pinch force during dental scaling can be influenced by tool handle design. A previously published study by our group demonstrated that the weight and diameter of periodontal instrument handles had significant effects on the hand muscle load and pinch force of practitioners performing a simulated manual scaling task [10]. An instrument with a large diameter (10 mm) and a light weight (15 g) required the least amount of muscle load and pinch force, the traditional smaller instrument diameters and heavier weights were associated with greater muscle activity and pinch force. The cutting action of scaling is performed by pulling the periodontal tool blade along the surface of the tooth, from the gum line toward the top of the tooth, in order to remove plaque. The cutting motion is done by pulling the periodontal handle along its longitudinal axis by flexing the fingers, extending the wrist or supinating the forearm. The return, push motion does not involve cutting, but just repositions the cutting blade to the gum line. Changes to the tool shape that improve the coupling of the fingers to the tool may reduce the applied pinch force [11]. Grip and pinch strength is one of the most important factors related to proper hand function [12,13]. Many recent studies have been performed in order to evaluate grip and pinch strength and provide standard values among people of different age groups [14,15]. Some of these research studies looked at the effects of various parameters on grip and pinch strength [16], therefore some of them could provide models for estimating grip and pinch strength [17-20]. The tests for evaluation of hand grip strength are simple, safe and reliable and they do not require expensive and complicated instruments [21]. Therefore hand held dynamometer which is a simple and easy measuring muscle strength tool is applicable [22]. Few studies focus on comparing hand function and pain between different professions, therefore this study compared the level of pain, hand grip and pinch strength between physical therapy and dental students who usually use their hand to do their job more than some professions.

Purpose: This study has been planned with the aim of identifying and comparing the level of pain, hand grip and pinch strength between physical therapy and dental students.

Materials and Methods

Participants: This study examined 64 students (32 physical therapy and 32 dental students) aged 18-24 years old who are first year and second year students. The place of study is Sifa University in Izmir, Turkey. To qualify for the study, subjects had to be a healthy and study physical therapy or dentistry. Subjects were excluded if they had had a surgery in upper limb had thenar atrophy (weakness or atrophy of the thenar muscles are an indication of severe CTS, and in most cases, surgical release is (recommended); or had a steroid injection into the carpal canal in the past 3 months or a prior carpal tunnel release [23].

Measurements: Body Mass Index (BMI) was calculated following the measurement of each participant's weight and height. Hand grip strength; was measured using a Jamar Analogue Hand Dynamometer with participants seated, their elbow by their side and flexed to right angles, and a neutral wrist position, the dynamometer handle position II and provision of support underneath the dynamometer. This position, followed by calculation of the mean of three trials of grip strength for each hand, has been well-documented as reliable [24]. The purpose of this test is to measure the maximum isometric strength of the hand and forearm muscles. The subject was asked to squeeze the dynamometer with maximum isometric effort, and maintain it for 3 seconds. No other body movement was allowed (38). Three attempts for each subject were conducted, alternating right and left hands with one-minute rest between two attempts to overcome the fatigue. All the subjects were evaluated in same position and under the same protocol. The dynamometer was reset to zero prior to each reading of grip strength, and it was read to the nearest increment of two. Mean of the three trials was considered for analysis. The results were compared between right and left hand [25]. Pinch Strength was assessed using Pinch gauge [26]. Thumb pulp was placed over the lateral aspect of proximal interphalangeal joint of the index finger, other fingers flexed; and the gauge was placed with dial facing up [27]. The subjects were instructed to place the lateral side of their index finger of right hand on the underside of the gauge and their thumb pulp on top and squeeze maximally 3 times and the mean of the three readings was obtained. The same was repeated with the left hand. Visual Analog Scale (VAS) was chosen as the primary outcome measure and used to quantify pain intensity in hand.

Citation: Ahmed Fatih DEMIR., *et al.* "Comparison of Pain, Hand Grip and Pinch Strength Between Physical Therapy and Dental Students". *EC Orthopaedics* 1.1 (2015): 27-32.

VAS, shown to be a reliable and valid measure [28,29]. It consists of a standard 10-cm line with verbal anchors indicating “none” at one end (0) and “severe” at the other (10). Participants were told to estimate their level of pain during activity and rest by an appropriate mark on the line.

Statistical Analyses

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS version 14.0) and *p* value of < 0.05 was regarded as statistically significant. Differences between physical therapy and dental students level of pain, hand grip and pinch strengths were compared using the independent sample t-test.

Results and Discussion

Results

The study was done on 32 physical therapy and 32 dental students, age range 18-24 years with a height range of 165-194 cm. The general characteristic data are presented in Table1.

Variables	D Students X Sd	PT Students X Sd	Total Sample X Sd
Age, y	19,34 + 1,066	19,66 + 1,359	19,50 + 1,222
Height, cm	172,5313 + 10,65283	168,4375 + 31,49187	170,4844 + 23,41143
Body mass, kg	66,91 + 13,439	66,41 + 11,951	66,66 + 12,618

Table 1: Characteristics of Study Participants.

*D: Dental PT: Physical Therapy.

Table-II shows that comparison of pain, hand grip and finger pinch strength between physical therapy and dental students. As shown in Tables II that there was a significant difference that is dental students had more pain during activity (*p* < 0.05). Moreover, the results showed that dental student’s have more right finger pinch strength than physical therapy students, when elbow was 90° flexed (*p* < 0.05) (Table 2). However no significant difference was noted in pain during rest (*p* > 0.05) (Table 2). It was found that there was no significant difference in left hand grip and finger pinch strength when elbow was 90° flexed (*p* > 0.05) (Table 2) There was also no significant difference both hand grip and finger pinch strengths when elbow was full extended between physical therapy and dental students (*p* > 0.05) (Table 2).

Variables	D Students X Sd	PT Students X Sd	P Value
R Hand Grip Strength	41,7997 + 18,12208	37,2259 + 13,36153	P > 0,05
	39,0172 + 16,31937	34,6631 + 11,95716	P > 0,05
R PinchStrength	8,5541 + 1,78947	8,4131 + 2,71201	P > 0,05
	8,1681 + 1,94924	8,8403 + 3,15659	P > 0,05
R 90° FlexedHand GripStrength	42,5894 + 19,52676	37,3784 + 12,34875	P > 0,05
	38,1525 + 13,75236	35,8169 + 12,57411	P > 0,05
R 90° FlexedPinchStrength	10,1675 + 3,34723	8,4975 + 2,39629	P < 0,05
	9,6019 + 3,58405	8,2497 + 3,18627	P > 0,05
Level of pain during activity	3,41 + 2,108	1,81 + 1,857	P < 0,05
Level of pain during rest	78 + 1,338	38 + 1,338	P > 0,05

Table 2: Comparison of Pain, Hand Grip and Finger Pinch Strength Between PT and D students.

*D: Dental PT: Physical Therapy

R: Right L: Left

Discussion

Grip and pinch strength are most important factors associated with proper function of hand [30,31]. Recently, there have been several studies for evaluation of grip and pinch strength. Some of these studies have evaluated the effect of various parameters on grip and pinch strength rate [32]. Dental work requires repetitive motions, as well as sustained postures for performing procedures. Dentists are therefore at risk for cumulative trauma disorders (CTDs) or repetitive strain injury, a condition associated with repeated or sustained movements of upper limbs and neck in challenging postures for long hours [33]. CTDs may affect different tissues including muscles, tendons and nerves. CTDs among dentists most commonly affect the upper body causing pain or other symptoms at the neck, shoulders, elbows, forearms, wrists, or hands [34, 35]. The impaired muscle function in the full hand grip, which also engages the local muscles of the hand, may be based on an injury to muscle tissue, nerve tissue, or a combination of both induced by vibration. Experimental studies have shown that vibration may damage nerve fibers and infraneural micro vessels as well as muscle fibers [36]. A study done by H. Dong *et al.* compared thumb pinch force between six dentists and six senior-year dental students and found that dental students applied greater mean peak pinch force compared to dentists, this is because increased experience in periodontal scaling leads to the application of less pinch force to accomplish scaling [37]. Analysis of data showed that dental students have more pain during activity and right finger pinch strength than physical therapy students when elbow was 90° flexed. Possibly, one of the reason is dental students use their hands too much in clinics. Another reason is vibrating tools used by the dental students may damage to their hand and this can cause some musculoskeletal problems or severe pain in their hands in the future.

Limitations

The study has some limitation that the current study evaluated subjects who are first and second year students, so involving third and fourth year students would have yielded more statistically significant results. Further, studies need to examine other factors such as the level of physical activity and fatigue, antropometric measurements and disabilities of the arm, shoulder and hand. The result obtained from the future studies considering the above mentioned factors can enhance the reliability of study.

Conclusion

The present study indicates that dental students have more activity pain than physical therapy and rehabilitation students. It can negatively affect over life quality and lead to musculoskeletal problems, unless it is prevented with therapeutic exercises. The data obtained in this study can be used an indicator of musculoskeletal disorders for dentists in future.

Acknowledgements

For their cooperation and support in this research, the authors gratefully thank all students for their participation in the study.

Bibliography

1. Kulaksız G. "El Dominansının, El Antropometrik Ölçümleri Üzerine Etkisinin İncelenmesi". Gazi Üniversitesi, Tıp Fakültesi Anatomi-Anabilim Dalı, Uzmanlık Tezi, Ankara (2001): 1-26.
2. Erzurumluoğlu K. "Türkiye'de Antropolojik İrkçilik Çalışmaları III". *Orkun Dergisi* 31 (2000): 23-25.
3. Tsuyoshi Tajika, *et al.* "Relationship Between Grip, Pinch Strengths and Anthropometric Variables, Types of Pitch Throwing Among Japanese High School Baseball Pitchers". *Asian Journal of Sports Medicine* 6.1 (2015): e25330.
4. Angst F, *et al.* "Prediction of grip and key pinch strength in 978 healthy subjects". *BMC Musculoskeletal Disorders* 11 (2010): 94-99.
5. Adedoyin RA, *et al.* "Reference Values for Handgrip Strength Among Healthy Adults in Nigeria". *Hong Kong Physics Journal* 27.1 (2009): 21-29.
6. Mathiowetz V, *et al.* "Reliability and validity of grip and pinch strength evaluations". *Journal of Hand Surgery* 9.2 (1984): 222-226.
7. Chong CK, *et al.* "Grip and pinch strength in Chinese adults and their relationship with antropometric factors". *Journal of the Formosan Medical Association* 93.7 (1994): 616-621.
8. MacDermid JC, *et al.* "The effect of physical factors on grip strength and dexterity". *British Journal of Hand Therapy* 7.4 (2002): 112-118.

Citation: Ahmed Fatih DEMİR, *et al.* "Comparison of Pain, Hand Grip and Pinch Strength Between Physical Therapy and Dental Students". *EC Orthopaedics* 1.1 (2015): 27-32.

9. Bohannon RW. "Is it legitimate to characterize muscle strength using a limited number of measures?" *Journal of Strength & Conditioning Research* 22.1 (2008): 166-173.
10. Dong H., et al. "The effects of periodontal instrument handle design on hand muscle load and pinch force". *Journal of the American Dental Association* 137.8 (2006): 1123-1130.
11. Dong H., et al. "The effect of tool handle shape on hand muscle load and pinch force in a simulated dental scaling task". *Applied Ergonomics* 38.5 (2007): 525-531.
12. Goodson A., et al. "Direct, quantitative clinical assessment of hand function: usefulness and reproducibility". *Manual Therapy* 12 (2007): 144-152.
13. Klum M., et al. "Normative data on wrist function". *Journal of Hand Surgery* 37.10 (2012): 2050-2060.
14. Bohannon RW, et al. "Reference values for adult grip strength measured with Jamar dynamometer: a descriptive meta-analysis". *Physiotherapy* 92.1 (2006): 11-15.
15. Klum M., et al. "Predicting grip strength and key pinch using anthropometric data, DASH questionnaire and wrist range of motion". *Archives of Orthopaedic and Trauma Surgery* 132.12 (2012) 1807-1811.
16. Vaz MHS and Diffey B. "Prediction equations forearm grip strength in healthy Indian male and female subjects encompassing a wide age range". *Annals of Human Biology* 29.2 (2002): 131-141.
17. Chandrasekaran B., et al. "Age and anthropometric traits predict hand-grip strength in healthy adults". *Journal of Hand and Microsurgery* 2.2 (2010): 58-61.
18. Hossain MG., et al. "Multiple regression analysis of factors influencing dominant hand grip strength in an adult Malaysian population". *Journal of Hand Surgery* 37.1 (2012): 65-70.
19. Momiyama H., et al. "Dynamic Movement of Center of Gravity with Hand Grip". *Journal of Biomedical Research* 27.2 (2006): 55-60.
20. Kim SW, et al. "Low Handgrip Strength is Associated with Low Bone Mineral Density and Fragility Fractures in Postmenopausal Healthy Korean Women". *Journal of Korean Medical Science* 27.7 (2012): 744-747.
21. Kima JIS., et al. "Comparison of grip and pinch strength between dominant and non dominant hand according to type of handedness of female college students". *Journal of International Academy of Physical Therapy Research* 2.1 (2011): 201-206.
22. Ehsanollah H., et al. "Hand grip and pinch strength: Effects of workload, hand dominance, age, and Body Mass Index". *Pakistan Journal of Medical Sciences* 29.1 (2013): 363-367.
23. Gilbertson L and Barber LS. "Power and pinch grip strength recorded using the hand-held Jamar dynamometer and B + L hydraulic pinch gauge. Normative data for adults". *British Journal of Occupational Therapy* 57.12 (1994): 483-488.
24.www.asht.org /ASHT: The American Society of Hand Therapists. Date of access 19/08/2012.
25. Melzack R. "The short-form McGill Pain questionnaire". *Pain* 30.2 (1987): 191-197.
26. Caraceni A., et al. "Pain Measurement Tools and Methods in Clinical Research in Palliative Care: Recommendations of an Expert Working Group of the European Association of Palliative Care". *Journal of Pain and Symptom Management* 23.3 (2002): 239-250.
27. Vaz MHS and Diffey B. "Prediction equations forearm grip strength in healthy Indian male and female subjects encompassing a wide age range". *Annals of Human Biology* 29.2 (2002): 131-141.
28. Dandannavar VS and Goudar SS. "Motor performance in upper limbs among regular computer users". *Life sciences and medicine research* (2010): LSMR-14.
29. Akesson I., et al. "Musculoskeletal disorders among female dental personnel - clinical evaluation and a five year follow-up of symptoms". *International Archives of Occupational and Environmental Health* (1999): 395-403.
30. Liss G., et al. "Musculoskeletal problems among Ontario dental hygienists". *American Journal of Industrial Medicine* 28 (1995): 521-540.
31. J L Thonnard., et al. "Short-term effect of hand-arm vibration exposure on tactile sensitivity and manual skill". *Scandinavian journal of work, environment & health* 23.3 (1997): 193-198.
32. Hui Dong., et al. "Pinch Forces and Instrument Tip Forces during Periodontal Scaling". *Journal of Periodontology* 78.1 (2007): 97-103.

33. Nalini YC and Veena Umesh B. "An Assessment of Hand Eye Co-ordination, Hand Grip Strength and Pinch Strength in Dentists".
Indian Journal of Physiotherapy & Occupational Therapy 9.1 (2015):

Volume 1 Issue 1 June 2015

© All rights are reserved by Ahmed Fatih DEMIR., et al.