



Research Article

COMPARISON OF PINCH GRIP VERSUS POWER GRIP IN DOMINANT AND NON-DOMINANT HAND OF GOLDSMITH WORKERS

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ABSTRACT

Aim: To assess pinch grip versus power grip strength in dominant and non-dominant hand of goldsmith workers.

Background: The work of goldsmith's is to hand assemble every piece of jewelry. This task requires high precision thus causing biomechanical stresses on hands and wrists. There are plenty of studies done to assess the normative data of power and pinch grip in healthy individuals but there is no study done to compare power versus pinch grips in dominant and non-dominant hand of goldsmith workers.

Methodology: Primary data collection was done using convenient sampling. 30 goldsmith workers were selected according to inclusion and exclusion criteria. Assessment was done using Jamar hand dynamometer and Jamar hydraulic pinch gauge.

Results: Both power and pinch grip strengths were stronger in dominant as compared to non-dominant hand but statistically they were not significant.

Conclusion: This study concludes that power and pinch strength do not show any significant differences between dominant and non-dominant hand.

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INTRODUCTION

The dexterity of the hand has two major categories; power grips and precision grips. Power grip is forceful flexion of all joints of fingers with maximum voluntary force that the individual is able to exert under normal bio kinetic conditions.¹ The synergistic action of flexor and extensor muscles is an important factor in strength of resulting grip. Fatigue, dominance of hand, duration of working, years of working, age, pain and sensory loss can affect the grip strength. Pinch grip is positioning grip and is used in fine coordinating activities more than power grip.¹ During this movement the thumb is opposed and flexed while the fingers are flexed at the MCP, PIP and the DIP.

In this grip compression is mainly produced by the extrinsic muscles of the hand (flexor digitorum superficialis, flexor digitorum profundus and palmaris longus) but also assisted by the metacarpophalangeal – joint, flexion force of the interossei, flexor pollicis brevis combined with the adducting force of the adductor pollicis. Phalangeal rotation is by interossei and lumbricals. The opponens also provides assistance through rotational positioning of the first metacarpal e.g. during the opening of a bottle cap.² Types of pinch grip are

Two-point tip pinch: Tip to tip grip of the fingers most commonly understood form of the pinch grip utilized when picking a pinch of salt for instance.

Two-point pad pinch/palmar pinch: The thumb pad and the pad of the index finger utilized to maneuver objects such as a light bulb.

The-lateral pinch/key pinch: A thin object held between the lateral surface of the index finger and the thumb such as when using a key.³

Gold ornament making industries are one of the widespread small-scale industries of India. A large number of goldsmiths are working there for prolonged period. Any Sustained static posture; increases the demand on the muscles, ligaments, and other soft tissues of the musculoskeletal system.⁴

The work of the goldsmith is to hand assemble every piece. This task requires precision, skilled work, and patience. In this work, they make use of tools such as cuticle,

Clippers, tweezers, hammers, rounded tip, beads or precious stones and also pieces of metal. This type of activity requires a biomechanical stress of hands and wrists.⁵

MATERIALS AND METHODS

Study Design

Type of study – observational study.

Duration of study – 6 months.

Location – metropolitan city.

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Sample Design

Sample size – 30
 Sample population – goldsmith workers.
 Sampling – convenient sampling

Materials Used

Jamar hydraulic pinch gauge
 Jamar hand held dynamometer
 Data collection sheet
 Consent form
 Table/Stool

Inclusion criteria

1. Subjects willing to participate
2. Healthy subjects
3. Subjects who have been making ornaments for at least last one year
4. Subjects willing to participate
5. Subjects who agreed to sign the consent form

Exclusion criteria

Upper limb trauma /injuries in the last 6 months without recovery

- (2) Neurological conditions (3) Cervical spine pathologies
- (4) Unwilling to participate (5) Congenital anomalies in upper limb

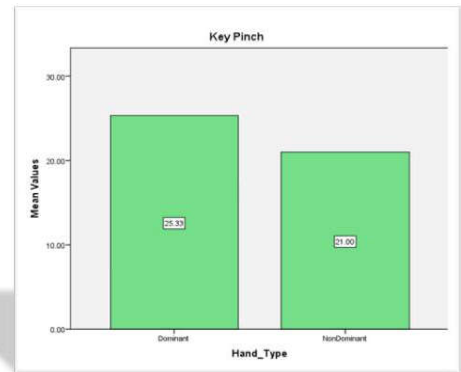
Procedure

This study was conducted in goldsmith’s population. The subjects included in the study were based on inclusion and exclusion criteria. Prior to the assessment demographic data was taken and subjects were explained about the study. A written consent was taken. All measurements were taken by the same observer to minimize any interpreter errors. For each subject, the power grip strength was measured first using the Jamar™ hand dynamometer. And this was followed by pinch grip measurement using the Jamar™ hydraulic pinch gauge. Both the dynamometer and pinch device were reset to zero prior to each reading. The power grip and pinch strength was measured in pounds. Hand dominance was determined by asking: “do you work with your right hand or left hand”. 30 healthy subjects, satisfying the selection criteria were included in the study.

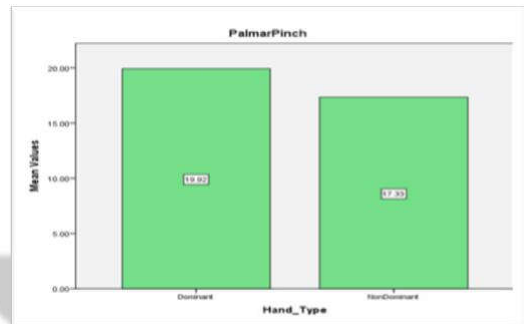
Subjects were seated comfortably on chairs and their feet flat on the floor. All the subjects were made to sit with their shoulder adducted and neutrally rotated, elbow flexed to 90°, forearm in the mid-prone position and wrist in slightly extended and ulnar deviated position for optimal performance in both power grip and pinch grip. Subjects are allowed to familiarize themselves with each instrument by one submaximal practice trial. Subjects are instructed to Squeeze as hard as possible. The same procedure is repeated thrice and the mean of all three recording are noted down. Each subject is instructed to squeeze for 3 seconds and then to take a 3 seconds break before the next squeeze. Pinch grip was then followed by using the pinch gauge, the test sequence of which was essentially identical to that of the power grip test. These readings are recorded after giving the subject a 2 minute break post Jamar dynamometer tests to avoid fatigue.

RESULT

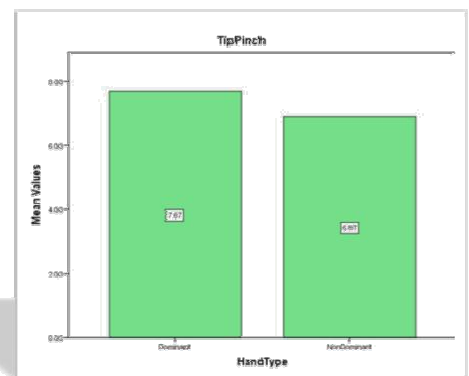
The study concluded that the pinch and the power grip strength was more stronger in dominant than in non-dominant hand but statistically there was no significant difference.



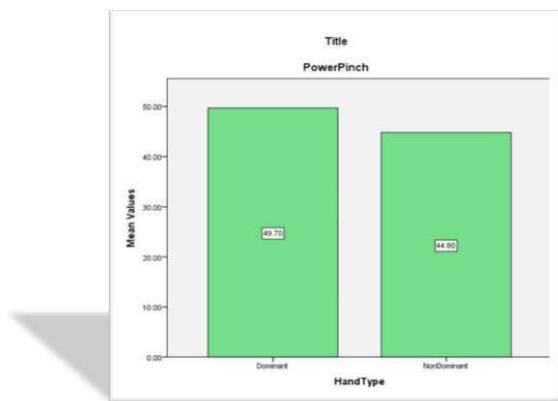
The results revealed that when key pinch was compared in dominant and non- dominant hand of goldsmith workers. The dominant hand revealed greater strength than the latter but they were statistically not significant.



The results revealed that when palmar pinch was compared in dominant and non-dominant hand of goldsmith workers. The dominant hand revealed greater strength than the latter but they were statistically not significant.



The results revealed that when tip pinch was compared in dominant and non- dominant hand of goldsmith workers. The dominant hand revealed greater strength than the latter but they were statistically not significant.



The results revealed that when tip pinch was compared in dominant and non- dominant hand of goldsmith workers. The dominant hand revealed greater strength than the latter but they but they were statistically not significant.

DISCUSSION

The process of jewelry manufacturing is to be performed manually & with daily practice in order to make the work faster; thus causing repetitive strain injury (RSI) & taking a toll on the health of workers.⁵ How much ever the industry gets revolutionized or new concept of work gets emerged ; some crafts are always important in the production of some industries & we cannot always replace the machine with the manpower.⁵ Goldsmiths require high-level of precision, repetitive hand motions, forceful pinching, and sustained wrist postures .

Jewelry making is one such apiary of activity where in technology has still not replaced humans especially in the process of assembling & giving that final touch to the pieces.⁵ Depending on workload the workers need to work either for straight 8 hours a day performing this activity or they break them down into steps. The process of assembling requires sitting for long hours and performing rapid, repetitive movements or maintaining static postures of hand thereby, resulting in overload or fatigue of hands and fingers. Also, the designing of tools (pliers, cables, screw drivers and clippers) demand load on the hand and wrist thus giving rise to various musculoskeletal disorders like carpal tunnel syndrome, supinator syndrome, etc.⁵

Grip and pinch strength measurements are frequently required to provide an outcome for hand injuries and operations. Study was carried out to determine the variations in grip and pinch strength hand injuries. The study demonstrated that differences exist between dominant and non- dominant pinch strengths of non manual workers.⁹ The reported results are contradictory to our study results. The possible reason for these differences could be due to the work demands of the manual workers versus that of non manual workers.

The present study, showed that the key grip strength is stronger than palmar and tip pinch strengths. Palmar pinch strength is stronger than tip grip strength. It was also found that power grip was the strongest component of all the grip strengths. Tip pinch strength was found weaker in comparison to the other grips in both dominant as well as non-dominant hands. The possible hypothesis for this could be the use of tools such as pliers that demands for power grip, cuticle

clippers and tweezers that requires palmar grip. Key pinch is required for holding the bases or the metal object required for soldering or holding the hammers.⁵

Previous study ⁸ carried out on healthcare professionals reported that surgeons require greater grip strength than other healthcare professionals. Therefore they found out that all three pinches i.e. the lateral pinch, pad-pad and tip-tip is significantly higher in surgeons than any other group. Which also correlates with the pinch grip strength of dentists. This is because occupation like surgeons also require strong grip strength for operating using instruments like screwdrivers, forceps, bone cutters, retractors, cast cutters, bone holding which is similar to that of the work of goldsmiths. Therefore this in in agreement to our present study.

In present study, comparing pinch and power grip strength in goldsmiths for the dominant versus non- dominant hand we found that the dominant hand was relatively much stronger than the non-dominant hand. However the differences were not statistically significant. According to the 10% rule the dominant hand is always stronger than the non- dominant hand.¹³ Our study results differ from the above mentioned rule.

The results obtained in our study is in concordance with another study ⁹ that reported no significant differences of grip strength between the dominant and non- dominant hand of heavy manual workers. Another study ⁶ revealed that dominant side had stronger grip and pinch strengths for whole group of healthy individuals. A similar picture was obtained for right handed participants where non-dominant hand grip was stronger and significantly higher for left handed individuals. However, this study was carried out on healthy population irrespective of their occupation, whereas present study is targeted skilled manual workers.

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