Original Article

Correlation of Lateral Pinch Strength with Hand Span in Bead Embroiderers

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Abstract

Background: *Lateral pinch strength is commonly employed indices of strength used in hand evaluations. For all handicrafts professionals, grip and pinch strength is an important criterion to be successful in their profession. The bead embroiderers are one of the major handicrafts worker groups of Bangladesh.*

Objectives: *The study was planned to compare and correlate hand span and lateral pinch strength of the hand in bead embroiderers to establish a baseline data of our own for further studies.*

Materials and Methods: *There was a cross-sectional and analytical study conducted on 150 bead embroiderers in group B and 50 sedentary workers in group A, carried out in the Department of Anatomy, Dhaka Medical College, Dhaka between July 2016 and July 2017. The lateral pinch was measured by using Pinch Gauge Dynamometer. The hand span was taken by using a ruler and unpaired student's t-test and the pearson's correlation coefficient were done to compare and correlate.*

Results: *Lateral pinch strength showed significant positive correlation with hand span in the group B ($r = +0.234$, $P<0.01$) and non-significant positive correlation with hand span in the group A ($r = +0.275$, $P=0.053$).*

Conclusion: *The study findings may contribute significantly to current knowledge for designing machines and hand held devices.*

Key words: *Lateral pinch, Bead Embroiderers, Sedentary workers*

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Introduction

The pinch and grips are commonly seen in many manufacturing industries from the design of small electronic parts to the assembly of large machinery .They are often used for high precision task such as connecting/disconnecting wires, assembling small electronic parts and adjusting controller knobs.[1] It is necessary to produce enough grip and pinch to manage activity of daily life.[2]

Grip and pinch strength are generally the most important parameters to determine proper hand function.[3] They not only describe hand normality but is also used as an objective evaluator of upper extremities in treating hand damage.[3] In pinch grip, metacarpophalangeal joint is stabilized by principally extensor pollicis brevis and flexor pollicis brevis.[4] Palpating thenar eminance during lateral pinch provide some appreciation of action of pinch grip muscle.[4] Peak pinch strength is only relevant for the application of pinch forces of very short durations, whereas sustained pinch strength provide more realistic assessment of strengths capabilities in applied settings. [5]

Acquisition of strength measures in general and finger strength in particular, can require specialized equipment that is not easily integrated in to a working environment.[6] Lateral pinch strength exertions by males on dominant hand was found to be significantly higher. [7–9]

It was reported that mismatches between human anthropometric dimensions and equipment dimensions are known to be contributing factor, for decreased productivity, discomfort, accident, stress, fatigue and injuries.[10]

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Materials and Methods

This cross-sectional and analytical type of study was conducted on the adult Bangladeshi 150 male bead embroiderers in group B and 50 adult Bangladeshi male sedentary workers in group A. The data analysis was carried out in the Department of Anatomy, Dhaka Medical College and Hospital (DMCH), Dhaka from July 2016 to June 2017, after getting ethical clearance from Ethical Review Committee (ERC) of DMCH. The calculated sample size was 150 and cluster sampling done. The detail study procedure was given below.

All the participants age ranging between 25 to 50 years, having 5 years working experience and the age was confirmed by the national ID cards. Both groups have same socioeconomic status.

Procedure of measurement of lateral pinch strength

The pinch strength measurement was recorded by a pinch gauge, with the subject sitting on a chair with the elbow flexed at 90o and wrist in neutral position (Figure 1). Subjects were asked to exert his maximal voluntary contraction (MVC) on the pinch gauge and to hold that force for three second. To overcome the fatigue, subject was given one minute resting period between each exertion. Mean value of three exertion was taken into account. [11]

Pinch Gauge Dynamometer

Figure 1: The procedure of measurement of lateral pinch strength

The procedure of measurement of Hand span

At first the ruler was placed on the table. Then the subject was asked to open his hand as wide as possible and put the thumb finger of the hand on the ruler at the '0' mark. Measurement was taken from the tip of the thumb to the tip of the little finger in cm.[12] (Figure 2)

Figure 2: Procedure of measurement of hand span

Ethical clearance was obtained from the Ethical Review Committee (ERC) of Dhaka Medical College, Dhaka.

Results

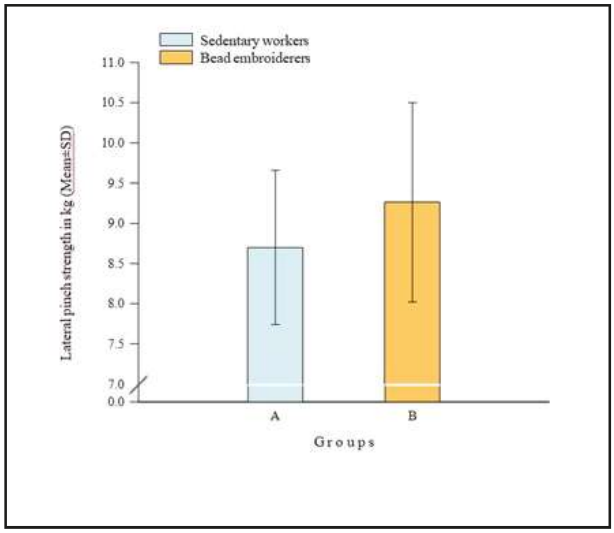
Mean lateral pinch strength (LPS) was 8.70±0.96 kg and 9.26±1.24 kg in group A and group B respectively. The lateral pinch strength ranged from 6.33 kg to 10.83 kg in group A and 7.16 kg to 13.50 kg in group B.

Significant difference was observed between group A and group B in the mean lateral pinch strength (P<0.01). Where mean lateral pinch strength was greater in group B than that of group A. (Table I)

Table I: Comparison of lateral pinch strength between group A and group B

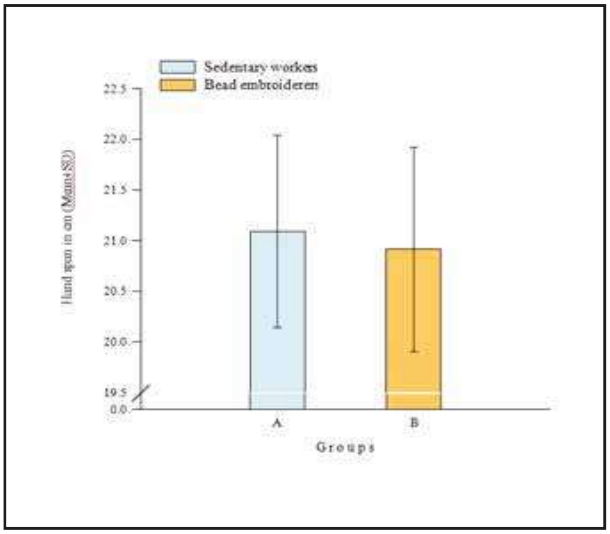
Groups	Lateral pinch strength in kg Mean±SD	*P value*
A (n=50)	8.70±0.96 (6.33 - 10.83)	0.004 **
B (n=150)	9.26±1.24 (7.16 - 13.50)	0.004 **

Table I shows there is significant different in term of LPS in kg. Comparison between group done by unpaired Student's 't' test, ** = significant at P<0.01.



Group A : Sedentary workers
Group B: Bead embroiderers

Figure 3: Lateral pinch strength of group A and group B



Group A : Sedentary workers
Group B: Bead embroiderers

Figure 4: Hand span of group A and group B

Mean hand span was 21.09 ±0.95 cm and 20.91 ±1.01 cm in group A and group B respectively. The hand span ranged from19.30 cm to 23.40 cm in group A and 17.60 cm to 23.50 cm in group B (Table II)

No significant difference was observed between group A and group B group in the mean hand span (P=0.258). Mean hand span was greater in group B than that of group A.

Table II: Comparison of hand depth, hand thickness and hand span between group A and group B

Parameter	**A (n=50)**	**B (n=50)**	**p-value**
Mean±SD			
Hand span	21.09±0.95	20.91±1.01	0.258 ^{ns}
(cm)	(19.30 -23.40)	(17.60 -23.50)	

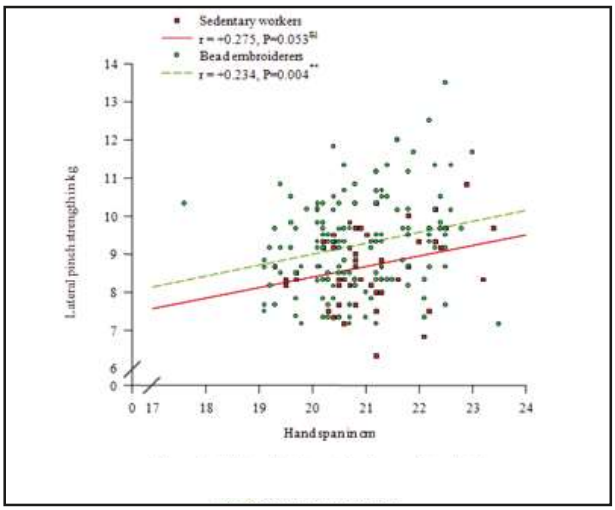
Table II shows significant difference in term of Hand depth, Hand thickness in mm and no significant difference in term of Hand span in cm. Figures in parentheses indicate range. Comparison between group done by unpaired Student's 't' test, ns = not significant, * = significant at P<0.05. (Figure 4)

Lateral pinch strength showed non-significant positive correlation with hand span in the group A (r = +0.275, P=0.053) and significant positive correlation with hand span in the group B (r = +0.234, P<0.01). (Table III)

Table III: Correlation of lateral pinch strength with different anthropometric variables of group A and group B

Anthropometric	**Group A (n=50)**		**Group B (n=150)**	
Parameters	***r value***	***P value***	***r value***	***P value***
Hand span	+0.275	0.053 ^{ns}	+0.234	0.004 **

Pearson's correlation coefficient (r) test was performed to compare relationship between parameter, ns = not significant, * = significant at P<0.05, ** = significant at P<0.01, *** = significant at P<0.001. (Figure 5)



Group A: Sedentary workers
Group B: Bead embroiderers

Figure 5: Relationship between hand span and lateral pinch strength of group A and group B

Discussion

The present anthropometric study was carried out among bead embroidrers in Dhaka city and sedentary workers with a view to measure lateral pinch strength and hand span. It was also looked for any correlation between them.

No significant (P= 0.258) difference was observed between the sedentary workers (group A) and the bead embroiderers (group B) in the mean hand span. In the present study lateral pinch strength showed significant positive correlation with hand span in the group B (r= +0.234, P>0.01).

In contrary to this, Mohammadian, et al. reported mean hand span which was significantly lower (P <0.0001) than the findings of the present study. The researchers showed significant positive correlation between lateral pinch strength and hand span (r= +0.17, P<0.05).[12]

The economic growth and technological improvements have led to greater demand and development of machine and devices and used in industrial settings. Manual operation is still indispensable in different work places, even though there has been a great progress in the automation. Lateral pinch is correlated with hand span, therefore, knowledge of their measurement will be helpful to make the design of hand held device for workers. The lack of properly designed needle and equipments may lead to lower work performance and higher incidence of work related injuries.

Conclusion

The dimensions like lateral pinch strength and hand span may play an important role in designing machine and devices. Further studies with larger sample size to get more precise of Bangladeshi people to establish baseline data is recommended.

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