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LEVELS OF HANDGRIP STRENGTH AND ITS ASSOCIATION WITH NECK PAIN AND THUMB RADIAL ABDUCTION ANGLE AMONG DENTISTS WORKING AT DENTAL INSTITUTES OF PESHAWAR

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Abstract

Background: Handgrip strength is the fundamental unit required by dentists for fulfilling their professional responsibilities. Dentists are prone to suffering from neck pain because of their awkward working postures. Neck pain is thought to have a significant impact upon the hand grip strength, and dentists are suggested to have a severe decrease in hand grip strength because of the prevalence of neck pain. In Saudi Arabia, 21.69% of dentists are reported to drop out of their jobs annually because of neck pain. It is important to determine the association between neck pain and hand grip strength. Thumb musculature plays a significant role in determining the hand grip strength of an individual. So, it must be determined that if the deviation of thumb radial abduction angle from normal, has any association with the hand grip strength in dentists. Objectives: To determine the levels of hand grip strength among dentists working at dental institutes of Peshawar (RCD and SBDC). To determine the association between neck pain and hand grip strength in dentists. To find out the association between thumb radial abduction angle and hand grip strength among the dentists. Methodology: 231 dentists were selected from the dental institutes of Peshawar, using convenience sampling method. Handheld dynamometer was used to measure the hand grip strength, and the best of three measurements were recorded as result. ACSM guidelines were followed for the normal values of handgrip strength in each gender. Neck pain was recorded using NPRS, with 0 being no pain and 10 being the worst pain possible. A short arm universal goniometer was used to measure the thumb radial abduction angle, the normal range being 53-71°. Results:36.8% of the participants had a weak hand grip strength. No association was found between neck pain and hand grip strength. There was also no association between thumb radial abduction angle and hand grip strength. The factors proven to be significantly associated with handgrip strength are gender (p=0.011), age (p=0.000), and the years of experience of the dentists (p=0.009). Conclusion: No association exists between neck pain and handgrip strength, as well as no association between thumb radial abduction angle and hand grip strength. Weak grip strength was more prevalent among the dentists (36.8%).

Introduction:

Dentists heavily rely on grip strength to firmly hold and manipulate dental instruments during various procedures. Grip strength is essential for maintaining control, precision, and accuracy during treatments, as well as for providing the necessary force required for effective instrument manipulation.[1] Weak grip strength can compromise a dentist's ability to perform precise movements, resulting in compromised treatment outcomes, such as inaccurate tooth preparation, improper alignment of dental restorations, and reduced efficiency in completing tasks.[2] It can also increase the risk of instrument slippage, which can result in accidental injury to the patient or the dentist. Moreover, the constant use of forceful gripping without sufficient strength can lead to muscle fatigue, leading to a decrease in a dentist's endurance, potentially limiting the number of procedures they can perform comfortably in each period. Musculoskeletal disorders, such as neck pain and thumb radial abduction issues, are prevalent occupational health problems in the dental profession. The nature of dental work involves repetitive hand movements, prolonged static postures, and gripping of dental instruments, which can directly impact grip strength.

Grip weakness, characterized by reduced grip strength, can contribute to the development or exacerbation of neck pain and alterations in thumb radial abduction angle among dentists.[3] The association between grip weakness and neck pain in dentists can be explained through biomechanical and musculoskeletal factors. Dentistry involves repetitive and sustained gripping of dental instruments, which can lead to increased muscle tension and fatigue in the hand, forearm, and upper body. This increased muscle tension and strain can contribute to the development of neck pain.[4] Dentists with weak grip strength may rely on excessive force or awkward hand positions to maintain instrument control, leading to increased muscle effort and abnormal loading of the musculoskeletal system .Such compensatory movements and postures can disrupt the natural alignment and function of the neck and shoulder girdle, potentially contributing to the development of neck pain.[1] Weak grip strength has also been associated with alterations in thumb radial abduction angle. It plays a crucial role in grasping and manipulating dental instruments. Dentists may experience weak grip strength because of the inappropriate positioning of their thumb leading to deviations from the optimal angle required for efficient instrument manipulation.

As dentists rely on their handgrip strength to conduct their work-related tasks, having a weakened grip would put them in a position where they would have to quit their jobs. For this reason, it is important to understand the prevalence of weak grip in dentists, as well as to identify the factors that might affect handgrip strength. Variety of previous studies have provided varying results, so it is important to identify the gap that exists in the literature regarding the topic. Also, it is necessary to correctly determine the associations among the variables, so the future researchers who might want to pursue this topic would have a significant understanding of how different variables act in determining the handgrip strength in dentists.

Methodology:

Objectives:

- To determine the levels of handgrip strength among dentists working at dental institutes of Peshawar.
- To determine the association between neck pain and handgrip strength in dentists.
- To determine the association between thumb radial abduction angle and handgrip strength among dentists.

Study Design:

The research was an observational, cross-sectional study.

Study Setting:
Dental institutes of Peshawar including Rehman College of Dentistry and Sardar Begum Dental College.

Sample Size:
Total population of our study was 574. The sample size was 231, calculated at 95% confidence interval, using an online sample size calculator, Open-Epi.

Sampling Technique:
The sampling technique was non-probability, convenience sampling.

Inclusion Criteria:
- Dentists who worked for 45-50 minutes/day, 5 times a week.
- Male and female dentists at the setting.

Exclusion Criteria:
- History of any orthopaedic procedure in neck and upper limb.
- Individuals who declined consent for data collection.

Data Collection Tools:
- Jamar Handheld Dynamometer was used to measure handgrip strength.
- Neck pain was measured using Numeric Pain Rating Scale.
- Thumb radial abduction angle was measured using a universal goniometer.

Data Collection Procedure:
The participants were seated comfortably, their forearms being perpendicular to their arm, while the dynamometer was supported slightly by the examiner to counteract gravity. Participants were instructed to squeeze the dynamometer with maximum force using their dominant hand, and the reading was recorded by the examiner directly in front. Three measurements were obtained, and the best of those readings was reported as the result. The thumb radial abduction angle was measured using a short arm universal goniometer. The participant was seated with hand flat on a table. The axis of the goniometer was on the anatomical snuffbox, the stationary arm exactly parallel to the index finger. The participants were instructed to slide their thumbs maximally towards the radial side, until they felt their palms stretch. The movable arm was moved along the thumb, and the angle was recorded in degrees. Neck pain was recorded from 0-10, with 0 being no pain and 10 being the worst pain possible.

Results:
The ages of the participants ranged between 23 and 56 years. 83 dentists from RCD and 148 dentists from SBDC participated in the research. Gender distribution showed 100 males and 131 females. 36.8% had a poor grip strength and 51.5% reported to be suffering from neck pain. 119 participants had an abnormal thumb radial abduction angle. There exists a significant association among the gender (p= 0.011), age (p= 0.000), and the years of experience of dentists (p= 0.009) with handgrip strength. However, the variables such as neck pain, BMI, specialty, and thumb radial abduction angle have no significant association with the level of handgrip strength of the dentist.

Table 1: ***Associations of Variables***

Variables	P-values
Neck pain & HGS	**0.787**
Gender & HGS	0.011*
Age & HGS	0.000*
BMI & HGS	0.606
Department& HGS	0.071
Years of experience & HGS	0.009*

TrA angle & HGS	0.685

Discussion:

In 2014, a cross-sectional study was conducted in Saudi Arabia, comprising of 25 dentists.[5] The results of the study showed a positive correlation between neck pain and handgrip strength in dentists and attributed these findings to the stimulation of nerve endings due to neck pain, which causes sensorimotor integration and hence causes strong contraction of the muscles of upper extremity. The findings of the present study do not agree with this claim as there was no association between the two factors and having greater neck pain did not signify its association with neck pain.

A study was conducted in Germany in 2020, involving industrial workers.[6] The study involved 145 employees, who worked with their spines bent and adding severe strains on their cervical and thoracic spines. The results showed that the greater the pain in neck, the lower was the HGS of the participants. The present study contradicts these results as the handgrip was not affected by an increase or decrease in neck pain.

A study was conducted in Saudi Arabia in 2021, comprising of 100 dentists.[7] Their thumb radial abduction angle was found to have a significant association with the handgrip strength, and thumb musculature was reported to be highly involved in determining the handgrip strength. The present study contradicts these findings as it shows that there does not exist any significant association between thumb radial abduction angle and handgrip strength.

A systematic review conducted in 2016[8] concluded that with the increase in age, the handgrip strength significantly decreases. The present study also agrees with these findings because the results confirm that age has a significant association with handgrip strength.

In 2016, a study was conducted on school going Italian children.[9] The results of the study showed that male children had higher muscle mass than their female age fellows. This also leads to the increased handgrip strength of the males than the females. The present study also describes the results in these terms where gender is demonstrated to have a significant association with the handgrip strength.

A study was conducted in Turkey in 2015[10] consisting of professional rock climbers. It was observed that the climbers had a greater grip strength of their dominant hand, and their handgrip strength kept increasing with the amount of time they invested in climbing. The results of the present study agree with this, as the dentists who had a greater work experience presented with a greater handgrip strength. This might be attributed to the demands of the profession, as both professions require the professional to possess a greater handgrip strength, otherwise it might be difficult to sustain their jobs.

This means that the present study does not agree with all the work already done regarding the present topic. It might be due to the reason that the previous studies had limited number of participants, whereas the present study includes a greater sample size. However, there is no specific standard available with which to compare the results of the specific study, as most of the studies are cross-sectional surveys, or meta-analyses of the surveys.

Conclusion:

No association was found in the present study between neck pain and HGS in dentists. Also, no significant association existed between TrA Angle and HGS. However, grip strength was found to be significantly associated with the age, gender, and years of experience of the dentist. Greater grip strength was prevalent among males. Out of 231 participants, 36.8% had poor handgrip strength.

Recommendations:

Only 51 participants had excellent handgrip strength according to their age group. This shows that grip strengthening must be incorporated into a physical therapy plan that involves dentists complaining of dropping instruments. It is also suggested to the future researcher pursing this topic, that they find out the correlation between the factors that are proven to be associated with handgrip strength and compare how the hand grip strength in dentists is different from that in other professionals that involve the same repetitive motions of the wrist joint. Also, conduct an RCT, in which dentists would undergo long term ergonomic corrections, and report any effects on hand grip strength.

Strength Of the Study:

- This study had a good response rate because the dentists were fascinated by the idea of their handgrip strength checked, as it was entirely different from their profession, but at the same time a necessity.
- Many dentists reported neck pain as debilitating, and they were eager to find out if their neck pain would affect their professional life.
- The present study involved an extensive sample size, giving equal opportunity to both males and females to participate. The previous studies held had a very limited number of participants that were localized to a specific environment, while this study had participants from different environments.

Limitations:

- The division of dentists among the specialties was not equal.
- Self- reporting of weight and height by the participants affected the reliability of the results.
- Many participants were anxious while getting their grip strength measured, which might have led to different results than if they were relaxed.
- As the participants consisted predominantly of females, and females are proven to have differing results than males, the results of the study might be gender biased.

Conflict Of Interest

The authors declare that there was no conflict of interest in their study.

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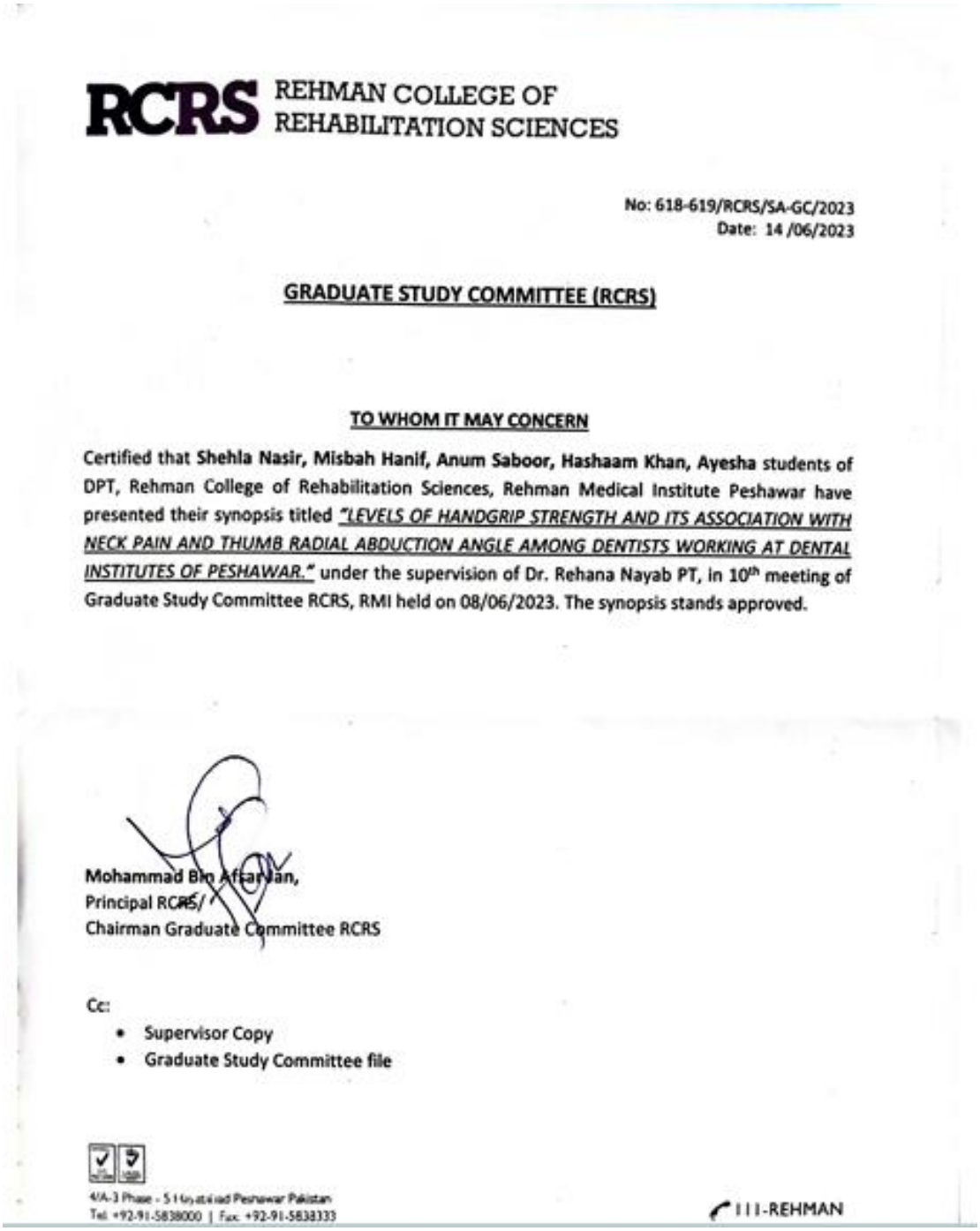

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TO WHOM IT MAY CONCERN

Certified that **Shehla Nasir, Misbah Hanif, Anum Saboor, Hashaam Khan, Ayesha** students of DPT, Rehman College of Rehabilitation Sciences, Rehman Medical Institute Peshawar have presented their synopsis titled *"LEVELS OF HANDGRIP STRENGTH AND ITS ASSOCIATION WITH NECK PAIN AND THUMB RADIAL ABDUCTION ANGLE AMONG DENTISTS WORKING AT DENTAL INSTITUTES OF PESHAWAR."* under the supervision of Dr. Rehana Nayab PT, in 10th meeting of Graduate Study Committee RCRS, RMI held on 08/06/2023. The synopsis stands approved.

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