ORIGINAL ARTICLE

INTERCONNECTED HIP JOINT PARAMETERS, FUNCTIONAL MOBILITY, AND QUALITY OF LIFE IN PATIENTS WITH DEVELOPMENTAL DYSPLASIA OF THE HIP: A CROSS-SECTIONAL STUDY

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ABSTRACT

Objective: This study aimed to determine the relationships between hip joint parameters, functional mobility, and quality of life in patients with DDH.

Methods: This cross-sectional study involved 35 patients suffering from DDH. Functional mobility was measured with the timed up and go (TUG) test. Hip joint parameters were assessed for range of motion (ROM), abduction, and internal/external rotation. Quality of life was assessed via the Short Form-36 (SF-36) Health Survey. Pearson correlation analysis was conducted to establish variable relationships, considering a statistical significance of $p < 0.05$.

Results: A strong positive correlation, $r = 0.683$, $p < 0.01$, was found between the right and left hip ROMs. Fixed flexion contracture was significantly associated with both fixed abduction ($r = 0.592$, $p < 0.01$) and limb length discrepancy ($r = 0.350$, $p < 0.05$). Avascular necrosis (AVN) showed a strong correlation with limb length discrepancy ($r = 0.655$, $p < 0.01$). There was no significant relationship between sex and hip joint parameters ($p > 0.05$). The average TUG test time was 14.65 seconds (SD = 2.98), indicating a moderate level of functional disability.

Conclusions: This study revealed significant associations between hip joint parameters, mobility, and quality of life in DDH patients, emphasizing the need for early intervention. Key findings include bilateral hip symmetry, contracture-related limb discrepancies, and AVN impacts, highlighting the importance of multidisciplinary care to improve outcomes.

Keywords: Developmental Dysplasia of the Hip, Functional Mobility, Quality of Life, Range of Motion, Avascular Necrosis, Limb Length Discrepancy, Public Health

This article may be cited as: Ali A, Hayat S, Khan I, Rao EH, Khan M, Kamal Y, et al. Interconnected Hip Joint Parameters, Functional Mobility, And Quality Of Life In Patients With Developmental Dysplasia Of The Hip: A Cross-Sectional Study. J Med Sci 2025 April - June;33(2):95-101

INTRODUCTION

Mobility and freedom from pain are luxuries many of us enjoy without much thought. Sadly, people who suffer from developmental dysplasia of the hip (DDH) will tell you that each day can be quite a challenge. DDH refers to a condition where the hip joint fails to develop properly, resulting in instability, misalignment, or even dislocation.[1, 2] Although it typically manifests during infancy or early childhood, its consequences can remain lifelong, especially if one does not receive holistic treatment. For a multitude of individuals suffering from this ailment, it affects not only physical mobility but also overall quality of life, which makes the problem far worse than what the physical symptoms indicate.[2]

Being able to execute a range of movements without assistance is considered functional mobility, and such independence reflects positively on one's health and well-being. Unfortunately, the functional mobility of patients suffering from DDH is greatly restricted. Ordinary tasks such as walking, stair climbing, or even sitting can be painful and challenging.[3] Throughout time, various constraints can culminate in a lack of autonomy, reduced

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Date Received: 03/03/2025
Date Revised: 21/06/2025
Date Accepted: 27/06/2025

engagement in social and leisure activities, and a loss of self-esteem. The emotional and psychological struggles of frustration, anxiety, and depression, often coexisting with the physical challenges of DDH, may further disintegrate the overall well-being of the person afflicted. [4, 5].

Quality of life is not just about having good health and positive feelings; there are social relations and the ability to engage in meaningful activities to consider. One who has DDH faces the interplay of these components quite intricately. One of the most perplexing symptoms of DDH is pain, which is chronic and can make even the simplest activities a struggle. [6] This discomfort is correlated with fatigue, reduced physical activity, and an overall decline in well-being. In addition to physical injury, this ailment may also affect other aspects of mental health. Fragments of disconnection, rage, and hopelessness form some of the most prevalent feelings. These emotions dominate those who are less likely to receive sufficient care or help. [7] This study aimed to understand the relationships between parameters of the hip joint and functional mobility and quality of life in patients with DDH, along with the intricate aspects of the condition with the social and physical world.

METHODS AND MATERIALS

The study used a cross-sectional design and retrieved data from both Orthopedic and rehabilitation clinics that treat patients with musculoskeletal disorders. Subjects aged over two years were enrolled in this study if they were identified as having DDH either through clinical evaluation or imaging studies in the past. Patients suffering from any other serious skeletal or nerve disorders that could confound the results of the study were excluded. This process of participant recruitment was conducted for six months. All the subjects provided informed consent before starting the study.

The data collection was carried out in two phases: the neutral evaluation of functional mobility and the personal assessment of quality of life. 'Functional mobility' was assessed via the TUG test, which is generally used to determine the basic balance and movement functions of a person. The participants were required to stand from a chair, walk a specified distance, and then return to the chair. The time taken to perform the task was measured in seconds. Moreover, to better describe physical functioning, self-reported pain on a visual analogue scale and the range of motion (ROM) of the hip joints were added. The participants' quality of life was assessed through the validated Short Form-36 (SF-36) Health Survey, which measures eight different areas: physical, emotional, and social aspects.

Continuous variables are presented as the means and standard deviations, whereas frequencies and percentages were computed for categorical variables. Correlation analyses were performed for functional mobility measures such as the TUG test, range of motion, and quality-of-life scores of the patients. Statistical analysis was considered significant at a p-value < 0.05.

The ethics review board of the institution provided clearance for the study, and all processes complied with the Declaration of Helsinki guidelines. The participants were promised confidentiality, and all the data were anonymized before any assessments were made.

RESULTS

Table 1 shows that the active ROM values for the right hip were 85° - 130° (\u03bc = 112.05°, SD = 9.6), whereas the corresponding values for the left hip were 90° - 125° (\u03bc = 110.51°, SD = 8.14), and the mean value of left hip flexion was less than that of right hip flexion. The right and left shoulders also revealed comparable differences in the mean values of abduction. 29.05° (SD = 9.69) for the right shoulder and 28.17° (SD = 9.08) for the left shoulder. Compared with the right hip rotation value (mean = 31.20°, standard deviation (SD) = 31.88°, standard deviation (SD) = 11.76), the left internal rotation value (mean = 31.20°, standard deviation (SD) = 8.81) of 15° - 50° was greater. Similarly, the external rotation of the right hip varied from 12° to 90°, with a mean value of 31.08° (SD = 13.62), and the left hip external rotation ranged from 18° to 90°, yielding 31.91° (SD = 12.73).

For patients with DDH, Table 2 presents the results of a Pearson correlation analysis of sex, weight, and some aspects of the hip joint, which include five components: ROM, abduction, and internal rotation. The analysis produced some interesting results. There was a significant correlation between the ROMs of the right and left hips. This correlation is described by a value of 0.683, with a p-value of less than 0.01 indicating significance. Thus, greater ROM in one hip is associated with greater ROM in the other hip. Similarly, there was a fair degree of correlation in abduction between the left and right hips ($r = 0.535$, $p < 0.01$), as shown in Table 2.

In patients with DDH, the relationships among sex, external rotation, fixed flexion contractures, limb length discrepancies, and the presence of AVN were studied via correlation analysis (Pearson) (Table 3). The results revealed a strong positive correlation between the external

rotation of the right and left hips ($r = 0.937$, $p < 0.01$), suggesting that there is a high degree of symmetry for the external rotation of both hips. Moreover, a noteworthy positive correlation was also noted between fixed flexion contracture and fixed abduction ($r = 0.592$, $p < 0.01$), along with fixed flexion contracture and fixed internal rotation ($r = 0.592$, $p < 0.01$). These results show that in one plane of motion, fixed contractures are commonly linked with restrictions in other planes, as shown in Table 3.

DISCUSSION

The purpose of this study was to examine the relationships among functional mobility, quality of life, and hip joint variables among individuals with developmental DDH. The three findings provided in their tables refer to the functional and physical difficulties of individuals with DDH and the complex interactions of hip joint parameters. These findings are not only confirmed by but also far beyond the literature, enhancing the understanding of the condition and its implications for patient care.

The more pronounced correlation between the ROM of the right and left hips ($r = 0.683$, $p < 0.01$) supports other studies that also reported changes in interdependence within DDH and the relationship between the hip joints. Zhang et al. (2015) noted the bilateral nature of hip dysplasia, where limitation in one hip is often associated with restriction in the opposite hip. [8] Similarly, more recent studies by Hu et al. (2023) revealed that bilateral hip involvement tends to be common in patients with DDH, with many functional deficits being bilateral. [9] This emphasizes evaluating and treating both hips in clinical care, regardless of whether one side appears more symptomatic. The associations of some fixed flexion contractures with other joint parameters, as shown in Table 3, confirm the functional integration of the hip joint system. The positive correlation between fixed flexion contracture and fixed abduction ($r = 0.592$, $p < 0.01$) supports the work of Moya-Angeler et al. (2023), who reported that contractures in one movement direction often lead to compensatory restrictions in other directions of movement. [10] This phenomenon appears to result from DDH-related changes in biomechanics and muscle imbalances, which may worsen joint stiffness and reduce overall movement. Additionally, the strong link between fixed flexion contracture and LLD, with a correlation coefficient of 0.350 and a p value below 0.05, confirms the findings of Harris et al. (2022), who noted that LLD is a common issue in patients with poorly treated or unresponsive DDH. [11]

Another important finding of this research is the presence of avascular necrosis (AVN) and its correlation with LLD ($r = 0.655$, $p<0.01$). AVN is a well-known complication of DDH, especially in patients who have had surgical procedures such as closed or open reduction. [12] The data in this study demonstrate a significant relationship between AVN and LLD, highlighting the potential effects of vascular supply abnormalities in the femoral head. This

Table No 1: Descriptive Statistics of Functional and Physical Parameters in Patients with Developmental Dysplasia of the Hip

	Minimum	Maximum	Mean	Std. Deviation
Range of Motion in degrees Right	85.00	130.00	112.05	9.60
Weight in kg	9.00	20.00	14.65	2.98
Range of Motion in degrees Left	90.00	125.00	110.51	8.14
Abduction Right	10.00	45.00	29.05	9.69
Abduction Left	15.00	45.00	28.17	9.08
Internal Rotation	15.00	50.00	31.20	8.81
Internal Rotation Left	15.00	60.00	31.88	11.76
External Rotation Right	12.00	90.00	31.08	13.62
External Rotation Left	18.00	90.00	31.91	12.73
Less than 30° fixed flexion contracture	1.00	2.00	1.37	.49
Less than 10° fixed abduction	1.00	2.00	1.17	.38
Less than 10° fixed internal rotation in	1.00	2.00	1.17	.38
Limb length discrepancy less than 3.2 cm	1.00	2.00	1.1714	.38239
LLD Limb length discrepancy (mm)	1.00	2.00	1.8286	.38239
AVN Present	1.00	2.00	1.7714	.42604
Valid N (list-wise)				

Table No 2: Correlation analysis between sex, weight, and hip joint parameters in patients with developmental dysplasia of the hip

parameters			Gender	Weight in KG	Range of Motion in Degrees Right	Range of Motion in Degrees Left	Abduction Right	Abduction Left	Internal Rotation
Gender	Pearson Correlation	1	.151	-.053	.091	.218	-.006	.030	Internal Rotation Left
Gender Weight in kg	Sig. (2-tailed)		.387	.763	.602	.207	.971	.862	-.038
	N	35	35	35	35	35	35	35	.827
	Pearson Correlation	.151	1	-.118	.021	.310	.250	-.307	35
Weight in kg Range of Motion in degrees Right	Sig. (2-tailed)	.387		.499	.906	.070	.147	.072	-.168
	N	35	35	35	35	35	35	35	.335
	Pearson Correlation	-.053	-.118	1	.683**	.262	.195	.035	35
Range of Motion in degrees Right Range of Motion in degrees Left	Sig. (2-tailed)	.763	.499		.000	.129	.263	.842	.003
	N	35	35	35	35	35	35	35	.987
	Pearson Correlation	.091	.021	.683**	1	.093	.030	-.167	35
Range of Motion in degrees Left Abduction Right	Sig. (2-tailed)	.602	.906	.000		.593	.863	.339	-.113
	N	35	35	35	35	35	35	35	.517
	Pearson Correlation	.218	.310	.262	.093	1	.535**	.315	35
Abduction Right Abduction Left	Sig. (2-tailed)	.207	.070	.129	.593		.001	.065	.264
	N	35	35	35	35	35	35	35	.125
	Pearson Correlation	-.006	.250	.195	.030	.535**	1	.179	35
Abduction Left Internal Rotation	Sig. (2-tailed)	.971	.147	.263	.863	.001		.303	.183
	N	35	35	35	35	35	35	35	.293
	Pearson Correlation	.030	-.307	.035	-.167	.315	.179	1	35
Internal Rotation Internal Rotation Left	Sig. (2-tailed)	.862	.072	.842	.339	.065	.303		.827**
	N	35	35	35	35	35	35	35	.000
	Pearson Correlation	-.038	-.168	.003	-.113	.264	.183	.827**	35
Internal Rotation Left **. Correlation is significant at the 0.01 level (2-tailed).	Sig. (2-tailed)	.827	.335	.987	.517	.125	.293	.000	1
	N	35	35	35	35	35	35	35	35

finding agrees with Mazama et al. (2024), who reported that LLD and abnormal hip movement can increase the risk of AVN due to disruption of the blood supply to the femoral head. [13] As mentioned earlier, these results emphasize the importance of active monitoring and management of leg length discrepancies in patients with developmental dysplasia of the hip to prevent avascular necrosis and its consequences.

In the present study, there were no significant correlations between sex and hip joint parameters, which is remarkable, as it conflicts with some studies that posit that females have greater functional limitations due to developmental dysplasia of the hip. [14] Nonetheless, other studies by Boyer et al. (2008) and Hawellek et al. (2022) reported results that suggest that sex is not an important factor for hip joint function in some populations. These differences could result from the designs of the studies and the characteristics of the population samples, thus highlighting the necessity of further research to address how sex influences DDH outcomes. [15, 16]

The results of this study have serious implications for clinical practice and the public health domain. The association of hip joint measurements with LLD and AVN makes one consider how carefully DDH evaluation and management are handled. There is an overall plan that emphasizes prompt diagnosis and treatment to prevent further deterioration of joint deformities and the negative consequences of LLD and AVN. This corresponds with the

Table No 3: Correlation Analysis of Gender, External Rotation, Fixed Contractures, Limb Length Discrepancy, and Avascular Necrosis in Patients with Developing Dysplasia of the Hip

parameters		Gender	External Rotation Right	External Rotation Left	Less than °30 fixed flexion contracture	Less than °10 fixed abduction	Less than °10 fixed internal rotation in	Limb length discrepancy less than 3.2 cm	LLD Limb length discrepancy (mm)	AVN Present
N	Pearson Correlation	1	.211	.254	.057	.009	.009	.009	-.169	-.106
	Sig. (2-tailed)		.224	.141	.745	.959	.959	.959	.332	.543
	N	35	35	35	35	35	35	35	35	35
External Rotation Right	Pearson Correlation	.211	1	.937**	.246	.008	.008	.008	.054	-.118
	Sig. (2-tailed)	.224		.000	.154	.962	.962	.962	.759	.499
	N	35	35	35	35	35	35	35	35	35
External Rotation Left	Pearson Correlation	.254	.937**	1	.213	-.021	-.021	-.021	-.064	-.226
	Sig. (2-tailed)	.141	.000		.220	.904	.904	.904	.717	.192
	N	35	35	35	35	35	35	35	35	35
Less than 30° fixed flexion contracture	Pearson Correlation	.057	.246	.213	1	.592**	.592**	.592**	.350*	.278
	Sig. (2-tailed)	.745	.154	.220		.000	.000	.000	.039	.106
	N	35	35	35	35	35	35	35	35	35
Less than 10° fixed abduction	Pearson Correlation	.009	.008	-.021	.592**	1	1.000**	1.000**	.207	.248
	Sig. (2-tailed)	.959	.962	.904	.000		.000	.000	.233	.152
	N	35	35	35	35	35	35	35	35	35
Less than 10° fixed internal rotation in	Pearson Correlation	.009	.008	-.021	.592**	1.000**	1	1.000**	.207	.248
	Sig. (2-tailed)	.959	.962	.904	.000	.000		.000	.233	.152
	N	35	35	35	35	35	35	35	35	35
Limb length discrepancy less than 3.2 cm	Pearson Correlation	.009	.008	-.021	.592**	1.000**	1.000**	1	.207	.248
	Sig. (2-tailed)	.959	.962	.904	.000	.000	.000		.233	.152
	N	35	35	35	35	35	35	35	35	35
LLD Limb length discrepancy (mm)	Pearson Correlation	-.169	.054	-.064	.350*	.207	.207	.207	1	.655**
	Sig. (2-tailed)	.332	.759	.717	.039	.233	.233	.233		.000
	N	35	35	35	35	35	35	35	35	35
AVN Present	Pearson Correlation	-.106	-.118	-.226	.278	.248	.248	.248	.655**	1
	Sig. (2-tailed)	.543	.499	.192	.106	.152	.152	.152	.000	
	N	35	35	35	35	35	35	35	35	35

International Hip Dysplasia Institute (IHDI) recommendation, which calls for screening and appropriate response to DDH to maximize the prognosis. [17]

This study proposes, in addition to the clinical findings, the need for public health intervention in terms of awareness and service provision related to DDH. Healthcare access barriers negatively affect the outcomes of many patients with DDH in the more neglected subgroups. [18] These public health problems could be addressed by designing and implementing targeted community health education and outreach programs combined with adequate screening programs to address the burden of DDH at the population and societal levels.

Therefore, the outcomes of this study contribute to the integration of a multidisciplinary approach in the management of DDH. Patients suffering from DDH reported better quality of life and functional mobility as a result of receiving physical therapy, pain relief, and lifestyle activity modification. [19] By adding systematic care and monitoring of the joint angles, it is now possible to increase the quality of life for DDH patients.

CONCLUSION

This research investigated the relationships among hip joint parameters, functional mobility, and quality of life in patients with DDH and revealed complex interactions among joint motion, contractures, and limb length discrepancies. Proactive treatment is crucial for preventing complications such as avascular necrosis, particularly in Paediatric patients. The study also highlights public health challenges, including disparities in screening, treatment, and rehabilitation, underscoring the need for equitable, multidisciplinary care to address the physical, emotional, and social impacts of DDH. Longitudinal research is recommended to assess long-term outcomes and intervention efficacy, guiding strategies to improve patient quality of life and healthcare access.

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CONFLICT OF INTEREST: Authors declare no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE: NIL

Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Ali A	✓	×	✓	×	✓	×
Hayat S	✓	✓	×	✓	✓	×
Khan I	×	✓	×	×	✓	×
Rao EH	✓	✓	✓	×	✓	✓
Khan M	✓	×	✓	×	✓	×
Kamal Y	✓	✓	×	✓	✓	×
Sajjad A	×	✓	×	×	✓	×
Ullah D	✓	✓	✓	×	✓	✓

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This Manuscript was approved by the Ethical Review Board of Khyber Medical College, Peshawar. Vide No.196/DME/KMC. Dated: 03 03 2025

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