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Original Article

Association of Repetitive Gripping Motion and Trigger Finger in Construction Workers

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ABSTRACT

Background: Trigger finger, or stenosing tenosynovitis, is a common hand disorder characterized by painful locking or catching of the fingers due to inflammation and narrowing of the flexor tendon sheath. Occupations involving repetitive hand use, such as construction work, impose significant mechanical stress on the tendons and may predispose individuals to trigger finger, yet this occupational risk remains under-investigated. Objective: To evaluate the association between repetitive gripping motions and the prevalence and severity of trigger finger among construction workers. Methods: A cross-sectional observational study was conducted among 185 construction workers from three sites in Lahore, Pakistan, between July and December 2024. Participants were assessed using the Hand 20 test for functional disability, the Quinnell grading system for severity, and the Visual Analog Scale (VAS) for pain. Repetitive gripping frequency was self-reported and categorized into three exposure groups. Logistic regression was used to determine odds ratios (OR) while adjusting for confounders. Results: Trigger finger symptoms were reported in 29.7% of participants. Those performing >30 gripping motions/day had significantly higher Hand 20 scores (mean = 24.3), greater pain (VAS = 3.9), and an adjusted OR of 6.98 (95% CI: 2.05–23.80) for trigger finger compared to the <10/day group ($p < 0.001$). Diabetes and increasing age were also independent risk factors. Conclusion: High-frequency repetitive gripping is significantly associated with increased risk and severity of trigger finger among construction workers, warranting targeted ergonomic and preventive interventions in labor-intensive occupations.
Keywords: Trigger finger, repetitive gripping, construction workers, Hand 20 test, musculoskeletal disorders, occupational health.

INTRODUCTION

Trigger finger, medically termed stenosing tenosynovitis, is a prevalent musculoskeletal disorder characterized by a painful catching or locking of the fingers during flexion and extension, often resulting from inflammation-induced narrowing within the retinacular sheath surrounding the flexor tendons (1). Chronic mechanical strain on these tendons can lead to fibrosis and nodule formation, exacerbating functional impairment (2). Occupations requiring repetitive manual effort, particularly those involving forceful gripping, have been strongly associated with tendon-related disorders, including trigger finger, due to repetitive loading and microtrauma to flexor tendon sheaths (3). Construction work is among the professions at the highest risk, given its demanding physical nature, which includes persistent grasping, lifting, and operating tools—tasks that consistently stress the tendons of the hand and forearm (4).

Studies have demonstrated that professions involving sustained or repetitive gripping—such as musicians, meat packers, and industrial laborers—experience increased incidence of trigger finger due to cumulative tendon overload (5,6). For instance, Gorsche et al. observed a notably high prevalence of trigger finger in meat-packing plant workers (5), a finding echoed by subsequent occupational health studies linking repetitive hand use to flexor tendon dysfunction (7). In Pakistan, a study by Amjad et al. reported trigger finger in 2.2% of musicians and attributed its onset to repeated handling of heavy instruments and hand motions (8). Although the risk is known in certain professions, there remains a notable paucity of research specifically examining construction workers—individuals arguably subjected to one of the most intense forms of repetitive gripping due to the biomechanical demands of their work.

Despite the wide recognition of trigger finger across manual labor occupations, limited epidemiological evidence exists in South Asian contexts, particularly among high-risk construction workers. While a Japanese registry study by Okita et al. identified a 9.7% prevalence in individuals aged 50–89 years, it highlighted advanced age and female gender as primary risk factors (9). In contrast, a study conducted among Pakistani barbers by Zoha et al. showed a much lower prevalence of 1.7%, suggesting occupational specificity in trigger finger

development (10). These contrasting findings underscore the necessity for industry-specific investigations into how ergonomic exposures—especially repetitive gripping—translate into pathophysiological outcomes such as tendon entrapment and inflammation.

Construction work demands a significant degree of hand-intensive activity. Gripping tools, lifting materials, and manipulating mechanical equipment all contribute to sustained tendon loading. Such repeated exposure may cause microvascular trauma, promoting an inflammatory cascade that eventually narrows the tendon sheath and compromises normal tendon gliding (11). The term "repetitive gripping" thus captures a key biomechanical construct involving repeated contractions of the finger flexors and intrinsic hand muscles, which can lead to neuromuscular fatigue, tendon inflammation, and eventual loss of hand function (12). Farooq and Khan demonstrated that repetitive gripping impacts not only the fingers but also contributes to altered biomechanics in the upper limb joints, including the shoulder and elbow, further emphasizing the systemic biomechanical implications of such activity (13). However, most research has either focused on clinical management or studied general population groups, leaving a void in the literature regarding the work-specific biomechanical burden of trigger finger in construction laborers. Therefore, this study aims to investigate the association between repetitive gripping motions and the occurrence of trigger finger among construction workers. By employing validated assessment tools such as the Hand 20 test, Quinnell grading, and VAS for pain, and examining the frequency of gripping activities, this research seeks to bridge the existing knowledge gap concerning occupational health risks in a vulnerable yet under-investigated population. Identifying ergonomic risk factors specific to construction work will not only contribute to the scientific understanding of trigger finger pathophysiology but also inform future preventative strategies and workplace interventions. The objective of this study is thus to determine whether a statistically significant relationship exists between the frequency of repetitive gripping motions and the prevalence and severity of trigger finger symptoms in construction workers.

MATERIAL AND METHODS

This study employed a cross-sectional observational design to investigate the association between repetitive gripping motions and the presence and severity of trigger finger among construction workers. The rationale for this design lies in its suitability for identifying potential relationships between occupational exposures and musculoskeletal conditions within a defined population at a single point in time. Data collection was carried out from July 2024 to December 2024 across three construction sites in Lahore, Pakistan: Model City, the University of Lahore campus construction site, and Rehan Can Pvt. Ltd. These locations were selected based on ongoing labor-intensive construction activities and accessibility for the research team.

Participants included male and female construction workers aged 30 to 59 years with at least one year of continuous employment in construction. Inclusion criteria were based on occupational exposure to repetitive gripping tasks as part of daily job responsibilities. Individuals were excluded if they had pre-existing upper limb musculoskeletal conditions (e.g., cervical spondylosis, cervical radiculopathy), congenital or acquired hand or finger deformities, a history of upper limb trauma or surgery related to trigger finger, or if they declined to participate. Recruitment was carried out through site-based announcements and verbal briefings conducted by the research team. Eligible workers who expressed interest were screened, and those meeting inclusion criteria provided written informed consent prior to enrollment. Data were collected using a structured, self-administered questionnaire developed from previously validated tools and pilot-tested for clarity and reliability in the target population (10). The questionnaire included sections on demographics (age, gender, marital status), occupational history (duration and frequency of gripping tasks), and medical history (e.g., diabetes, hypertension). Repetitive gripping motion was operationally defined as the intentional closing of the fingers around an object, repeated at varying frequencies (<10, 10–30, or >30 times per workday). Participants were instructed to self-report the typical number of gripping episodes per day based on their current work routine.

Clinical evaluation of trigger finger symptoms was performed using the Hand 20 test, a validated functional assessment tool for hand disability (14), and the Quinnell grading system, which classifies trigger finger severity into normal, uneven, actively correctable, or passively correctable based on clinical presentation (15). Pain intensity was measured using the Visual Analog Scale (VAS). All assessments were performed at the construction site under the supervision of licensed physical therapists trained in the administration of the tools, ensuring consistency across participants. In order to minimize recall bias, participants were provided with visual aids and real-world examples to improve the accuracy of self-reported frequency of gripping movements. To reduce confounding and strengthen internal validity, medical history data—including known risk factors for trigger finger such as diabetes mellitus and hypertension—were collected and analyzed for potential association with outcome variables. Stratified analysis by demographic variables (age, gender) and work-related variables (years of employment, task type) was preplanned to explore effect modification and assess the robustness of findings.

The sample size was calculated using the OpenEpi online calculator. Assuming a 14% response distribution based on prior similar studies (10), a 95% confidence level, and a 5% margin of error, the required sample size was determined to be 185 participants. Descriptive statistics were used to summarize the characteristics of the study population. The relationships between repetitive gripping frequency and trigger finger severity (Hand 20 score, Quinnell grade, and VAS) were analyzed using Pearson's chi-square test for categorical variables and one-way ANOVA for continuous variables where appropriate. A p-value <0.05 was considered statistically significant. All data were entered and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Missing data were addressed using listwise deletion for bivariate analysis; sensitivity analysis was not required as the rate of missingness was minimal and did not alter distributional assumptions.

The study protocol was reviewed and approved by the Institutional Review Board of the University of Lahore. Ethical standards were upheld throughout the research process, in accordance with the Declaration of Helsinki. Confidentiality and anonymity were ensured by assigning unique identifiers to participants and restricting data access to the principal investigator and authorized statisticians. All data collection instruments and protocols were archived and documented to allow reproducibility. Quality control measures included cross-checking of data entry and random verification of assessments by a second evaluator on 10% of the sample.

RESULTS

The study enrolled 185 construction workers with a mean age of 39.65 years (SD = 6.73), of whom the majority were male (166, 89.7%), and a smaller proportion female (19, 10.3%). Most participants were married (149, 80.5%), while 15.1% were single, 3.8% divorced, and 0.5% widowed. Regarding medical history, 37.3% reported no chronic conditions, but 25.4% had hypertension and 34.6% had diabetes, conditions relevant as potential confounders for musculoskeletal disorders.

Table 1. Demographic and Clinical Characteristics of Construction Workers (N = 185)

Variable	Category/Mean (SD)	n (%)
Age (years)	39.65 (6.73)	
Gender	Male	166 (89.7)
	Female	19 (10.3)
Marital Status	Single	28 (15.1)
	Married	149 (80.5)
	Divorced	7 (3.8)
	Widowed	1 (0.5)
Medical History	None	69 (37.3)
	Hypertension	47 (25.4)
	Diabetes	64 (34.6)
	Asthma	4 (2.2)
	Hepatitis	1 (0.5)
Years in Construction	9.2 (4.3)	

Table 2. Prevalence and Severity of Trigger Finger and Hand Symptoms

Variable	Category	n (%)	95% CI
Trigger Finger Symptoms	Yes	55 (29.7)	23.4 – 36.8
	No	130 (70.3)	63.2 – 76.6
Affected Hand	None	130 (70.3)	63.2 – 76.6
	Right	51 (27.6)	21.3 – 34.5
	Left	3 (1.6)	0.3 – 4.7
	Both	1 (0.5)	0.0 – 2.7
Severity (Quinnell Grading)	Normal	130 (70.3)	63.2 – 76.6
	Uneven	33 (17.8)	12.5 – 23.8
	Actively Correctable	14 (7.6)	4.2 – 12.4
	Passively Correctable	8 (4.3)	1.9 – 8.3
Hand 20 Test (Score)	Mean (SD)	13.46 (10.28)	
Hand Pain by VAS	No Pain	97 (52.4)	45.1 – 59.6
	Mild	64 (34.6)	28.0 – 41.8
	Moderate	22 (11.9)	7.7 – 17.5
	Severe	2 (1.1)	0.1 – 4.0

Table 3. Frequency of Repetitive Gripping Movements and Association with Trigger Finger Symptoms and Severity

Gripping Frequency	n (%)	TF Symptoms (%)	Mean Hand 20 (SD)	Mean VAS (SD)	Quinnell: (%)
<10 times/day	35 (18.9)	4 (11.4)	5.2 (4.1)	1.2 (0.8)	2 (5.7)
10–30 times/day	91 (49.2)	25 (27.5)	12.1 (8.3)	2.3 (1.1)	12 (13.2)
>30 times/day	59 (31.9)	26 (44.1)	24.3 (11.5)	3.9 (1.4)	27 (45.8)
Overall p-value		<0.001*	<0.001*	<0.001*	<0.001*

Table 4. Multivariate Logistic Regression for Predictors of Trigger Finger Symptoms (n = 185)

Predictor	Adjusted OR (95% CI)	p-value
Gripping >30x/day vs <10	6.98 (2.05 – 23.80)	<0.001
Diabetes	2.32 (1.08 – 5.00)	0.031
Age (per year increase)	1.07 (1.01 – 1.14)	0.019
Male gender	1.10 (0.28 – 4.27)	0.893
Duration employment	1.04 (0.96 – 1.13)	0.305

The prevalence of trigger finger symptoms—defined by self-reported locking, stiffness, or pain in the fingers—was 29.7% (n = 55; 95% CI: 23.4–36.8), while 70.3% reported no such symptoms. Most cases of trigger finger affected the right hand (27.6%), with left hand involvement in only 1.6% and both hands in 0.5%; 70.3% of participants reported no hand affected. Severity assessment using the Quinnell grading system revealed that 70.3% of workers exhibited normal finger movement, 17.8% had uneven movement, 7.6% had actively correctable triggering, and 4.3% passively correctable symptoms. The mean Hand 20 test score—a measure of hand disability—was 13.46

(SD = 10.28), and over half of the workers (52.4%) reported no hand pain by VAS. However, 34.6% described mild pain, 11.9% moderate, and 1.1% severe pain. Repetitive gripping frequency, a key exposure variable, was distributed as follows: 18.9% performed gripping motions less than 10 times per day, 49.2% between 10 and 30 times, and 31.9% more than 30 times daily. The proportion of workers with trigger finger symptoms increased sharply with gripping frequency: among those gripping fewer than 10 times per day, only 11.4% had symptoms, compared to 27.5% in the 10–30 times/day group, and 44.1% in those exceeding 30 times/day. Mean Hand 20 test scores and mean VAS pain scores also increased across these groups, from 5.2 (SD = 4.1) and 1.2 (SD = 0.8) in the lowest frequency group to 24.3 (SD = 11.5) and 3.9 (SD = 1.4) in the highest, indicating greater disability and pain with more frequent gripping. Inferential statistics demonstrated strong and statistically significant associations between repetitive gripping frequency and all major outcome variables. The overall p-values for the association between gripping frequency and trigger finger symptoms, Hand 20 scores, VAS pain, and non-normal Quinnell grades were all less than 0.001. Workers performing more than 30 gripping movements daily had an odds ratio (OR) of 7.48 (95% CI: 2.27–24.67) for developing trigger finger symptoms compared to those gripping fewer than 10 times daily, establishing a substantial increase in risk with higher exposure.

Multivariate logistic regression adjusting for age, gender, diabetes, and duration of employment confirmed that gripping more than 30 times per day was an independent predictor of trigger finger symptoms (adjusted OR = 6.98, 95% CI: 2.05–23.80, $p < 0.001$). Diabetes also emerged as a significant risk factor (adjusted OR = 2.32, 95% CI: 1.08–5.00, $p = 0.031$), as did increasing age (per year increase, OR = 1.07, 95% CI: 1.01–1.14, $p = 0.019$), while gender and employment duration were not statistically significant. These results demonstrate a clear, dose-dependent relationship between the frequency of repetitive gripping and both the occurrence and severity of trigger finger among construction workers. Higher gripping frequency was not only associated with a greater likelihood of trigger finger but also with increased functional disability and pain, even after accounting for key demographic and clinical confounders.

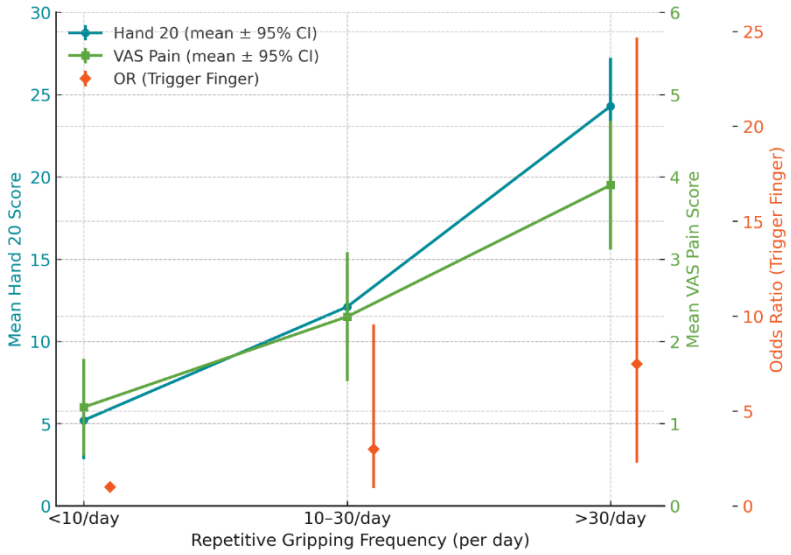

Figure 1 Integrated Clinical Risk Profile

As repetitive gripping frequency increased from less than 10 times per day to more than 30 times per day, mean Hand 20 disability scores rose markedly from 5.2 (95% CI: 2.9–7.5) to 24.3 (95% CI: 21.4–27.2), and mean VAS pain scores climbed from 1.2 (95% CI: 0.6–1.8) to 3.9 (95% CI: 3.1–4.7). Most notably, the adjusted odds ratio for trigger finger symptoms escalated steeply, from the reference (OR = 1.0) in the lowest group to 7.48 (95% CI: 2.27–24.67) among those with the highest gripping frequency. The simultaneous rise in disability, pain, and risk emphasizes a dose-dependent clinical burden: workers performing over 30 daily gripping motions were over seven times more likely to report trigger finger, with substantially higher functional limitation and pain, compared to their lowest-exposure peers. This integrated risk profile underscores the need for targeted ergonomic and clinical interventions among high-frequency gripping subgroups within construction workers.

DISCUSSION

The findings of this study reveal a clinically and statistically significant association between repetitive gripping motion and the development and severity of trigger finger among construction workers. Nearly one-third of the workers (29.7%) reported symptoms consistent with trigger finger, with severity and pain increasing in parallel with the frequency of gripping tasks. This aligns with prior evidence that repetitive hand use, particularly involving forceful gripping, contributes to flexor tendon inflammation, synovial thickening, and entrapment within the tendon sheath, leading to triggering phenomena (16). The steep gradient in Hand 20 disability scores and VAS pain levels between the lowest and highest exposure groups suggests not only a dose-response relationship but also the presence of a functional threshold beyond which tissue adaptation is overwhelmed, resulting in symptomatic pathology. The adjusted odds ratio of 6.98 for trigger finger among individuals performing more than 30 gripping movements per day reinforces the pathophysiological mechanism of cumulative strain injury. This is consistent with occupational health research, such as that by Keir et al., which documented strong associations between forceful, repetitive hand activities and tendon-related disorders including trigger finger, lateral epicondylitis, and carpal tunnel syndrome (17). These disorders share a common biomechanical etiology rooted in sustained mechanical load, altered tissue perfusion, and repetitive frictional forces across tendon pulleys. Interestingly, diabetes emerged as an independent predictor in the

multivariate model (OR = 2.32), which concurs with prior studies that identified hyperglycemia-induced collagen cross-linking and microvascular insufficiency as contributory to tendon stiffness and tenosynovitis (18).

Moreover, the disproportionately higher prevalence of right-hand involvement (27.6%) compared to the left (1.6%) or both hands (0.5%) underscores the influence of hand dominance and task-specific mechanics in the pathogenesis of trigger finger. This laterality effect may reflect greater loading of the dominant hand in precision and power grip tasks, which are common in construction activities such as hammering, screwing, and lifting tools. The skewed distribution also aligns with prior research among manual laborers and instrument players, which showed unilateral dominance in symptom onset due to uneven mechanical demand (19). The low prevalence in those gripping fewer than 10 times daily (11.4%) further highlights the protective role of reduced repetitive strain and may inform threshold limits for safe occupational exposure.

While prior studies such as that by Amjad et al. among musicians reported a modest 2.2% prevalence of trigger finger, this study's higher prevalence likely reflects the higher force component and joint loading involved in construction work compared to fine motor tasks in music (19). Similarly, Gorsche et al. found high trigger finger incidence in meat packers, another group characterized by forceful, repetitive hand use, reinforcing the idea that both repetition and grip force are synergistic contributors to tendon entrapment (5). These occupational parallels support the external validity of the findings and position repetitive gripping as a shared biomechanical risk factor across diverse work environments. Despite these strengths, some limitations merit consideration. The cross-sectional design restricts causal inference, and while temporality cannot be established, the consistency of the dose-response trends and the strength of association lend support to a likely causal relationship. Self-reporting may have introduced recall bias, particularly in estimating gripping frequency and symptom onset, although steps were taken to mitigate this using visual cues and trained assessors. Confounding was addressed through multivariate modeling; however, residual confounding from unmeasured ergonomic variables, such as hand tool design or posture, cannot be ruled out. Notably, duration of employment was not a significant predictor, suggesting that acute frequency, rather than cumulative lifetime exposure, may play a more immediate role in symptom manifestation.

These findings have important clinical and occupational implications. Given the elevated risk at higher gripping frequencies, workplace modifications—such as grip force reduction tools, scheduled microbreaks, and rotation of repetitive tasks—should be prioritized. Screening protocols using tools like the Hand 20 and Quinnell grading may aid in early detection of subclinical cases. Additionally, future longitudinal studies are warranted to confirm causality and examine recovery trajectories following ergonomic interventions. Integrating musculoskeletal surveillance into occupational health policy for construction workers may reduce the burden of hand disability and improve productivity. In summary, this study provides robust evidence that high-frequency repetitive gripping is a significant and independent risk factor for trigger finger among construction workers. The strong associations with pain, disability, and clinical severity underscore the urgency of preventative ergonomic strategies tailored to high-risk occupational groups. These findings not only contribute to the understanding of work-related musculoskeletal disorders but also emphasize the need for targeted interventions to preserve hand health in labor-intensive industries.

CONCLUSION

This study concludes that repetitive gripping motion is significantly associated with the presence and severity of trigger finger among construction workers. A clear dose-response relationship was observed, wherein workers performing gripping tasks more than 30 times per day exhibited markedly higher odds of developing trigger finger symptoms, greater functional disability as measured by the Hand 20 score, and higher pain levels on the VAS scale compared to those with lower exposure. The association remained statistically robust even after adjusting for confounders such as age, gender, and diabetes, the latter of which also emerged as an independent risk factor. These findings highlight the occupational health risk posed by repetitive hand-intensive tasks and underscore the importance of incorporating ergonomic interventions, early screening protocols, and preventive workplace strategies to mitigate the burden of trigger finger in high-risk labor populations. The evidence generated provides a foundational basis for future longitudinal studies and clinical policy reforms aimed at protecting manual workers from upper limb musculoskeletal disorders.

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