

Relationship of Strength with Pain and Function of Hand in Female Patients with Chronic Rheumatoid Arthritis

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ABSTRACT

Rheumatoid arthritis is a chronic systematic inflammatory disease which is characterised by pain and functional loss in an individual with bilateral involvement of hands, resulting in loss of joint integrity and bony deformities. Grip strength decreases the functional ability and hamper the Activity of daily livings (ADLs). The objective of present study was to assess the relationship between grip strength with key strength, pain and function of rheumatoid hand. A Total of 103 female Rheumatoid arthritis patients of age group 20 to 60 years as per inclusion and exclusion criteria were enrolled for this study. Grip strength was measured by Hand dynamometer and key strength was measured by digital pinch meter, pain score of severity and interference were quantified by Brief Pain Inventory (BPI) scale, hand function score was calculated by short form score for assessment and quantification of chronic rheumatoid affection of hand (SF-SACRAH). There was a significant positive correlation between right hand Grip strength with key strength of right hand ($r = .559, p < 0.01$) and hand function score ($r = -.230, p < 0.05$). The positive correlation of left-hand grip strength with left hand key strength ($r = .616, p < 0.01$) and pain severity score ($r = -.198, p < 0.05$) was also found. The study concludes a positive correlation between grip strength of right hand with key strength and function of right hand in chronic rheumatoid arthritis patients whereas severity of pain shows positive correlation with left hand grip strength. Rheumatoid patients need a better rehab management or their functional status.

KEY WORDS: BPI, GRIP STRENGTH, KEY STRENGTH, RA, SF-SACRAH.

INTRODUCTION

Rheumatoid arthritis is chronic inflammatory autoimmune disease, which is characterised by symmetrical involvement of joint pain and functional loss (Ellegard 2019; Tanaka 2021). According to WHO (2019), rheumatoid arthritis is the second most common cause of disability which affects the productive years of adult life and approximately 50 percent of rheumatoid arthritis patients were not able to perform their full-time job in developed countries. Rheumatoid arthritis is a progressive disease which results in destruction of synovial layer of joint. The mechanism of destruction of joint in rheumatoid arthritis is well known and the osteoclasts have the potential role in erosion of focal bone. Several types of osteoclastic activity are seen by electron microscopy in area

of subchondral bone of metacarpal heads of rheumatoid joint (Smolen et al. in 2019). In early rheumatoid arthritis the inflammation affects the activities of daily livings (ADLs) because of pain and swelling. As disease progresses joint become worsen and hamper the functional activity of patients (Tanak 2019). The grip force and pinch force get decreased due to involvement of MCP joint and functional activity and ADLs ability of an individuals is also hampered due to muscular weakness in these patients (Juan et al. 2019; Ellegard 2019; Tanaka 2021).

A compensatory intervention programme such as assistive devices and joint protection splints are needed to improve ADLs in rheumatoid arthritis disease (Kopruluoglu et al. 2020). Despite the pharmaceutical intervention physical therapy was also play remarkable role in management of chronic RA patients. Large joints respond well but small joints need more attention of physical therapist for functional status. The objective of this study was to measure the grip

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and key pinch strength of both the hand and correlate them with severity and interference score of pain and hand function in chronic rheumatoid arthritis female patients. This study will help to provide guidance for management of functional disabilities of hand in female patients of chronic rheumatoid arthritis. These patients may need a better protocol for better functional status (Tanaka 2021).

MATERIAL AND METHODS

The study was conducted in Pt.B.D. S PGIMS Rohtak from July (2016) to June (2017). Total 103 female subjects were enrolled in study as per inclusion criteria who signed the Helen ski declaration form. Ethical clearance was obtained from the institutional ethical committee of Pt. B.D. Sharma PGIMS Rohtak wide letter No: IEC/17/387 dated 25.03.17 for data collection, before commencement of study. Female subjects between age group of 20-50 years, who clinically diagnosed RA as per ACR criteria 1987 at least 2 years and subjects on DMARDs more than 2 years with no hand deformities were included in study. Severe anaemic, evidence of hypothyroid, renal, cardiac and pulmonary disease, who has undergone any recent fracture and hand surgery and pregnant females were excluded from study (Borsson et al. 2009). Grip strength is a muscle strength of flexor group of muscle and it was quantified by hand dynamometer. It was measured in sitting position with shoulder slightly in abduction and zero degree in medial and lateral rotation, elbow in flexed to 90-degree forearm was in zero degree of supination and pronation, and wrist in 0 to 30 degree of dorsiflexion and 0 to 10 degrees in ulnar deviation (Robert et al. 2011; Salaffi et al. 2021).

Key strength was measured by digital pinch gauge. Key strength was measured because it was usually used to hold key and other utensils used in daily activities. Position of subjects were sitting with shoulder slightly in abduction and in lateral rotation, elbow was flexed to 90 degree, forearm was in zero degree of supination and pronation and wrist in 0 to 30 dorsiflexion and 0 to 10 degree in ulnar deviation. Examiner held the distal end of gauge to prevent dropping (Mathiowetz et al. 1985; Silva et al. 2018). Brief pain inventory scale was used to measure pain severity and interference score in this study. In Chronic Rheumatoid Arthritis, various physical functions of patients were measured in terms of qualitative and quantitative data. Pain was also measured in quantitative form so as to check after treatment whether condition of patients is improved or not. Brief pain inventory was a self report questionnaire which include severity of pain and interference of pain.

Severity of pain was assessed by mean value of four questions of various level of pain during past few weeks which were measured on 0 to 10 Visual Analogue Scale. Pain interfere score was calculated by mean value of five questions of various activity of daily living like walking, mood, relationship with others and sleep etc (Somers et al. 2009). SF-SACRAH was a score for assessment and quantification of chronic rheumatoid affection of hand, which was used to measure the functional activity of rheumatoid hand. It is a self report questionnaire which is concerned mainly with hand function, pain and stiffness.

It consists of five questions out of which three were based on various functional hand activities and one each for pain and stiffness. Each question rated 0 to 100 score, whereas 0 meant patients hand activities was possible without any difficulties, 50 meant hand activities were possible with some difficulties and 100 meant unable to do (Kumar et al. 2012; Stummer et al. 2017).

RESULTS AND DISCUSSION

A total of 103 female patients of chronic rheumatoid arthritis were participated in the study and all of them completed the study. The results were analysed with the software SPSS-16.0 for window version. Mean and SD were calculated for Grip strength, key strength, pain scores and hand function. Correlation was checked between the various variables (grip strength, key pinch strength, pain severity score, pain interference score, hand function score) by bivariate two tailed test of correlation using Pearson coefficient. In all statistical analysis, $p < 0.05$ was considered as significant.

Figure 1.1: grip strength measured by hand dynamometer.



The demographic data of all patients was such as age, duration of disease, Duration of DMARDs, blood reports, grip and key strength of both the hand, hand function score and pain severity and interference score were shown in table 1.1.

Table 1.2. Represent the correlation of the right-hand grip strength with other variables. Right hand grip strength shows positive correlation between with left hand grip strength ($r = .738$, $p < 0.01$), key strength of right hand ($r = .559$, $p < 0.01$) and hand function score, SF-SACRAH ($r = -.230$, $p < 0.05$).

Table. 1.3. Represent the correlation of the left-hand grip strength with other variables. Left hand grip strength show positive correlation between with left hand key strength ($r = .616$, $p < 0.01$) and pain severity score ($r = -.198$, $p < 0.01$) and hand function score, SF-SACRAH ($r = -.230$, $p < 0.05$).

This study was conducted to evaluate the correlation between grip strength with key pinch strength of both the hands, pain severity and interference score and hand function score in chronic rheumatoid arthritis patients. In this study grip strength of right hand showed positive correlation with key strength of right hand ($r = .559$, significant $p < 0.01$) and with

hand function score SF-SACRAH ($r=-.230$, significant $p<0.05$). Whereas grip strength of left hand showed positive

correlation with key pinch strength of left hand ($r=.616$, significant $p<0.01$) and with pain severity score ($r=-.198$, significant $p<0.05$).

Table 1.1 the demographic data of the subjects (n=103).

	min	Max	Mean \pm SD
Age (years)	20	50	40.45 \pm 7.58
Residential status	Urban 58	Rural 45	
Duration of Disease (years)	2	15	5.19 \pm 3.05
Duration of DMARDs (years)	2	10	3.43 \pm 1.86
Family history	Yes 43	No 60	
Occupation	Home maker 38	Working 65	
Rheumatoid factor	Positive 81	Negative 22	
Blood report			
Hb	6	14.7	10.74 \pm 1.75
ESR	12	100	50.94 \pm 15.86
Dexa score	-2.8	1.7	-.06 \pm 1.42
Grip strength (Kg)			
Right hand	2.8	14.1	8.80 \pm 2.18
Left hand	3	15.3	8.73 \pm 2.51
Key strength (Kg)			
Right hand	1	9.3	4.54 \pm 1.73
Left hand	1.2	7.2	4.26 \pm 1.69
Pain			
Severity score	3	9.25	6.24 \pm 2.16
Interference score	2	8.75	6.71 \pm 1.88
Hand function score	16	94.3	59.27 \pm 37.00
SD: standard deviation min: minimum max: maximum			

Table 1.2. Correlation of right grip strength with other variables.

Variables	Pearson's correlation coefficient (r)	p-value (by 2 tailed test)	Significant
Left grip grip strength	.738*	.000	Significant at the 0.01 level (2-tailed).
Right hand key strength	.559*	.000	Significant at the 0.01 level (2-tailed).
Pain severity score	-.181	.067	NS
Pain interference score SF-SACRAH	-.043	.664	NS
	-.230	.019	Significant at the 0.05 level (2-tailed).
*: significant $p<0.01$ NS: non-significant			

Table 1.3. Correlation of left-hand grip strength with other variables.

Variables	Pearson's correlation coefficient (r)	p-value (by 2 tailed test)	Significant
Left hand key strength	.616*	.000	Significant at the 0.01 level (2-tailed).
Pain severity score	-.198*	.045	Significant at the 0.05 level (2-tailed).
Pain interference score	-.161	.104	NS
SF-SACRAH	-.181	.067	NS
*: significant p<0.01		NS: non-significant	

Dellhag and Bjelle et al. (1995) reported that hand grip force was significantly correlated with hand function. Terslev et al. (2003) identified the pathological processes which are responsible for this are thought to be 'rheumatoid cachexia' (loss of muscle cell mass and destruction of muscle architecture because of the autoimmune, catabolic nature of the condition) as well as disuse atrophy of muscle, which hamper the functional activity of hands. Adams et al. (2004) and Ellegaard et al. (2019) described that Pain is also affect the functional activity of hands and accordingly cause the ADLs limitations (Ellegaard et al. 2019; Salaffi et al. 2021).

Uutela et al. (2018) also reported that muscle strength of hands were lowered in rheumatoid arthritis patients and it was significantly correlated with hand function. Bjork et al. (2011) reported that women feel more pain as compared to men and pain severity affect the hand function as disease progressed. Hallert et al. (2012) also reported that despite of all intervention at regular follow up in rheumatoid patients the disability is progresses as disease progressed because of joint damage (<2years). Dedeoglu et al. (2013) found the positive correlation between hand strength with pain and functional activity in rheumatoid arthritis patients. Approximately 30% reduction in hand function were found as compared to healthy individuals. Bohannon RW. et al.in (2013) found that grip and key pinch strength were associated to disability and impairment, level of disease activity, joint surface damage, discomfort, and disease duration in the rheumatic population. Salaffi et al. (2021) described that joint pain and swelling were common symptoms resulting in diminished grip strength and function of hand (Salaffi et al. 2021). The limitation of study was wide age group 20-50 years and dominant hand was not considered. Future research is needed to find the relationship between dominant hands with functional activity and quality of life in chronic rheumatoid arthritis patients. This study was design to evaluate the correlation between grip strength of hands with pain severity and function in chronic rheumatoid hand.

CONCLUSION

The findings of the present study concluded that grip

strength of right hand shows the positive correlation between key pinch strength of right hand and function of hand in Chronic Rheumatoid arthritis patients. Whereas grip strength of left hand showed positive correlation with key pinch strength of left hands and pain severity score. The study states that research hypothesis is accepted.

Conflict of Interests: Authors declare no conflict of interests to disclose.

Ethical clearance Statement: Ethical clearance was obtained from the institutional ethical committee of Pt. B.D. Sharma PGIMS Rohtak wide letter No: IEC/17/387 dated 25.03.17 for data collection, before commencement of study.

Data Availability Statement: The database generated and /or analysed during the current study are not publicly available due to privacy, but are available from the corresponding author on reasonable request.

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