

Assessment of handgrip strength among clients with osteoarthritis

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Abstract

Osteoarthritis (OA) is a type of degenerative joint disease that results from breakdown of joint cartilage and underlying bone. The most common symptoms are joint pain and stiffness. Usually, the symptoms progress slowly over years. Initially they may occur only after exercise but can become constant over time. Other symptoms may include joint swelling, decreased range of motion, and, when the back is affected, weakness or numbness of the arms and legs.

Objectives: To assess the level of handgrip strength and association between level of handgrip strength among clients with osteoarthritis with their selected demographic variables.

Methodology: A descriptive cross-sectional study design was used. 50 osteoarthritis clients were selected by using Non-Probability convenience sampling technique. Handheld dynamometer was used to assess the level of handgrip strength among clients.

Results: The study result showed that mean and standard deviation on right-hand and left hand for 90° Elbow Flexion were 63±15 and 64±14, 90° Shoulder Flexion were 66±16 and 59±15 and Arm Dangled Position were 60±15 63±16 respectively. The calculated paired 't' test value for 90° Elbow Flexion was 2.96, 90° Shoulder Flexion was 1.98, Arm Dangled Position was 2.23 found to be statistically significant at $p < 0.05$ level. Conclusion - The study concluded that handgrip strength need to be assessed and appropriate exercises can be implemented to improve handgrip strength among clients with osteoarthritis.

Keywords: hand grip strength and osteoarthritis

Introduction

Osteoarthritis (OA) is a type of degenerative joint disease that results from breakdown of joint cartilage and underlying bone [1]. The most common symptoms are joint pain and stiffness. Usually, the symptoms progress slowly over years. Initially they may occur only after exercise but can become constant over time. Other symptoms may include joint swelling, decreased range of motion, and, when the back is affected, weakness or numbness of the arms and legs [2]. The most commonly involved joints are the two near the ends of the fingers and the joint at the base of the thumbs; the knee and hip joints; and the joints of the neck and lower back. Joints on one side of the body are often more affected than those on the other. The symptoms can interfere with work and normal daily activities [3].

According to medical information source 2021, osteoarthritis is the most common form of arthritis, affecting about 237 million people, or 3.3% of the world's population. In the United States, 30 to 53 million people are affected, and in Australia, about 1.9 million people are affected. It becomes more common as people become older. Among those over 60 years old, about 10% of males and 18% of females are affected. Osteoarthritis is the cause of about 2% of years lived with disability [4].

Causes include previous joint injury, abnormal joint or limb development, and inherited factors [5]. Risk is greater in those who are overweight, have legs of different lengths, or have jobs that result in high levels of joint stress.

Osteoarthritis is believed to be caused by mechanical stress on the joint and low grade inflammatory process [6]. It develops as cartilage is lost and the underlying bone becomes affected. As pain may make it difficult to exercise, muscle loss may occur [7]. Diagnosis is typically based on signs and symptoms, with medical imaging and other tests used to support or rule out other problems. In contrast to rheumatoid arthritis, in osteoarthritis the joints do not become hot or red [8].

The main symptom is pain, causing loss of ability and often stiffness. The pain is typically made worse by prolonged activity and relieved by rest. Stiffness is most common in the morning, and typically lasts less than thirty minutes after beginning daily activities, but may return after periods of inactivity [9]. Osteoarthritis can cause a crackling noise (called "crepitus") when the affected joint is moved, especially shoulder and knee joint. A person may also complain of joint locking and joint instability. These symptoms would affect their daily activities due to pain and stiffness [10]. Some people report increased pain associated with cold temperature, high humidity, or a drop in barometric pressure, but studies have had mixed results. [11] Osteoarthritis is the most common cause of a joint effusion of the knee. Osteoarthritis commonly affects the hands, feet, spine, and the large weight-bearing joints, such as the hips and knees, although in theory, any joint in the body can be affected. As osteoarthritis progresses, movement patterns (such as gait), are typically affected [12].

In smaller joints, such as at the fingers, hard bony enlargements, called Heberden's nodes (on the distal interphalangeal joints) or Bouchard's nodes (on the proximal interphalangeal joints), may form, and though they are not necessarily painful, they do limit the movement of the fingers significantly [13]. Osteoarthritis of the toes may be a factor causing formation of bunions, rendering them red or swollen. The objectives of the present study were

- a) To assess the domainwise level of handgrip strength among clients with osteoarthritis.
- b) To find the association between level of handgrip strength among clients with osteoarthritis with their selected demographic variables.

Methodology

Study Design: A descriptive cross-sectional study design was conducted among osteoarthritis clients. 50 osteoarthritis clients were selected by using non-probability convenience sampling technique in Medicine OPD, PHC, Avadi. The eligibility criteria were a) clients diagnosed as Osteoarthritis. b) clients between 18 – 65 years. c) clients of both the sexes were included in the study. d) clients who can able to read and write Tamil and English. e) clients who are available at the time of Data collection. During the initial interview, the purpose of the study was explained to the participants. The participants have been informed that participation is voluntary, and they can withdraw from the study at any time. Confidentiality of information was achieved by maintaining anonymity of the participants. Then the investigator distributed the structured questionnaire for collecting socio-demographic and asked the samples to give their responses by reading carefully. Handheld dynamometer was used to assess the level of handgrip strength from the participants. The clients were asked to seat in an upright position and were instructed to exert a maximum pressure on the handle of the handheld dynamometer in various positions such as 90° elbow flexion, 90° shoulder flexion and arm dangled positions. An average score is then calculated using the measurements from each hand respectively.

Statistical Analysis: Descriptive statistics were used to describe the demographic variables. Descriptive statistics were used to describe the demographic variables, clinical variables and the level of handgrip strength among clients with osteoarthritis. Demographic variables and level of handgrip strength were given in frequencies with percentage. Association between level of handgrip strength among clients with osteoarthritis with their selected demographic variables was analysed using Chi-Square test. $P < 0.05$ was considered as statistically significant. Inferential statistics were used to analyse the data collected. Mean and standard deviation and median value at 25th and 75th percentile were used to compute the level of handgrip strength in clients with osteoarthritis.

Result

About 50 osteoarthritis clients participated in the study. Based on the demographic variables (60%) were aged between 36 – 40 years (60%) were females (72%) were Hindu (32%) were illiterate and undergone primary education (48%) were daily wagers (60%) were in the

income group of Rs. 20,001 – 30,000, 40 (80%) had non-consanguineous type of marriage (60%) were living in the nuclear family (38%) belong to upper middle-class family (56%) were having sedentary life style activity.

Table 1: Frequency and percentage distribution of demographic variables of handgrip strength in patient with osteoarthritis N = 50

S. No	Demographic Variables	Frequency	Percentage
1	Age of Patient		
	18 – 25 Years	8	16%
	26 – 35 Years	12	24%
	36 – 40 Years	30	60%
2	Sex of Patient		
	Male	20	40%
	Female	30	60%
	Others	0	0%
3	Religion		
	a) Hindu	36	72%
	b) Christian	4	8%
	c) Muslim	10	20%
4	Education		
	a) Illiterate	16	32%
	b) Primary School	16	32%
	c) High School	10	20%
	d) Graduate	8	16%
5	Occupation		
	a) Unemployed	11	22%
	b) Daily Wages	24	48%
	c) Agricultural and fishery workers	7	14%
	d) Technicians and associate professionals	8	16%
6	Family monthly income		
	a) Rs. 10000-20000	10	20%
	b) Rs.20001-30000	30	60%
	c) Rs. 30000 & Above	10	20%
7	Types of Marriage		
	a) Consanguineous Marriage	10	20%
	b) Non-Consanguineous Marriage	40	80%
8	Types of Family		
	a) Nuclear	30	60%
	b) Joint	10	20%
	c) extended	10	20%
9	Socio Economic Status		
	a) Lower Class	10	20%
	b) Lower Middle Class	11	22%
	c) Upper Middle Class	19	38%
	d) Upper Lower Class	10	20%
	e) Upper Class	0	0%
10	Type of Activity		
	a) Heavy Activity	10	20%
	b) Moderate Activity	12	24%
	c) Sedentary Activity	28	56%

Table 2: Mean and Standard deviation of handgrip strength in patient with osteoarthritis N = 50

Hand strength	Mean	Standard deviation	Median With 25 th and 75 th Percentile
Right Hand	66.36	6.74	68 (64,69)
Left Hand	62.68	6.19	64 (64, 65)

Table 2 depicts the mean and standard deviation of handgrip strength among clients with osteoarthritis. The mean score and standard deviation on right hand were 66.36 ± 6.74 and

the Left-Hand mean score were 62.68 ± 6.19 respectively. The median value on right hand is 68 and left hand is 64 respectively.

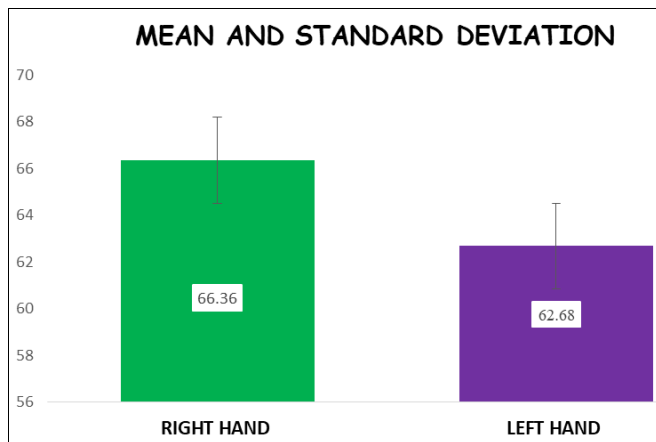


Fig 1: Mean deviation and standard deviation of patient with osteoarthritis

Table 3: Domain wise assessment of handgrip strength among clients with osteoarthritis

Strength output	Right hand	Left hand	t	p value
90° Elbow Flexion	63±15	64±14	2.96	<0.05
90° Shoulder Flexion	66±16	59±15	1.98	<0.05
Arm Dangled Position	60±15	63±16	2.23	<0.05

The table 3 depicts domain wise assessment of handgrip strength among osteoarthritis clients.

Right Hand: The mean and standard deviation for 90° Elbow Flexion was 63 ± 15 , 90° Shoulder Flexion was 66 ± 16 and the Arm Dangled Position was 60 ± 15 respectively.

Left Hand: The mean and standard deviation for 90° Elbow Flexion was 64 ± 14 , 90° Shoulder Flexion was 59 ± 15 and the Arm Dangled Position was 63 ± 16 .

The calculated paired ‘t’ test value for 90° Elbow Flexion was 2.96, 90° Shoulder Flexion was 1.98, Arm Dangled Position was 2.23 found to be statistically significant at $p < 0.05$ level

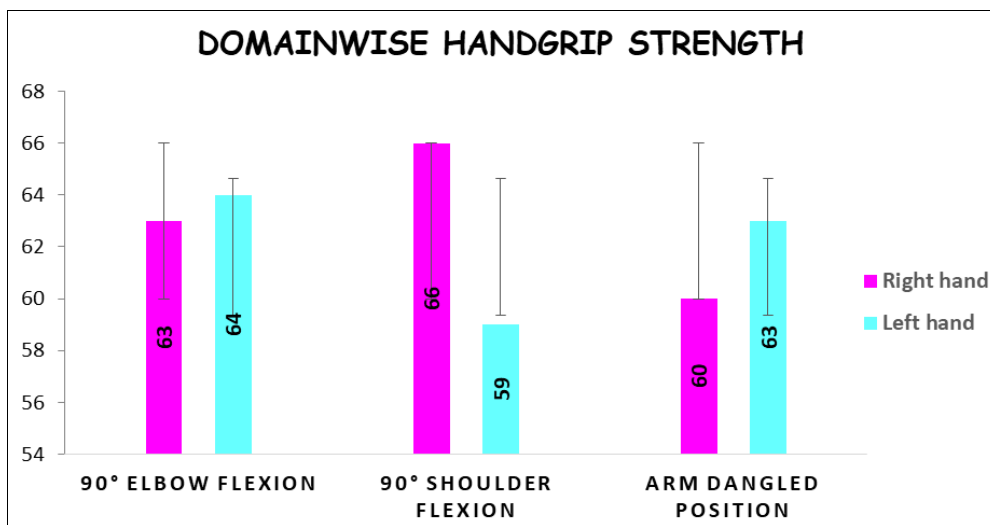


Fig 2: Domain wise assessment of handgrip strength among clients with osteoarthritis

Discussion

Objective 1: To assess level of handgrip strength among clients with osteoarthritis

The present study shows that the mean and standard deviation of handgrip strength among clients with osteoarthritis. The mean score and standard deviation on right hand were 66.36 ± 6.74 and the Left-Hand mean score were 62.68 ± 6.19 respectively. The median value on right hand is 68 and left hand is 64 respectively.

The present study was supported by the following studies. Petchiappan. V *et al.* (2018) [14] conducted a comparative study to assess the handgrip strength in RA and FM patients and to compare it with the age and sex matched controls among 30 subjects. The study result showed that the mean hand grip force in dominant right hand was 87.8 ± 22.7 kilograms in fibromyalgia while in RA it was 60.3 ± 21.0 kilograms. Non-dominant hand grip was 72.5 ± 25.7 kilograms in fibromyalgia while in RA it was 52.2 ± 29.3 kilograms [14]. Heather L Hutchins-Wiese *et al.* (2019) conducted a descriptive study to assess the grip strength among 258 HDM population. Voluntary convenience

sample of 34 HDM clients (23 women, 11 men) participated in the grip strength assessment. The study result showed that the average maximum grip strength was 21.99 ± 6.97 kg for the dominant hand; 16 clients were categorized as having normal, 6 intermediate, and 12 weak grip strength [15]. Uma B.V *et al.* (2019) [16] conducted a comparative study to assess the level of hand grip strength and fine motor skills in 50 skilled and 50 non-skilled persons. The study results showed that MVC values were $22 \text{ Kg} \pm 9.2$ and $26 \text{ Kg} \pm 12.6$, PDT scores were 67 ± 7.9 & 66 ± 9.1 FT count was 111 ± 29.8 and 108 ± 29.2 in skilled non skilled persons [16].

Objective 2: To assess the domain wise level of hand grip strength among clients with osteoarthritis.

The study findings on domain wise level of hand grip strength among clients with osteoarthritis were depicted follows as

Right Hand: The mean and standard deviation for 90° Elbow Flexion was 63 ± 15 , 90° Shoulder Flexion was 66 ± 16 and the Arm Dangled Position was 60 ± 15 respectively.

Left Hand: The mean and standard deviation for 90° Elbow Flexion was 64±14, 90° Shoulder Flexion was 59±15 and the Arm Dangled Position was 63±16.

The calculated paired 't' test value for 90° Elbow Flexion was 2.96, 90° Shoulder Flexion was 1.98, Arm Dangled Position was 2.23 found to be statistically significant at $p < 0.05$ level.

The present study was supported by the following studies. Jakub S. Gašior *et al.* (2018) [17] conducted a cross-sectional study to assess the maximal isometric hand grip strength among 135 school-aged children. The study result showed that maximal mean (\pm SD) HGS achieved was 9.9 (\pm 3.1) kg with position 1, 10.4 (\pm 3.1) kg with position 2, and 9.0 (\pm 3.2) kg with position 3. Handle position 2 was the most comfortable position for 73% of participants. The study concluded that participants obtained significantly higher results using position 2 than using positions 1 or 3 ($P < 0.01$) [17]. Tarek M. El-gohary *et al.* (2019) [18] conducted a cross-sectional study to assess the level of hand-grip and key pinch strength at three arm positions among 61 healthy college students. The hand grip strength on right hand at 90° elbow flexion is 82.5±15.7, 90° shoulder flexion is 84.8±18.4, arm dangled position is 82.9±16.6 at $p > 0.05$ respectively [18].

Objective: To find out the association between level of handgrip strength in patient with osteoarthritis.

The findings of the present study showed that the demographic variables such as osteoarthritis clients aged between 36 – 40 years ($\chi^2=24.9169$, $p=0.00354$), females ($\chi^2=26.831$, $p=0.0001$) and sedentary physical activity ($\chi^2=9.27$, $p=0.05$) had shown statistically significant association with level of hand grip strength. The other demographic variables had no significant association with level of hand grip strength among clients with osteoarthritis. The present study was supported by the following studies. Lihui Wen *et al.* (2017) [19] conducted a prospective study to investigate the association between grip strength and hand and knee radiographic osteoarthritis among 2251 Korean adults. The study result showed that Grip strength in men and women was negatively related to hand (both $p < 0.001$) and knee (men, $p < 0.001$; women, $p = 0.010$). Hand (men, $p < 0.001$; women, $p = 0.001$) and knee (both $p < 0.001$) joint space narrowing (JSN) showed the strongest associations with low grip strength, regardless of gender [19]. Petchiappan. V *et al.* (2018) [14] conducted a comparative study to assess the handgrip strength in RA and FM patients and to compare it with the age and sex matched controls among 30 subjects. The study result showed that age and sex matched healthy controls in both dominant and non-dominant hand grip was significantly lower in RA group ($p < 0.001$) while non-dominant hand grip strength in FM was significantly lower than controls ($p < 0.001$) [14]. Piumi Nakandala *et al.* (2019) conducted a cross-sectional descriptive study on hand grip strength among 524 young undergraduate students. The study result showed that HGS of the dominant hand of male students was 35.27 \pm 5.91 kg, which is significantly higher ($p < 0.05$) than that of the females (19.52 \pm 4.34 kg), the mean BMI normal range (Females- 20.10 \pm 3.40, Males-20.84 \pm 3.37) and the HGS is low, which indicated the association between the sedentary nature of lifestyle and HGS ($P=0.001$) [20].

Conclusion

Evidence based care gives opportunity for nurses to improve their ability and to use the theoretical knowledge in practice. Nurses play a pivotal role in assessing the level of hand grip strength among clients with osteoarthritis. The present study findings highlighted the importance assessing the hand grip strength among clients with osteoarthritis and to improve the proficiency in nursing care. The study concluded that domains such as 90° elbow flexion, 90° shoulder flexion and arm dangled position are critical for assessing the hand grip strength in order to identify physical needs of the clients.

Acknowledgement

The Researchers would like to extend their gratitude and thanks to the study participants.

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