# To Assess the Relationship between the Neck Pain and Hand Grip Strength in Final Year and Internship under Graduate Dental Students, due to the Impact of Poor Ergonomics

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**Abstract:** *Aim: The aim of this study was to assess the relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students, due to the impact of poor ergonomics. Objectives: To evaluate the level of neck pain among dental students using Neck pain disability index. To evaluate the hand grip strength among dental students using Baseline hand dynamometer. To evaluate the impact of the symptoms of neck pain and hand grip due to ergonomics amongst current final year and internship undergraduate dental students. Methodology: 70 students were selected for the study according to the inclusion criteria, NDI was used to the samples to evaluate the neck pain and BASELINE DYNAMOMETER was used to samples to evaluate the hand grip strength. The subjects had undergone assessment for 2 weeks. Then the collected data was divided on the basis of presence of cervical pain, hand dominance and gender. Then data was tabulated and interpreted by using statistical analysis principles. Result: After tabulation and statistical analysis, according to Karl Pearson correlation coefficient, there is showed significant changes in relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students due to poor ergonomics. Conclusion: The conclusion of this study indicates that there is the relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students due to poor ergonomics. Thus, proving the alternate hypothesis and rejecting the null hypothesis.*

**Keywords:** Neck pain, Hand grip strength, Ergonomic, Dental student, Occupational Therapy.

**Place of Study:** K. S. Rangasamy Institute of Dental Science and Research, Erode, Tamilnadu.

**Period of Study: 3** Months duration

## 1. Introduction

Neck anatomy is a well-engineered structure of bones, nerves, muscles, ligaments and tendons. There are 7 vertebrae (bones) in the neck. Together they form the upper most section of the vertebral column which is known as the "cervical spine". They are labelled C1 to C7 with C1 at the top and C7 furthest from the head and adjoining the first vertebra of the next section of the spine.

The cervical spine is a marvellous and complex structure. It is capable of supporting a head weighing 15 or more pounds while moving in several directions. No other region of the spine has such freedom of movement. This combination however, complexity and mobility, make the neck susceptible to pain and injury.

If the cervical spine is moving away from the range of movement repeat, it will leads to pain at the neck. Neck mobility is matchless. It is capable of moving the head in many directions: 90° of flexion (forward motion), 90° of extension (Backward motion), 180° of rotation (side to side), and almost 120° of tilt to either shoulder. Neck pain is one of the most significant problems in dental professions because the dentistry professions maintain prolonged static neck bending position.

Dentists are at high risk for musculoskeletal disorders due to the nature of their work. Musculoskeletal pain is more frequently noted by oral health providers than any other occupational hazard, including communicable diseases and other physical and emotional disorders. Work-related musculoskeletal disorders make up 34 percent of lost workday injuries. These are the injuries that result from repetitive work, awkward or constrained postures, heavy lifting, pinching grasps, forceful movements, and vibrating tools.

Hand grip is the functional unit of dentists used in firm holding of instruments and tools .Muscles of hand grip supplied by cervical nerves. Dentists put their neck in high physical load for prolonged time that lead to neck pain. 54.4% of dentists in K.S.A. have neck pain and 21% drop out of their job. (S. Vijay, 2016). The occupational therapist improve the functional performance in dental professionals by reduce the pain by using some techniques such as rest, ice or heat, postural maintenance, modify lifestyle, etc. In this study the research intend to determine the impact of the ergonomics in the relationship between the neck pain and hand grip in final year and internship under graduate dental students.

## 2. Aim and Objectives

### Aim

The aim of this study was to assess the relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students, due to the impact of poor ergonomics.

### Objectives

- To evaluate the level of neck pain among dental students using Neck pain disability index (NDI).
- To evaluate the hand grip strength among dental students using Baseline hand dynamometer.
- To evaluate the impact of the symptoms of neck pain and hand grip strength due to ergonomics amongst current final year and internship undergraduate dental students.

### Hypothesis

### Null Hypothesis

There is no significant relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students due to poor ergonomics.

### Alternative Hypothesis

There is significant relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students due to poor ergonomics.

## 3. Review of Literature

### S. Vijay and M. Ide et al (2016)

The aim of the study was to determine the prevalence, distribution and impact of the symptoms of musculoskeletal pain amongst current undergraduate dental students at a UK dental institute. In this study, 398 undergraduate students were participated and the researcher has used a modified version of the Nordic Back Pain questionnaire to evaluate the subject's neck pain. The result concluded that the prevalence of pain in overall dental students, 79% of respondents reported experiencing one of the either ie neck, upper back or lower back pain with 42% of these experiencing this pain for 30 or more in the past year.

### C. J. Grobler et al (2013)

The aim of the study was to investigate whether isometric handgrip strength (IHGS) is a predictor of increased musculoskeletal injury risk in automotive assembly workers. Self-reported musculoskeletal injury/accident data and recent musculoskeletal symptoms were recorded using a modified Nordic musculoskeletal questionnaire in that study. 445 subjects (workers) were available in that study but 206 subjects (46%) were participated. The results of the study, sixty participants (29%) reported a musculoskeletal injury/accident at work in the preceding 5 years. Mean IHGS in this population was lower than international normative values. The conclusion of the study was to weak handgrip did not predict increased risk of musculoskeletal injuries/accidents.

### R Nutalapati, R Gaddipati et al (2009)

The aim of the study was to determine ergonomics in dentistry and the prevention of musculoskeletal disorders in dentists. That study focused on worker and relationship to their occupational environment. The result concluded that musculoskeletal problems of dentistry should be prevented by increasing awareness of the postures used during work, redesigning the workstation to promote neutral positions, examining the impact of instrument use on upper extremity pain, and healthy work practices to reduce the stress of dental work on the practitioner's body.

### Bethany Valachi and Keith valachi et al (2003)

The aim of the study was to determine the mechanisms leading to the high prevalence of musculoskeletal pain in dentistry. In this article, the researcher has selected and examined the published literature or reviews related to the development of musculoskeletal pain and MSDs among dental operators. The result concluded that the abnormal postures, muscular imbalance, muscle necrosis, trigger points, hypomobile joints, nerve compression, and spinal disk herniation or degeneration also leads to musculoskeletal pain in dentistry.

## 4. Methodology

The aim of this study was to assess the relationship between the neck pain and hand grip strength in final year and internship undergraduate dental students, due to the impact of poor ergonomics.

### Research Design

The research design is a non-experimental and was a survey based study.

### Population

Accessible population was adapted in this study.

### Sampling Size

70 subjects are included in this study.

### Sample Techniques

Convenient sampling technique was adapted.

### Study Place

The subjects were selected from K.S.Rangasamy Institute of Dental Science and Research, Erode.

### Inclusion Criteria

Both genders were included.
Subjects between 21 to 25 years were only included.
Right hand dominant subjects were only included.

### Exclusion Criteria

The participants were excluded if they had any other orthopaedic condition or any previous relevant surgery which could cause neck pain.

### Duration of the Period

Total duration of the study was 3 months.

# 5. Instrumental and Measurement Tool

## 1) Neck Pain Disability Index

### Description
The Neck Disability Index (NDI) was developed in 1989 by Howard Vernon. The Index was developed as a modification of the Oswestry Low Back Pain Disability Index with the permission of the original author (J. Fairbank, 1980). In 1991, Vernon and Mior published the results of a study of reliability and validity in the Journal of Manipulative and Physiologic Therapeutics.

Each of the 10 items is scored from 0 - 5. The maximum score is therefore 50. The obtained score can be multiplied by 2 to produce a percentage score. Occasionally, a respondent will not complete one question or another. The average of all other items is then added to the completed items.

### Scoring Interpretation
0 – 4      = no disability;
5 – 14      = mild;
15 – 24    = moderate;
25 - 34    = severe;
Above 34 = complete.

### Administration
It requires 3 to 8 minutes.

### Validity of the Tool
Face validity was estimated based on the subject's response during the initial evaluation as to whether the questionnaire was relevant to his/her disorder.

### Reliability of the tool
The reliability of acute neck pain is 0.81-0.89.
The reliability of chronic neck pain is 0.97-0.99.

## 2) Visual Analogue Scale
### Description
The **visual analogue scale** (**VAS**) is a psychometric response scale which can be used in questionnaires. It is a measurement instrument for subjective characteristics or attitudes that cannot be directly measured. When responding to a VAS item, respondents specify their level of agreement to a statement by indicating a position along a continuous line between two end-points.

### Validity and reliability
The Validity of scale is 0.76 to 0.84.
The Reliability of scale is 0.60 to 0.77.

## 3) Baseline Hand Dynamometer
### Description
The Adjustable Hand Dynamometer offers many features for both routine screening work and for evaluating hand trauma and disease.

### Parts of Baseline Hand Dynamometer
Dual-Scale Readout: The Baseline Hand Dynamometer displays grip force in pounds and kilograms—200 pounds or 90 kilograms maximum reading.

Peak-Hold Needle: For convenience and easy recording, the Baseline Dynamometer automatically retains the highest reading on a special peak-hold needle. This reading remains on the gauge until the examiner resets it.

Accurate and Reproducible: The baseline dynamometer is isometric in use, with almost no perceptible motion of the handles, regardless of grip strength. The hand grasp is both comfortable and effective. These features combine to ensure accurate, reproducible results.

Adjustable Handle: To accommodate various size hands, the Baseline Dynamometer handle adjusts to five grip positions: from 1- 3/8 to 3-3/8 inches, in half-inch increments.

### Procedure
Have the individual sit with their shoulder adducted and neutrally rotated, elbow flexed at 90°, forearm in neutral position, and wrist between 0° and 30° dorsiflexion and between 0° and 15° ulnar deviation. Set the **Baseline Hand Dynamometer** to the second handle position from the inside.

### Reliability
In initial pressure, the reliability is ranges from 0.88 to 0.93.

### Procedure of Study
A sample size of 70 subjects was included in this study. Initially, permission for doing research was received from the subjects by getting consent form.

Then details such as name, age, sex, hand dominant, history of neck pain and ergonomic history was taken by using assessment form and the procedure was explained to the subjects.

The hand grip strength was measured for both hands using hand dynamometer for three trials. The neck pain was measured using visual analogue scale and neck pain disability index.

The collected data was divided on the basis of presence of cervical pain and gender. The divided values were used to calculate mean, standard deviation and      p value by using manual statistical principle. Finally correlation was calculated for with and without cervical pain based on gender and hand dominance. That calculation was done by using Karl Pearson's correlation method. [4]

Formulae such as,

$$r = \sum xy \div N\sigma x\sigma y$$

Here,
r is correlation coefficient
σx is standard deviation of series x
σy is standard deviation of series y
Correlation was found for analysing the relationship between hand grip strength and cervical neck pain. The results were tabulated and interpreted.

**Data Analysis and Results**

**Table 1:** Comparison of left hand grip strength among final year male dental students with and without cervical neck pain

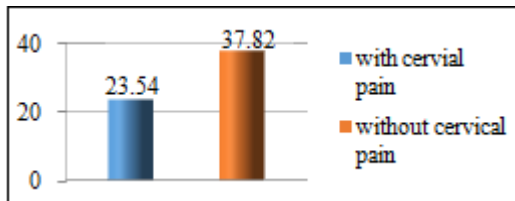| Category | Mean value | SD | P value | r value |
|---|---|---|---|---|
| With cervical pain | 25.69 | 3.683 | 0.0074 | -0.7537 |
| Without cervical pain | 40.18 | 6.047 | | |
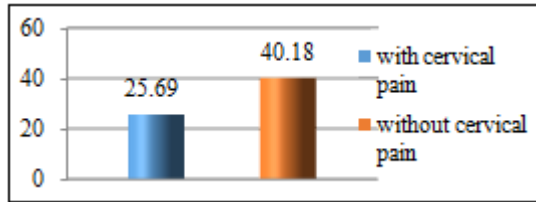


**Graph 1**

Table: 1 and Graph: 1 is showing comparison of left hand grip strength among final year male dental students with and without cervical pain, where mean values are 25.69 and 40.18 respectively, where the r value is -0.7537 and p value is 0.0074 which shows it is statistically significant.

**Table 2:** Comparison of right hand grip strength among final year male dental students with and without cervical neck pain

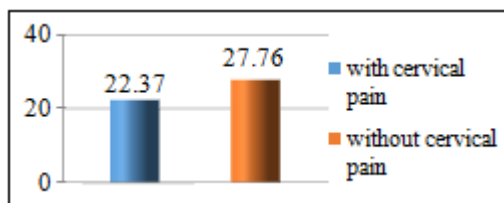| Category | Mean value | SD | P value | r value |
|---|---|---|---|---|
| With cervical pain | 23.54 | 4.274 | 0.9568 | -0.0185 |
| Without cervical pain | 37.82 | 5.250 | | |



**Graph: 2**

Table: 2 and Graph: 2 is showing comparison of right hand grip strength among final year male dental students with and without cervical pain, where mean values are 23.54 and 37.82 respectively, where the r value is -0.0185 and p value is 0.9568 which shows it is statistically not significant.

**Table 3:** Comparison of left hand grip strength among final year female dental students with and without cervical neck pain

| Category | Mean value | SD | P value | r value |
|---|---|---|---|---|
| With cervical pain | 22.37 | 5.911 | 0.0454 | -0.4909 |
| Without cervical pain | 27.76 | 6.969 | | |



**Graph 3**

Table: 3 and Graph: 3 is showing comparison of left hand grip strength among final year female dental students with and without cervical pain, where mean values are 22.37 and

27.76 respectively, where the r value is -0.4909 and p value is 0.0454 which shows it is statistically significant.

**Table 4:** Comparison of right hand grip strength among final year female dental students with and without cervical neck pain

| Category | Mean value | SD | P value | r value |
|---|---|---|---|---|
| With cervical pain | 19.46 | 5.564 | 0.0411 | -0.4997 |
| Without cervical pain | 22.94 | 5.847 | | |
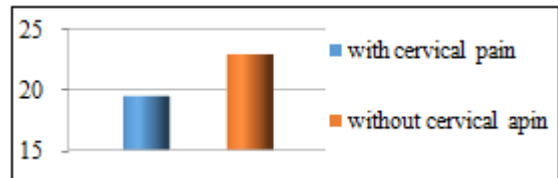


**Graph 4**

Table: 4 and Graph: 4 is showing comparison of right hand grip strength among final year female dental students with and without cervical pain, where mean values are 19.46 and 22.94 respectively, where the r value is -0.4997 and p value is 0.0411 which shows it is statistically significant.

## 6. Discussion

The purpose of this study was to assess the relationship between the neck pain and hand grip strength in final year and internship. The aim of the study was to identify the impact of poor ergonomics on dental students.

In this study, the subjects were chosen from KSR INSTITUTE OF DENTAL SCIENCE AND RESEARCH, ERODE based on the inclusion criteria. The data collection was done by using NECK PAIN DISABILITY INDEX and BASELINE HAND DYNAMOMETER. The collected data were calculated by using statistical principles. Finally, the correlation was done by using KARL PEARSON'S CORRELATION COEFFICIENT.

Table: 1 and Graph: 1 is showing comparison of left hand grip strength among final year male dental students with and without cervical pain, were mean values are 25.19 and 40.18 respectively, where the r value is -0.7537 and p value is 0.0074 which shows it is statistically significant.

Table: 2 and Graph: 2 is showing comparison of right hand grip strength among final year male dental students with and without cervical pain, mean values are 23.54 and 37.82 respectively, where the r value is -0.0185 and p value is 0.9568 which shows it is statistically not significant.

Table: 3 and Graph: 3 is showing comparison of left hand grip strength among final year female dental students with and without cervical pain, mean values are 22.37 and 27.76 respectively, where the r value is -0.4909 and p value is 0.0454 which shows it is statistically significant.

That result was supported by David W. Rising et al (2005), investigated the body distribution and severity of reported musculoskeletal pain in a population of dental students, considering increased exposure to clinical experience with years in dental school. A total of 271 dental students in all

four school years completed a questionnaire focusing on pain reported in five general body regions. Forty-six to 71 percent of students reported body pain, with the percentage generally increasing with years in dental school. Women reported having the worst pain in their neck/shoulder region; men reported having the worst pain in their mid- to lower back regions.

Table: 4 and Graph: 4 is showing comparison of right hand grip among final year female dental students with and without cervical pain, were mean values are 19.46 and 22.94 respectively, the r value is -0.4997 and p value is 0.0411 which shows it is statistically significant.

Bethany Valachi, Keith Valachi et al (2003) determined the mechanisms leading to the high prevalence of musculoskeletal pain in dentistry. During treatment, however, operators should strive to maintain a neutral, balanced posture.

Dentists frequently assume static postures, which require more than 50 percent of the body's muscles to contract to hold the body motionless while resisting gravity. The static forces resulting from these postures have been shown to be much more taxing than dynamic (moving) forces. Keeping in mind regarding these factors at a budding stage for the young upcoming dentistry students, Occupational therapy under the branches of ergonomics musculoskeletal disorders and work study can effectively help in countering the ill-effects.

Since, it is mandatory for every dentist to handle heavy hand pieces with various types of sharp cutting, drilling and scaling burr setups; the hand grip strength is a very essential component in manipulation of same. The occupational therapist thus are investing to formulate a standardized protocol for interpreting the different hand grip strength for manipulation of various occupational equipments not just field of dentistry but other various professionals.

From the above graphs it is clearly evident that the dominant right hand has less hand grip strength in subjects with cervical pain when compared with the left non dominant hand. The figures i.e., for male dental students with cervical pain dominant right hand grip strength mean value obtained was 23.54 and for non dominant left hand grip strength mean value obtained was 25.69. And, for female dental students with cervical pain dominant right hand grip strength mean value obtained was 19.46 and for non dominant left hand grip strength mean value obtained was 22.37 though is not alarming but early indicative of increased vulnerability towards cumulative trauma injuries of upper limb due to compromised grip strength and prolonged precision dental tools handling.

Here, we could also cross sectionalised that both the genders suffered from cervical pain and had compromising reduced level of grip strength over all strengthening of though cervical region, upper limbs and trunk could definitely benefit these group of professionals. But, to affirmate above mention strategy for further research is definitely suggested.

At least with the obtained data we can evidently educate the dental students about the vulnerability towards various problems and to maintain the safety precautions for the patient and self.

The data was supported by R. D. Kilgour and A. Vigano et al (December 2013) conducted a study on cancer patient's hand grip strength. That study has been shown to predict survival and is associated with changes in body composition, nutritional status, inflammation, and functional ability in several chronic disease conditions. And, Helen C.Roberts et al., (2011) conducted on sarcopenia patients in old age people. That study determines a clinical definition of sarcopenia based on low muscle mass and reduced muscle function (strength or performance). From the above supportive studies a new future scope regarding the hand grip strength can be initiated for not just dentists but also other professionals who constantly rely on various precision grip and pinch strengths.

That study showed significant that the impact of the ergonomics in the relationship between the neck pain and hand grip in final year and internship Undergraduate Dental Students.

Based on the results and interpretation, the study accepts the alternative hypothesis and rejecting the null hypothesis.

## 7. Conclusion

From the result of this study it was concluded that there is significant the relationship between the neck pain and the hand grip strength among final year and internship dental students, due to impact of poor ergonomics. Thus, proving the alternate hypothesis and rejecting the null hypothesis.

## 8. Limitations and Recommendations

### 8.1 Limitations

- The study was conducted on 21 to 24 years dental students.
- The study was done on a large sample size.
- The study was conducted for shorter duration.
- The study was conducted on students only two colleges.

### 8.2 Recommendations

- The study can be conducted on different aged professionals.
- The study can be conducted on other professionals.
- The study can be done on mass sample size.
- The study can be conducted on multiple colleges.
- Future studies with different epidemiological parameters for considerations of formulating the normative data.

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