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Hyperextension of the Thumb: Prevalence and its Impact on Grip Strength in Manual Therapy Practitioners

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Abstract

Background: Manual therapists, such as physiotherapists are frequently engaging in repetitive hand motions that necessitate significant grip strength and stability of the thumb. Thumb hyperextension beyond its usual range of motion, can result in decreased hand grip strength and potentially hinder the therapist's ability to carry out their responsibilities proficiently. The study hypothesizes that manual therapists with thumb hyperextension will demonstrate significantly lower grip strength compared to those without hyperextension. The objective of this study is to evaluate the frequency of thumb hyperextension and its correlation with decreased hand grip strength in manual therapists. **Methods**: A cross-sectional study involved 309 physiotherapists with at least 1 year of manual therapy experience. Assessments included thumb extension range of motion using a goniometer and hand grip strength with a digital dynamometer. Spearman's correlation test was employed to determine the relation between thumb hyperextension and demographic variables with grip strength. **Results**: Prevalence of thumb hyperextension was 41% among the participants. The mean grip strength and the work experience of the participants were 32.25±2.92 and 5.29±3.98 respectively. However, there is no significant relationship exist between thumb hyperextension and demographic with grip strength. **Conclusion**: The study demonstrates a significant occurrence of thumb hyperextension among physiotherapists, with 41% of participants being affected. However, there was no significant association observed between thumb hyperextension and grip strength, as well as between demographic characteristics and grip strength. This study indicates that thumb hyperextension is frequently observed among manual therapists, but it does not have a direct effect on their grip strength and is not impacted by demographic characteristics. **Major Findings:** Thumb hyperextension affects 41% of manual therapists, but no significant association exists with grip strength or demographic factors, suggesting it doesn't directly impact this population.

Keywords: Grip Strength, Health Risk, Manual Therapists, Thumb Hyperextension

1. Introduction

Manual therapists, such as physiotherapists, chiropractors, and massage therapists, have a vital role in the management and treatment of musculoskeletal problems. Due to the nature of their occupation, they are very prone to developing Musculoskeletal Diseases (MSDs) that affect their hands, as their job requires frequent and repeated use of their hands[1]. Hyperextension of the thumb is a distinct syndrome that can have a substantial impact on hand function, resulting in decreased grip strength and deteriorate professional performance. The

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Metacarpophalangeal (MP) joints enable a broad range of finger movements such as pinching and gripping[2]. Thumb hyperextension occurs when the thumb is extended beyond its normal range of motion, often due to repetitive stress and overuse. Joint instability, discomfort, and weakness can arise from this illness, leading to a decrease in hand grip strength[3]. Hand grip strength is an essential predictor of hand function and is necessary for efficiently carrying out manual therapy approaches[4]. Previous findings reported that 83% of Physiotherapists who do spinal manipulation reported experiencing thumb pain, which was worsened by using manipulative therapy procedures. Also, physiotherapist practicing manual therapy for more than 5 years are experiencing thumb pain within 12 months period[5]. Studies have shown that physiotherapists are vulnerable to musculoskeletal disorders due to their profession. After back and neck pain, thumb issues are the second most common complaints. Thumb hyperextension can lead to recurrent strain in physiotherapists due to the repeated use of their thumbs, which can strain the ligaments and joints[6]. Grip strength is a crucial component of general health and function of upper extremity. In healthy adult populations, grip strength is categorized as follows: Poor if less than 29.0 kg, moderate between 29.0 and 34.0 kg, and good if greater than 34.0 kg. The grasp becomes wider as the thumb moves away from the palm and increases the area of contact between the palm and the object[7,8]. Thumb extension range of motion restrictions can impair the hands capacity to produce its maximal grip force[9]. A therapist's capacity to execute manual treatments efficiently may be jeopardized by a reduction in hand grip strength, which could result in subpar work output and a higher risk of occupational harm[10]. There is a dearth of comprehensive data regarding the prevalence and relationship between thumb hyperextension and hand grip strength in manual therapists, even though the importance of hand grip strength and the occurrence of thumb disorders in this professional group are acknowledged. Understanding this relationship is crucial in order to develop targeted interventions that could mitigate these occupational hazards and improve the well-being and proficiency of manual therapists. Although manual treatment heavily relies on hand function, there is a lack of studies specifically investigating thumb hyperextension and decreased grip strength in this population. It is essential to address this gap to develop effective preventive and therapeutic approaches. This study hypothesizes that manual therapists with thumb hyperextension will demonstrate significantly lower grip strength compared to those without hyperextension. Therefore, the current study aimed to determine the prevalence of thumb hyperextension and its correlation with grip strength amongst physiotherapist practicing manual therapies.

2. Materials and Methods

2.1 Participants

A total of 309 participants were recruited for this cross-sectional study, using convenience sampling. Participants were physiotherapists with at least one year of experience in manual therapy. Inclusion criteria specified participants aged between 24 and 39, from both genders, currently practicing in Bangalore. Exclusion criteria included individuals with a history of hand surgery, inflammatory hand disorders, arthritis, previous thumb or wrist injuries, or any other chronic musculoskeletal conditions of the upper limb. Additionally, those involved in secondary occupations requiring significant physical labour were excluded to maintain study consistency.

2.2 Sample Size

The sample size was estimated using the Taro Yamane formula, based on a 95% confidence interval and a 5% margin of error[11]. With an assumed total population of 1,500 registered physiotherapists in Bangalore, the required sample size was calculated as 306. To ensure adequate representation, 309 participants were recruited.

2.3 Sampling Method and Recruitment

A convenience sampling method was used to recruit participants due to practical constraints in accessing the full physiotherapist population in Bangalore. Participants were recruited through professional networks, physiotherapy clinics, and local physiotherapy associations. Information about the study was distributed via emails and notices at professional gatherings, inviting eligible manual therapy practitioners to participate voluntarily.

2.3.1 Ethical Approval and Participant Consent

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Dayananda Sagar

University. Informed consent was secured from each participant prior to data collection. Participants were provided with detailed information regarding the study's objectives, potential risks, and confidentiality measures. Participation was voluntary, and all participants were informed of their right to withdraw from the study at any stage. To maintain confidentiality, participant data was anonymized, and only aggregated data was used in analysis and reporting. Access to individual data was restricted to the principal investigators.

2.4 Outcome Measurement

2.4.1 Thumb Extension Range of Motion

The process of assessing the Range of Motion (ROM) for thumb extension using a finger goniometer involves accurately measuring the angle formed by the thumb when extended. The patient's positioning involves keeping their fingers relaxed and aligning the goniometer correctly with the proximal or distal bone of the thumb. The patient is asked to extend their thumb away from the palm, and compensatory movements are monitored to ensure isolation. The angle on the goniometer is read and recorded, and the process is repeated if necessary for accuracy[12].

2.4.2 Hand Grip Strength

A calibrated digital Jamar dynamometer (Performance Health, Warrenville, IL) was employed, with its handle positioned in the second position. Participants were directed to exert maximum force on the dynamometer while sitting upright, with their arms at their sides, elbows bent at a 90° angle, and forearms in a neutral position. The patient was instructed to squeeze the dynamometer with maximum effort, maintaining the squeeze for three to five seconds. The measurements were recorded in kilograms and the average of the three measurements was calculated to represent the patient's hand grip strength[13].

2.5 Statistics Analysis

SPSS software, version 29.0.10, from Chicago, Illinois-based SPSS Inc., was used for data analysis[14]. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were used to summarize the data. The prevalence rate of decreased hand grip strength and hyperextension of the thumb was calculated. The relationship between demographic variables, Range of Motion (ROM) of thumb extension, and grip strength of the dominant hand was assessed using Spearman's correlation (r) as the data did not meet the normality assumption[15].

3. Results

The study included 309 participants, with a female majority (59.2%). The average age of participants was 29.1±4.2, and their average BMI was 25.42±3.06. Regarding work experience, the majority had 5 years or less (55.7%), with fewer participants in the 6 to 10 years range (32.7%). The Range of Motion (ROM) for thumb extension in the dominant hand averaged 41.38±9.3, with 58.3% having a ROM of 45 degrees or less. The mean grip strength of the dominant hand was 32.25±2.92, with the highest frequency in the 30 to 34 kg range (44.3%) shown in Table 1.

Table 2 indicates that there was no significant correlation between grip strength of the dominant hand and ROM of thumb extension, BMI, age, or work experience, with p-values of 0.354, 0.414, 0.63, and 0.674 respectively. The only significant correlation observed was between age and work experience (Spearman's rho = 0.997, $p < .001$), indicating a strong positive relationship. No other variables showed significant correlations with each other, suggesting that grip strength, ROM of thumb

Table 1. Demographics of the participants (N = 309)

Variables	Mean ± SD	Frequency (%)
Gender		
Male		126(40.8)
Female		183(59.2)
Age (Year)	29.1±4.2	
BMI (kg/m2)	25.42±3.06	
Work experience (Year)	5.29±3.98	
Less than or equal to 5		172(55.7)
6 to 10		101(32.7)
ROM Thumb Extension (Dominant hand) (degrees)	41.38±9.3	
Less than or equal to 45		180(58.3)
More than 45		129(41.7)
Grip strength of dominant hand (Kg)	32.25±2.92	
Less or equal to 29		64(20.7)
30 to 34		137(44.3)
More than 34		108(35.0)
BMI- Body Mass Index, ROM- Range of Motion		

extension, BMI, and age are relatively independent of each other in this sample.

4. Discussion

The current cross-sectional study set out to find out how often thumb hyperextension is among manual therapists and whether it correlates with hand grip strength. The study aimed to provide a comprehensive assessment of the physical characteristics and demographic profiles of a sample of 309 participants. The descriptive statistics revealed that the participants had a mean age of 29.1 years, with a relatively even distribution of gender (59.2% male, 40.8% female) and a predominance of right-hand dominance (95.1%). The participants exhibited a mean BMI of 25.42 kg/m², indicating that a significant proportion (42.5%) were overweight[16]. These results show that the sample population typically maintains a healthy weight because they are within the normal range. This is significant because, for manual therapists who primarily rely on their physical talents, maintaining a healthy BMI is frequently linked to improved physical performance and a decreased risk of musculoskeletal illnesses[17].

The individuals mean work experience was 5.33 years, which suggests a moderate amount of professional exposure. Interestingly, most participants had worked for 5 years or fewer, which is consistent with the cohort's relatively youthful age. Given that less experienced therapists may differ physically from their more experienced colleagues, this demographic data is essential for understanding the study's conclusions. Because manual therapy procedures are repetitious, prior research has indicated that professional experience may impact physical attributes including thumb flexibility and grip strength[18].

Regarding the physical measurements, the participants had an average grip strength of 32.25 kg in their dominant hand, with the majority (44.3%) falling within the 30-34 kg range. The Range of Motion (ROM) of thumb extension in the dominant hand averaged 41.38 degrees, with over half (58.3%) of the participants having a ROM of 45 degrees or less. These findings provide valuable insights into the physical capabilities and limitations of the study population, which may have implications for various occupational and clinical applications. These results are in line with those of Holzbauer M. and Hopfner M, who observed that because of the demands of their work, a

Table 2. Spearman's correlation matrix for grip strength of dominant hand, ROM of thumb extension, BMI, age, work experience

		Grip Strength of Dominant Hand (Kg)	ROM of Thumb Extension (Dominant Hand) (Degrees)	BMI (kg/m2)	Age (Year)	Work Experience (Year)
Grip strength of dominant hand (Kg)	Spearman's rho df p-value	— — —				
ROM of thumb extension (Dominant hand) (degrees)	Spearman's rho df p-value	-0.053 307 0.354	— — —			
BMI (kg/m2)	Spearman's rho df p-value	0.047 307 0.414	0.037 307 0.516	— — —		
Age (Year)	Spearman's rho df p-value	0.028 307 0.63	-0.016 307 0.777	0.002 307 0.969	— — —	
Work experience (Year)	Spearman's rho	0.024	-0.012	-0.007	0.997***	—
	df	307	307	307	307	—
	p-value	0.674	0.836	0.9	<.001	—

Note. * p < .05, ** p < .01, *** p < .001

considerable percentage of manual therapists exhibit increased thumb hyperextension[19]. This distribution is consistent with earlier research by Amo-Setien, who classified grip strength in a healthy adult sample using comparable criteria[20].

The correlation analysis revealed that the measured physical characteristics and demographic variables were largely independent of one another. Grip strength of the dominant hand, ROM of thumb extension, BMI, age, and work experience did not exhibit any significant correlations, suggesting that these factors represent distinct and unrelated aspects of the participants profiles. The only exception was the strong, positive correlation between age and work experience, which is an expected relationship as individuals typically accumulate more work experience as they age[21].

There could be a number of reasons for this weak association. Initially, it is possible that the participants relatively young age and moderate work experience did not provide enough time for significant changes in their physical attributes to occur. Second, physical characteristics of manual therapists may become homogeneous due to identical training and work-related activities, which would reduce the diversity needed to find meaningful relationships. These results are in line with those of Ruiz-Fernandez MD, who likewise discovered no meaningful relationship between healthcare personnel physical ability and professional experienc[22].

Furthermore, the implications of thumb hyperextension extend beyond individual hand function, potentially impacting the overall quality of care provided by manual therapists. Reduced grip strength can compromise the therapist's ability to perform manual manipulations effectively, potentially leading to suboptimal treatment outcomes for patients. This underscores the importance of early detection and intervention for thumb hyperextension to preserve both the health of the therapist and the quality of care they provide[23]. Addressing these issues is crucial for the therapist's well-being and maintaining high standards in patient care[24].

The findings also highlight the need for comprehensive ergonomic assessments and interventions explicitly tailored to manual therapists. Given the high prevalence of thumb hyperextension and its potential impact on hand function, routine monitoring of thumb ROM and grip strength should be integrated into occupational health protocols for this population[25]. Ergonomic interventions might include adjustments to the therapist's work environment, adopting tools that minimize hand strain, and implementing exercises designed to strengthen the thumb and improve joint stability[8].

Given the critical role of manual therapy in pain management and physical rehabilitation, it is essential that therapists are aware of the potential risks associated with thumb hyperextension and take preventive measures to mitigate these risks[26]. Implementing evidence-based strategies to minimize thumb pain and enhance manual therapy outcomes is crucial for maintaining the effectiveness of treatment interventions[27]. Furthermore, modern teaching and practice methods that emphasize the preservation of hand function are necessary to ensure the longevity of therapists' careers[28].

In addition to these preventive measures, further research is warranted to explore the long-term effects of thumb hyperextension on manual therapists and to identify effective interventions that can mitigate these risks. Longitudinal studies could provide valuable insights into the progression of thumb hyperextension, its impact on hand function over time, and the effectiveness of various ergonomic and therapeutic interventions[29]. Such studies would help in developing evidence-based strategies to preserve hand function and improve the quality of life for manual therapists.

This study contributes to understanding manual therapists' occupational health risks, particularly thumb hyperextension and its impact on grip strength. The findings underscore the need for ongoing research, preventive strategies, and interventions to protect this vital workforce from conditions that could compromise their ability to perform manual therapies effectively. Addressing these issues is essential not only for the well-being of the therapists but also for ensuring the quality of care provided to patients.

5. Conclusion

This study explored the prevalence of thumb hyperextension among manual therapists and its potential relationship with hand grip strength. The findings indicate no significant associations between thumb hyperextension, job experience, and grip strength. Rather, the majority of participants demonstrated intermediate levels of both grip strength and thumb hyperextension. These observations suggest that, within a relatively young

and moderately experienced cohort, neither thumb hyperextension nor professional experience considerably impacts grip strength. Further research is needed to identify additional factors that may affect these physical characteristics to support the effectiveness and long-term health of manual therapists.

5.1 Limitations

This study has limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causality between thumb hyperextension and reduced grip strength. Longitudinal studies would be necessary to assess the progression of these conditions over time. Second, the sample was limited to manual therapists in a specific geographical region, which may limit the generalizability of the findings to other populations or settings. Third, the study relied on self-reported data for certain variables, such as work experience, which may be subject to recall bias. Additionally, the study did not account for other potential confounding factors, such as the therapists overall physical health, previous injuries, or the specific techniques used in their practice, which could influence the results. Future research should address these limitations by including a more diverse sample, using longitudinal designs, and considering additional variables that may impact the relationship between thumb hyperextension and hand function.

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7. Author's Contribution

VKC, HTK: Substantially contributing to conception, and acquisition of data; VKC, HTK: Substantially contributing to conception, design, analysis, interpretation of data and drafting the article and revising, VKC, VKP, BEO: Analysis and interpretation of data, drafting the article and revising.

8. Statement for Ethical Approval

Ethical approval letter no**:** ISC/Intern/DSU/2024/118.

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