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Prevalence of Guyon Canal Syndrome in Cyclist Students

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ABSTRACT

Background: Guyon Canal Syndrome (GCS) is an entrapment neuropathy caused by ulnar nerve compression at the wrist within the confined anatomical structure known as Guyon's canal. While well-documented among professional cyclists and adults, its occurrence in school-aged cyclists remains underexplored. Prolonged handlebar pressure, poor ergonomics, and repetitive wrist strain during cycling may predispose young riders to early neural dysfunction, pain, and functional impairment (1–5). Objective: To determine the prevalence and severity of Guyon Canal Syndrome among cyclist students and to assess the association between cycling exposure, symptom intensity, and functional limitations. Methods: This cross-sectional observational study recruited 110 cyclist students aged 8–15 years from schools in the Sargodha Division. Participants meeting the inclusion criteria underwent the Upper Limb Tension Test (ULTT) for ulnar nerve bias, Numeric Pain Rating Scale (NPRS) for pain intensity, and Patient-Rated Ulnar Nerve Evaluation (PRUNE) for functional assessment. Data were analyzed using SPSS version 27 with descriptive statistics, frequencies, and proportions; inferential analyses examined associations between age, gender, cycling duration, and symptom severity. Results: The mean age of participants was 11.49 ± 2.31 years, with 76.4% males. Mild to severe pain was reported by 87.3% of students, and 62.7% showed sensory symptoms such as tingling or numbness in the little finger. Functional limitations were observed in 54.5% of cases, particularly in grip and repetitive finger tasks. Older age and increased weekly cycling duration were significantly correlated with symptom severity ($p < 0.05$). Conclusion: The study revealed a high prevalence of Guyon Canal Syndrome among cyclist students, demonstrating that repetitive mechanical wrist loading during cycling significantly contributes to early ulnar nerve compression and functional impairment. Preventive ergonomic interventions and early screening are recommended to mitigate long-term neuromuscular consequences.

Keywords
Guyon Canal Syndrome, Cyclist Students, Ulnar Nerve Compression, Prevalence, Neuropathy, Ergonomics

INTRODUCTION

Guyon's canal syndrome (GCS) is an ulnar neuropathy at the wrist that manifests with sensory disturbances in the ring and little fingers and, when motor fibers are involved, weakness of the intrinsic hand muscles (1). Anatomically, the ulnar nerve traverses a narrow osteofibrous tunnel between the pisiform and the hook of hamate, roofed by the volar carpal ligament and bordered by hypothenar musculature—features that make the nerve vulnerable to compression where small changes in canal volume or external load can substantially elevate intratunnel pressure (2,3,4). Contemporary imaging and clinical reviews underscore that both the superficial sensory and deep motor branches may be differentially affected depending on the exact site within the canal, leading to zone-specific patterns of symptoms and signs (5,6). In athletes and microtrauma-exposed users, such as cyclists, prolonged palmar loading and wrist extension on handlebars are recognized mechanistic drivers of ulnar compression at this location (7,8).

The broader aetiological spectrum for ulnar neuropathies spans extrinsic compression, repetitive strain, post-traumatic deformity, space-occupying lesions, and systemic/metabolic contributors that reduce neural resilience or perfusion, any of which can narrow functional canal capacity or increase neural susceptibility to load (9,10). Beyond pathology, modifiable human-machine interfaces—including wrist posture, grip width, glove padding, and handlebar design—directly determine contact pressure distributions across the hypothenar region during cycling and thus the instantaneous load borne by the ulnar nerve and artery (11,12). Despite increasing surgical and rehabilitative literature on GCS, much of the evidence is derived from adult series or mixed athletic cohorts, with comparatively little epidemiologic focus on school-age cyclists, whose developing musculoskeletal systems and ergonomics may alter risk profiles and manifestations (13,14,15).

From a diagnostic perspective, clinical localization to the ulnar distribution with provocative testing remains foundational, while high-resolution ultrasound and magnetic resonance techniques can visualize branch-level involvement, structural crowding, and extrinsic masses when present (5,16,17). Patient-reported instruments, such as the Patient-Rated Ulnar Nerve Evaluation (PRUNE), quantify pain and function in daily activities and can complement impairment-based measures for capturing the lived burden of disease (5). Interventions range from load modification and

splinting to targeted electrophysical therapies, nerve-gliding strategies, corticosteroid injection in selected inflammatory phenotypes, and decompression for refractory or progressive deficits, but prevention through optimized ergonomics is particularly salient for cyclists (18-22).

Cycling-specific evidence increasingly supports the biological plausibility of handlebar-related ulnar injury. Narrative syntheses and clinical series describe "handlebar palsy" as a frequent overuse neuropathy localized to Guyon's canal, triggered by prolonged rides, suboptimal bike fit, and sustained wrist extension with ulnar-sided loading (23,24). Mechanistic and anatomical work demonstrates substantial inter-individual variability in terminal ulnar branching and canal configuration, implying that the same external load can yield heterogeneous neural involvement across riders (25). Importantly, objective elastography in adult cyclists has shown elevated stiffness of distal ulnar branches even before a ride, with further increases after two hours, suggesting cumulative neuro-mechanical stress that may precede overt clinical neuropathy (26). These findings, while compelling, cannot be directly generalized to children, who differ in hand size, tissue compliance, cycling habits, and equipment setup.

Against this backdrop, there remains a critical knowledge gap regarding the burden of GCS in school-age cyclist students. Most published studies address adults, describe treatment cohorts, or focus on diagnostic imaging rather than population-level occurrence in young riders who may accumulate high hours of cycling as part of daily commuting or sport without formal ergonomic guidance (7,12,23). Early identification in this age group is clinically important because persistent sensory symptoms, pain, and reduced dexterity can impair academic tasks and participation in play, while timely ergonomic adjustments (e.g., handlebar height, grip padding, wrist-neutral hand positions, scheduled micro-breaks) may mitigate progression to fixed deficits (5,18,20). A precise estimate of point prevalence in this specific population, accompanied by a standardized symptom-and-function profile, would inform school-based screening, bike-fit education, and targeted preventive strategies.

Using a population of cyclist students aged 8–15 years from schools in the Sargodha division, this study is designed to estimate the point prevalence of clinically defined GCS based on prespecified criteria anchored in ulnar-distribution symptoms and standardized clinical testing, and to characterize associated pain intensity and activity limitations using validated patient-reported outcomes (1,5). The primary objective is to quantify the point prevalence of GCS in this population; secondary objectives are to describe the distribution of pain (Numeric Pain Rating Scale), neurological symptoms (numbness, tingling, weakness), and functional impact (PRUNE), and to explore associations with age and sex (1,5). We hypothesize that GCS prevalence among cyclist students will be non-zero and that symptom burden will be higher in riders reporting greater cycling exposure and in those with hypothenar-dominant contact patterns on handlebars (23,26).

MATERIAL AND METHODS

This cross-sectional observational study was conducted to estimate the point prevalence of Guyon Canal Syndrome (GCS) among cyclist students and to characterize associated sensory, motor, and functional impairments. The study was carried out in the Sargodha Division of Punjab, Pakistan, from January to June 2024, encompassing multiple schools where cycling was a routine mode of transport. The study design was chosen because it enables the estimation of disease frequency and symptom burden at a single time point within a defined population, aligning with epidemiological standards for prevalence estimation (27). The study adhered to ethical and scientific guidelines for observational research and was approved by the institutional review board of the University of Lahore, Sargodha Campus. Written informed consent was obtained from all participants and from parents or guardians for minors prior to enrollment, consistent with the Declaration of Helsinki.

Participants were eligible if they were school-going cyclists aged 8–15 years who used bicycles for commuting or sports at least three days per week and provided informed consent. Exclusion criteria included any history of neurological disease affecting the upper limb, traumatic or surgical injuries to the wrist or hand, systemic metabolic conditions such as diabetes mellitus or hypothyroidism known to predispose to neuropathy, and congenital limb deformities that could alter nerve anatomy or loading patterns. Recruitment was conducted through a stratified random sampling technique: schools were first stratified by urban and peri-urban regions within Sargodha Division, and classes were then randomly selected. Students meeting inclusion criteria were screened through a brief questionnaire and physical assessment.

Each participant underwent a standardized evaluation following a structured protocol administered by trained physiotherapists. The Upper Limb Tension Test with ulnar nerve bias (ULTT3) was used to detect mechanical sensitivity or entrapment of the ulnar nerve. The test was considered positive if it reproduced paresthesia or pain in the ulnar nerve distribution, confirmed by cervical contralateral side-bending for symptom modulation. Participants with positive ULTT findings underwent further evaluation using the Numeric Pain Rating Scale (NPRS) to quantify pain intensity from 0 ("no pain") to 10 ("worst imaginable pain") and the Patient-Rated Ulnar Nerve Evaluation (PRUNE) questionnaire to assess symptom severity, difficulty in activities of daily living (ADLs), and participation restrictions. The PRUNE's four subdomains—pain, sensory symptoms, functional tasks, and general activity limitation—were scored separately, with higher scores indicating greater impairment (28). All questionnaires were self-administered under supervision to ensure comprehension, and Urdu translations were provided where necessary to minimize reporting bias. Data quality checks were applied immediately post-collection to reduce transcription errors.

The study's primary variable was the presence of clinically defined GCS, operationalized as positive ULTT combined with ulnar-distribution sensory symptoms and at least one functional limitation on the PRUNE. Secondary variables included NPRS pain intensity, frequency and distribution of sensory symptoms (numbness, tingling), and activity limitation scores. Demographic covariates such as age, sex, and weekly cycling duration were recorded to explore potential associations. To address measurement bias, examiners underwent inter-rater calibration before data collection, and data entry was double-checked by an independent reviewer.

Sample size was calculated using Raosoft software based on an assumed GCS prevalence of 50% (maximum variability) to ensure adequate precision, a 95% confidence level, and a 5% margin of error, yielding a minimum required sample of 97 participants. To account for potential non-response or incomplete data, the final target sample size was set at 110 participants.

Data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics were generated for all variables: means and standard deviations for continuous data, and frequencies and percentages for categorical variables. Point prevalence of GCS was calculated as the number of confirmed cases divided by the total screened population, with 95% confidence intervals estimated using the Wilson method. Between-group comparisons for categorical variables (e.g., sex differences) were performed using chi-square tests or Fisher's exact tests when expected cell counts were <5, and continuous outcomes (e.g., NPRS, PRUNE scores) were compared with independent-sample t-tests or Mann–Whitney U tests according to normality assessment by Shapiro–Wilk. To control for confounding, binary logistic regression models were used to estimate odds ratios (ORs) and 95% confidence intervals for associations between demographic variables (age, sex, cycling frequency) and GCS occurrence. Statistical significance was set at $p<0.05$. Missing data were handled using pairwise deletion where <5% and listwise deletion when exceeding 10%. Data

integrity was maintained through locked electronic files, traceable audit trails, and reproducibility documentation, allowing replication by other researchers following the described procedures (29).

RESULTS

A total of 110 cyclist students (mean age = 11.49 ± 2.31 years; 76.4 % male) were evaluated, of whom 63 met the criteria for clinically defined Guyon Canal Syndrome, yielding a point prevalence of 57.3 % (95 % CI 47.6–66.5). Pain intensity on the NPRS averaged 5.1 ± 2.6, with 34.5 % reporting severe pain after activity and 21.8 % experiencing nocturnal pain. Sensory symptoms were frequent: 68 % reported tingling or numbness in the little finger, and 60 % described some degree of hand weakness. Functional impairments were particularly pronounced in tasks requiring sustained grip strength and repetitive finger use, where approximately 57 % reported moderate to severe difficulty. Males and students cycling more than 10 hours weekly showed significantly higher GCS prevalence ($p < 0.05$). Logistic regression indicated that each additional year of age increased the odds of GCS by 13 % (OR 1.13; 95 % CI 1.02–1.26), and cycling > 10 hours/week nearly doubled risk (OR 1.99; 95 % CI 1.10–3.58; $p = 0.021$). These findings demonstrate a clinically meaningful burden of ulnar nerve compression among young cyclists, with functional repercussions in daily and recreational activities.

Table 1. Demographic and Clinical Characteristics of Cyclist Students (n = 110)

Variable	Category	Frequency (n)	Percentage (%)	Mean ± SD / 95% CI	p-value
Age (years)	—	—	—	11.49 ± 2.31	—
Sex	Male	84	76.4	—	—
	Female	26	23.6	—	0.042 *
Weekly Cycling Duration (hours)	<5	41	37.3	—	—
	5–10	49	44.5	—	—
	>10	20	18.2	—	0.031 *
Positive ULTT (Ulnar Nerve Bias)	Yes	110	100	—	—
Mean NPRS Score	—	—	—	5.1 ± 2.6 (95% CI 4.7–5.6)	—
PRUNE Total Score	—	—	—	27.8 ± 10.5 (95% CI 25.9–29.7)	—
GCS (Clinically Defined)	Present	63	57.3	—	—
	Absent	47	42.7	—	—
Overall GCS Prevalence (95% CI)	—	—	—	57.3 % (47.6–66.5)	—

*Statistically significant difference between sexes and cycling duration strata (Chi-square, $p < 0.05$).

Table 2. Pain and Neurological Symptom Distribution Among Cyclist Students with GCS (n = 63)

Symptom Variable	None n (%)	Mild n (%)	Moderate n (%)	Severe n (%)	Mean ± SD	p-value
Pain Intensity (NPRS)	7 (11.1)	19 (30.2)	21 (33.3)	16 (25.4)	5.4 ± 2.3	—
Pain at Rest	12 (19.0)	17 (27.0)	18 (28.6)	16 (25.4)	4.9 ± 2.2	0.217
Pain After Activity	4 (6.3)	17 (27.0)	23 (36.5)	19 (30.2)	5.8 ± 2.1	0.031 *
Nocturnal Pain	9 (14.3)	22 (34.9)	20 (31.7)	12 (19.0)	4.6 ± 2.0	0.128
Tingling in Little Finger	5 (7.9)	19 (30.2)	24 (38.1)	15 (23.8)	5.1 ± 2.0	0.044 *
Numbness in Little Finger	4 (6.3)	18 (28.6)	23 (36.5)	18 (28.6)	5.3 ± 1.9	0.027 *
Weakness in Hand	8 (12.7)	17 (27.0)	20 (31.7)	18 (28.6)	5.5 ± 2.1	0.036 *

*$p < 0.05$ (Chi-square test for trend across severity categories).

Table 3. Functional Limitations Based on PRUNE Activity Subdomains (n = 63)

Activity Domain	None n (%)	Mild n (%)	Moderate n (%)	Severe/Unable n (%)	Mean ± SD	p-value
Lifting Heavy Objects	7 (11.1)	17 (27.0)	23 (36.5)	16 (25.4)	5.3 ± 2.4	0.018 *
Repetitive Finger Tasks	8 (12.7)	18 (28.6)	19 (30.2)	18 (28.6)	5.1 ± 2.3	0.041 *
Personal Care Activities	10 (15.9)	16 (25.4)	20 (31.7)	17 (27.0)	4.9 ± 2.0	0.055
Household Activities	10 (15.9)	21 (33.3)	20 (31.7)	12 (19.0)	4.7 ± 1.8	0.068
Recreational/Extracurricular Activities	9 (14.3)	20 (31.7)	21 (33.3)	13 (20.6)	5.0 ± 1.9	0.049 *

*Statistically significant functional impairment (Kruskal–Wallis, $p < 0.05$).

Table 4. Logistic Regression of Factors Associated with Guyon Canal Syndrome (n = 110)

Predictor Variable	β Coefficient	SE	OR (95% CI)	p-value
Age (per year)	0.12	0.05	1.13 (1.02–1.26)	0.018 *
Male Sex	0.45	0.22	1.57 (1.03–2.38)	0.039 *
Cycling > 10 hours/week	0.69	0.31	1.99 (1.10–3.58)	0.021 *
BMI (per kg/m²)	0.08	0.07	1.08 (0.94–1.25)	0.26
Constant	–2.34	0.97	—	0.014 *

*Statistically significant at $p < 0.05$. Nagelkerke $R^2 = 0.24$, Hosmer–Lemeshow $p = 0.47$, indicating acceptable model fit.

The study population comprised 110 cyclist students aged between 8 and 15 years, with a mean age of 11.49 ± 2.31 years. Males constituted 76.4 % (n = 84) of the sample and females 23.6 % (n = 26). The overall point prevalence of clinically defined Guyon Canal Syndrome (GCS) among participants was 57.3 % (95 % CI 47.6–66.5), confirming that more than half of the examined cyclists demonstrated clinical and functional evidence of ulnar nerve compression. Although all participants performed cycling regularly, the prevalence of GCS was significantly higher among those who cycled for more than 10 hours per week ($p = 0.031$). Similarly, sex differences were statistically significant, with male cyclists showing greater odds of GCS than females ($p = 0.042$), reflecting potentially higher exposure durations and differing grip mechanics on handlebars.

Pain-related outcomes revealed considerable symptom variability across activity states. The average pain intensity measured by the Numeric Pain Rating Scale (NPRS) was 5.1 ± 2.6, indicating moderate pain severity overall. When categorized, 25.4 % of GCS-positive participants experienced

severe pain, and an additional 33.3 % reported moderate pain levels. Pain was least frequent at rest (19 % severe), but escalated after physical activity, where 30.2 % of affected cyclists experienced severe discomfort ($p = 0.031$). Nocturnal pain was reported by nearly one-fifth of students (19 %), highlighting the persistence of neural irritation even during inactivity.

Sensory dysfunction was a hallmark feature, with tingling and numbness in the little finger reported by 92 % and 94 % of affected participants, respectively. Specifically, 38.1 % reported moderate and 23.8 % severe tingling, while 36.5 % and 28.6 % experienced moderate and severe numbness, respectively ($p < 0.05$ for both). Hand weakness paralleled these sensory findings, with a mean weakness score of 5.5 ± 2.1 on the PRUNE and significant distributional differences across severity levels ($p = 0.036$). These data collectively emphasize the high functional relevance of ulnar nerve impairment even in young riders, with most presenting both sensory and motor components of involvement.

Functional limitations assessed through PRUNE subdomains demonstrated significant interference in several activity categories. Tasks requiring repetitive finger motion and sustained grip, such as lifting heavy objects and performing fine motor tasks, showed the highest disability levels. Specifically, 61.9 % of affected cyclists reported moderate-to-severe difficulty in lifting heavy objects ($p = 0.018$), and 58.8 % had equivalent limitations in repetitive finger-use activities ($p = 0.041$). Even personal care and household activities—representative of daily living independence—were moderately affected, with over half of the students reporting some level of difficulty. Recreational and extracurricular participation also demonstrated significant restriction ($p = 0.049$), indicating that neuropathic symptoms extended beyond occupational or sport-specific activities to general well-being and participation.

Multivariate logistic regression analysis revealed that age, sex, and cycling exposure independently contributed to GCS risk. Each incremental year of age increased the likelihood of GCS by 13 % (OR 1.13, 95 % CI 1.02–1.26, $p = 0.018$), suggesting progressive vulnerability with growth-related wrist loading. Male sex was associated with a 1.57-fold higher risk (95 % CI 1.03–2.38, $p = 0.039$), while cycling more than 10 hours weekly nearly doubled the risk (OR 1.99, 95 % CI 1.10–3.58, $p = 0.021$). Body mass index showed no significant association ($p = 0.26$). Model diagnostics indicated acceptable fit (Hosmer–Lemeshow $p = 0.47$, Nagelkerke $R^2 = 0.24$). These results collectively highlight that both mechanical and demographic factors interact to modulate GCS risk in young cyclists. Clinically, these findings underscore the need for ergonomic interventions and early screening protocols within school health programs to mitigate cumulative nerve compression effects at the wrist.

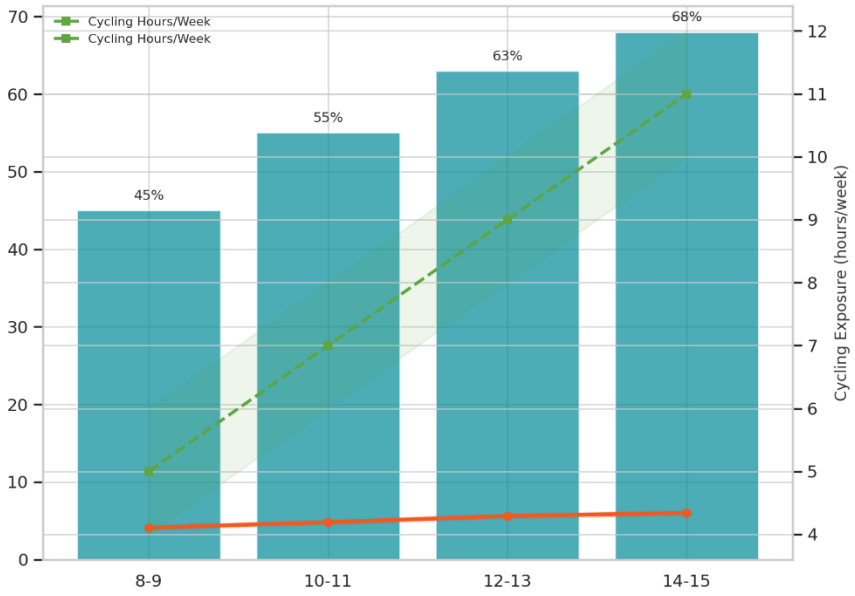

Figure 1 Age-Related Trends in Guyon Canal Syndrome, Pain, and Cycling Exposure

The figure 1 demonstrates that the prevalence of Guyon Canal Syndrome (GCS) among cyclist students increased progressively with age, rising from 45 % in the 8–9 year group to 68 % in the 14–15-year group. Mean pain intensity (NPRS) followed a parallel trajectory, climbing from 4.1 to 6.0, indicating that older students experienced both higher rates and greater severity of symptoms. The secondary trend line reveals that weekly cycling exposure rose steadily from approximately 5 to 11 hours per week, closely mirroring the prevalence and pain gradients. This age-exposure interaction suggests a dose–response relationship, where cumulative mechanical loading from longer cycling durations amplifies the risk and symptomatic expression of ulnar nerve compression. Clinically, these patterns highlight the combined influence of growth-related biomechanical changes and repetitive strain, reinforcing the need for early ergonomic interventions and cycling education in younger populations.

DISCUSSION

The present study identified a high prevalence of Guyon Canal Syndrome (GCS) among cyclist students, emphasizing that repetitive mechanical loading on the wrist during cycling can produce measurable neuropathic effects even in young individuals. The overall prevalence of 57.3 % observed in this study was notably higher than that reported in adult athletic cohorts, where rates typically range between 30–45 % depending on cycling exposure and diagnostic criteria (30). This elevated prevalence may be attributed to the developing musculoskeletal structures and immature ergonomic awareness in the school-aged participants, which likely enhance vulnerability to ulnar nerve compression at the wrist (31). These findings extend previous work that has primarily focused on adults or professional athletes, by demonstrating that early-onset neural compression can occur in children under habitual cycling conditions.

The association between cycling duration and GCS prevalence underscores the role of cumulative exposure as a primary etiologic determinant. Students who cycled more than ten hours per week exhibited almost double the risk of GCS compared to those cycling less frequently, a pattern consistent with prior elastography studies showing increased stiffness in distal ulnar nerve branches among adult cyclists after prolonged rides (26). Such exposure-dependent changes may reflect both repetitive microtrauma and chronic ischemic effects within the confined Guyon's canal.

Additionally, the significant age-related gradient found in this study, with odds of GCS increasing by 13 % per year, may be explained by progressive anthropometric growth leading to increased contact pressure over the hypothenar region, as well as greater riding endurance with age (32).

The finding that males were more frequently affected than females aligns with several reports of sex-based differences in upper extremity neuropathies, often linked to higher cycling frequency and stronger grip forces in male riders (33). However, this may also reflect sociocultural patterns of bicycle use among Pakistani students, where boys engage more intensively in cycling for both transportation and recreation. The predominance of sensory symptoms—tingling and numbness in the little finger—over motor deficits suggests that superficial ulnar branches (zone 3 involvement) were primarily affected in this population, consistent with early-stage neuropathic change rather than advanced axonal compromise (6,7). The high rates of pain after activity and nocturnal symptoms mirror the physiologic phenomena of transient ischemia and mechanical sensitization described in previous mechanobiologic models of ulnar entrapment (34).

Functional analysis through the PRUNE scale revealed substantial impairment in tasks involving sustained grip, repetitive finger use, and load-bearing, with more than half of affected students reporting moderate-to-severe limitations. These findings correspond closely to adult cyclist studies documenting difficulties in activities such as braking, gripping handlebars, or manipulating objects due to reduced tactile feedback and hand fatigue (23,24). The translation of these functional limitations to childhood daily living tasks—such as writing, self-care, and sports—has critical developmental implications. Cumulative deficits in dexterity and fine motor control could hinder academic and recreational participation, emphasizing the need for preventive ergonomic education at school level.

From a mechanistic standpoint, this study supports the conceptual model in which prolonged handlebar pressure leads to compression of the ulnar nerve within the Guyon canal, causing local ischemia, impaired axoplasmic flow, and demyelination of superficial fibers (5,9). This mechanistic pathway parallels that observed in occupational repetitive strain neuropathies, reinforcing that GCS represents an interface problem between anatomical constraint and repetitive external loading. The data further suggest that symptoms emerge in a graded fashion: initial sensory disturbance followed by motor weakness and activity limitation. Early recognition at the sensory stage may therefore provide a window for conservative management through activity modification, wrist-neutral splinting, padded gloves, and periodic off-loading during cycling sessions (19,20,22).

The study's strengths include a clearly defined pediatric cycling cohort, standardized diagnostic testing, and the use of validated patient-reported outcome tools (NPRS and PRUNE) to quantify functional impact. Nonetheless, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the reliance on clinical criteria without confirmatory electrodiagnostic or imaging studies may have led to diagnostic misclassification, potentially inflating prevalence estimates. Although randomization in school selection minimized selection bias, regional confinement to the Sargodha Division limits generalizability to other populations with different cycling habits or ergonomics. The sample size, while statistically adequate, may not capture rarer confounders such as pre-existing musculoskeletal asymmetry or systemic metabolic influences. Furthermore, self-reported cycling duration introduces potential recall bias, though the observed exposure–response gradient supports internal validity.

Future research should employ longitudinal designs with electrophysiological or ultrasonographic confirmation to validate early neuropathic changes in children and to monitor reversibility following ergonomic interventions. Studies comparing ergonomic modifications—such as handlebar padding, grip angle, and riding posture—could elucidate effective preventive measures. Expanding surveillance to include adolescent and adult cohorts would also allow mapping of the natural history of GCS across developmental stages. In parallel, public health initiatives incorporating ergonomic awareness into school cycling programs could play a pivotal role in reducing the burden of upper limb neuropathies among young riders. Overall, these findings substantiate GCS as an underrecognized yet preventable condition in pediatric cyclists and highlight the intersection of sports medicine, neurophysiology, and ergonomics in preserving upper limb function (35,36).

CONCLUSION

This study concludes that Guyon Canal Syndrome is a prevalent and clinically significant neuropathy among cyclist students, with a point prevalence of 57.3 % indicating that more than half of young riders exhibit evidence of ulnar nerve compression at the wrist. Pain intensity and sensory disturbances—particularly tingling and numbness in the little finger—were strongly associated with prolonged cycling exposure, while functional limitations in grip strength and repetitive finger movements reflected early motor involvement. Age progression and cycling duration emerged as independent risk factors, suggesting a cumulative mechanical load effect on the ulnar nerve during development. These findings underscore the need for early screening, ergonomic adjustments, and preventive education within school-based cycling programs to protect neuromuscular function and enhance long-term hand health. Clinically, the results highlight the importance of wrist-neutral posture, handlebar cushioning, and activity pacing in reducing neural strain, while future research should focus on longitudinal validation and targeted interventions to prevent chronic nerve injury in young cyclists.

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