www.journalmsr.com

الجمعية السعودية لجراحة العظام
Saudi Orthopedic Association

Journal of Musculoskeletal Surgery and Research

Original Article

Patients' quality of life assessment following treatment of leg length discrepancy in a single center in Riyadh

Fahad S. AlHuzaimi, SBOrth[1], Mohamed M. Zamzam, MSc (Ortho), PHD (Ortho)[1], Abdulrahman AlAujan, MBBS[2], Yousef A. AlDobikhi, MBBS[2], Yazeed A. AlKhayyal, MBBS[2], Mohammed O. AlOmar, MBBS.[2]

[1]Department of Orthopedics, King Saud University, King Khalid University Hospital, [2]Department of Orthopedics, College of Medicine, King Saud University, Riyadh, Saudi Arabia.

***Corresponding author:**
Fahad S. AlHuzaimi, Department of Orthopedics, King Saud University, King Khalid University Hospital, Riyadh, Saudi Arabia.

fsalhuzaimi@ksu.edu.sa

Received: 03 December 2022
Accepted: 13 February 2023
EPub Ahead of Print: 03 March 2023
Published: 06 May 2023

DOI
10.25259/JMSR_148_2022

Quick Response Code:

ABSTRACT

Objectives: Length disparities of children's limbs might make it difficult for them to engage in social, recreational, and leisure activities. The main goals of surgical treatment of limb length discrepancy (LLD) are to restore limb function and prevent adverse social effects. The aim of this study was to assess the quality of life (QoL) of children who received therapy for limb length discrepancies.

Methods: Twenty participants fit the inclusion criteria and completed the validated and translated version of the electronic questionnaire of the brief version of the world health organization questionnaire for QoL assessment the brief version (WHO-QoL-BREF). Answering the questionnaire was administered by an interviewer over the phone. The questionnaire comprised basic patient information and questions regarding the QoL.

Results: There were 12 male participants and eight females. The total WHO-QoL BREF score of the participants is 94.15 ± 10.01 (out of 125). The differences between the mean scores of all domains according to participants' demographic, distortion, and surgical variables were insignificant.

Conclusion: Ensuring the QoL and function improvement after treatment of LLD is crucial. More attention must be paid to selecting the appropriate procedure for the suitable patient when treating LLD.

Keywords: Limb length discrepancy, Health-related quality of life, Quality of life, Pediatrics

INTRODUCTION

Limb length discrepancy (LLD) is defined as a difference in lengths of the paired extremity limbs that is noticeably out of proportion. LLD's basic categories are structural (true) and functional (apparent). Some patients have concurrent structural and functional issues, which may balance one another or exacerbate the LLD.[1]

LLD causes can be congenital or acquired. Congenital limb deficiency diseases are challenging rare conditions that are usually associated with LLD. They are diverse, affecting 2–7 out of every 10,000 babies born worldwide.[2]

How to cite this article: AlHuzaimi FS, Zamzam M, AlAujan A, AlDobikhi YA, AlKhayyal Y, AlOmar MO. Patients' quality of life assessment following treatment of leg length discrepancy in a single center in Riyadh. J Musculoskelet Surg Res, 2023;7:79-83.

ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, transform, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms. ©2023 Published by Scientific Scholar on behalf of Journal of Musculoskeletal Surgery and Research

Disparities in the appearance and functionality of children's limbs might make it difficult for them to engage in social, recreational, and leisure activities, which can cause problems with behavior, mood, psychological well-being, and social adjustment. These elements, in addition to the difficult surgical procedures required for dealing with LLD, frequently impact these children's health-related quality of life (HRQL).[3-5]

The main goals for surgical treatment of LLD are to restore limb function and break the adverse effects of this condition on the musculoskeletal system. Proper functioning and physical activity are made possible by good balance and pain-free walking, which considerably raises patients' quality of life (QoL).[6] Prior studies show that children with one or both limbs lengthened face functional and psychological issues.[5-7]

Reconstruction is not always possible for patients with more severe limb deficiencies in children. However, amputation combined with a properly fitted prosthetic can be successful in those situations. Results in terms of function and QoL are comparable to those of children who underwent reconstruction.[8] Hence, knowing which treatments are more likely to result in higher QoL is essential to provide patients with better LLD care.

The influence of LLD on QoL used to receive relatively little consideration. This study aimed to assess the QoL of individuals who received therapy for LLD. Moreover, figuring out how various treatments can impact the general health of patients with LLD as well as their social and psychological status.

MATERIALS AND METHODS

A cross-sectional and retrospective study was conducted in a single center in Riyadh, Saudi Arabia. Our inclusion criteria included all patients of both genders who had a confirmed isolated LLD >2 cm or LLD with deformity with no previous surgical intervention and were treated using Ilizarov's circular external fixator, Taylor's spatial frame, Orthofix advanced LRS modular monolateral external fixator, and Precice intramedullary lengthening nail during the period from 2017 to 2020 were included in the study. Our exclusion criteria included all patients with angular or rotational deformity requiring correction alone without LLD and patients who were still under evaluation of their LLD or did not complete their treatment.

Twenty participants fit the inclusion criteria and were included in the study. Each participant was requested to answer a validated and translated version of the electronic questionnaire of the pretested World Health Organization questionnaire for QoL assessment, the brief version (WHO QoL-BREF). The response options range from 1 (very dissatisfied/very poor) to 5 (very satisfied/very good).[9] This questionnaire tests the QoL following surgical treatment for LLD. Answering the questionnaire was administered by an interviewer over the phone. The questionnaire comprised close-ended questions about the participants' basic information (age, gender, educational level, and occupation) and questions regarding the QoL. Consent was obtained from participants before data collection, emphasizing confidentiality and the right of participants to withdraw from the study at any point.

Data analysis was accomplished using Statistical Package for Social Studies version 22 (IBM Corp., NY, US). Continuous variables were expressed as mean ± standard deviation and categorical variables were expressed as percentages. The *t*-test and one-way ANOVA were used for continuous variables. $P < 0.05$ was considered statistically significant.

RESULTS

Twelve participants were males and eight were females [Table 1] demonstrates the demographic characteristics of the participants, including the operation type and site. Twelve of our patients equalized their LLD completely and eight require further lengthening procedures. The minimum length treated was 2 cm, while the maximum was 6.5 cm during 4–6 months of lengthening treatment.

The total WHO-QoL BREF score of the participants is 94.15 ± 10.01 (out of 125). The individual scores of the WHO-QoL BREF domains are presented in [Table 2]. The total female score is higher (95.75) than males (93.08). In addition, the mean QoL scores are higher in females in all domains than in males except the psychological domain. However, the differences are not significant [Table 3]. Furthermore, the differences between the mean scores of all domains according to participants' nationalities are insignificant.

Participants with acquired LLD had a higher total score of 97.00 compared to 93.20 in participants with congenital LLD. They also scored higher in all domains except general health and social relationships. Nevertheless, again, the differences were insignificant [Table 4].

[Table 5] compares the scores based on operation type. The highest total score was in individuals with LLD correction (96.89), followed by angular and rotational deformity and LLD (94.15). Nevertheless, the differences in total and each domain according to operation type are insignificant.

Seven of our patients had post-operative complications. They included four patients with pin tract infections, which were treated conservatively. In addition, one patient had delayed union, and two had fractures that required adjustment of the frame.

[Table 6] showed a higher total score in individuals with correction at the leg (95.33), followed by correction at the thigh (92.37). So far, the differences are also insignificant.

Table 1: Demographic characteristics of the participants including surgical details (*n*=20).

Gender	Male	12 (60%)
	Female	8 (40%)
Age (Mean in years, SD)		17.85±9.6
Nationality	Saudi	18 (90%)
	Non-Saudi	2 (10%)
Distortion type	Acquired deformity	5 (25%)
	Congenital malformation	15 (75%)
Operation type	Correction of angular deformity and LLD	7 (35%)
	Correction of LLD	9 (45%)
	Correction of angular and rotational deformity and LLD	4 (20%)
Operation site	Leg	12 (60%)
	Thigh	8 (40%)

Table 2: Mean score of the domains and the total score of QoL WHO QoL-BREF.

	Mean	SD±
General quality of life (out of 5)	4.25	0.79
General health (out of 5)	4.15	0.93
Physical score (out of 35)	26.6	4.48
Psychological score (out of 25)	15.3	1.81
Social Relationship score (out of 15)	12.3	1.42
Environment score (out of 40)	31.55	4.78
Total score (out of 125)	94.15	10.1

Higher score indicates good quality of life, SD: Standard deviation, WHO-QoL-BREF: World health organization questionnaire for quality of life assessment, the brief version, LLD: Limb length discrepancy

Table 3: Mean score of the domains and the total score of QoL WHOQoL-BREF according to gender.

	Male		Female	
	Mean	SD±	Mean	SD±
General quality of life (5)	4.17	0.83	4.38	0.74
General health (5)	3.92	1.00	4.50	0.76
Physical score (35)	26.33	4.56	27.00	4.63
Psychological score (25)	15.67	1.72	14.75	1.91
Social Relationships score (15)	11.83	1.19	13.00	1.51
Environment score (40)	31.17	5.57	32.13	3.56
Total score (125)	93.08	10.38	95.75	9.90

SD: Standard deviation, WHO-QoL-BREF: World health organization questionnaire for quality of life assessment, the brief version, QoL: Quality of life, LLD: Limb length discrepancy

Table 4: Mean score of the domains and the total score of QoL WHOQoL-BREF according to distortion type.

	Acquired		Congenital	
	Mean	SD±	Mean	SD±
General quality of life (5)	4.40	0.89	4.20	0.77
General health (5)	3.80	1.30	4.27	0.80
Physical score (35)	27.20	7.60	26.40	3.25
Psychological score (25)	15.60	2.70	15.20	1.52
Social Relationships score (15)	11.80	2.28	12.47	1.06
Environment score (40)	34.20	5.81	30.67	4.25
Total score (125)	97.00	16.36	93.20	7.47

SD: Standard deviation, WHO-QoL-BREF: World health organization questionnaire for quality of life assessment, the brief version, QoL: Quality of life, LLD: Limb length discrepancy

DISCUSSION

LLD is a common health disorder with various etiologies, each having its own functional effects on patients and their families. These effects include aberrant gait, knee, and hip discomfort, as well as psychological issues. Although many surgeons use a cutoff value of 2 cm as a trigger for surgery,[10-12] the main goal of surgical equalization of LLD is to enhance patients' function, gait, appearance, and mobility of the lower extremities and consequently improve patients' QoL. The results of the present study showed a comparable mean improvement in the participants' QoL (overall score of 75.32%). However, there were no significant relations between this improvement and all variables of the study participants.

Vitale *et al.* aimed in their study by using "the Child Health Questionnaire tool" to determine whether there was a relationship between LLD treatment and HRQL. They also tested whether the commonly used 2 cm threshold could identify individuals who would experience QoL issues or not. They noticed that LLD had a negative effect on the participants' psychosocial HRQL that could be improved by treatment. They also divided the participants into two groups, those with LLD >2 cm and those with ≤2 cm. They found that the scores were lower but insignificant in people with ≤2 cm LLD, which is against the hypothesis of a 2 cm cutoff threshold. Their findings suggested that many things should be considered when considering surgery, more than only physical limb differences.[10]

Table 5: Mean score of the domains and the total score of QoL WHOQoL-BREF according to operation type.

Type of correction	Correction of angular deformity and LLD		Correction of LLD		Correction of angular and rotational deformity and LLD	
	Mean	SD±	Mean	SD±	Mean	SD±
General quality of life (5)	4.42	0.78	4.33	0.71	3.75	0.96
General health (5)	3.85	0.89	4.33	1.00	4.25	0.96
Physical score (35)	26.43	4.79	27.67	5.07	24.50	1.73
Psychological score (25)	15.29	2.43	15.00	1.50	16.00	1.41
Social Relationships score (15)	12.00	1.91	12.56	1.33	12.25	0.50
Environment score (40)	30.29	6.58	33.00	3.74	30.50	3.10
Total score (125)	92.29	12.74	96.89	9.41	94.15	5.67

SD: Standard deviation, WHO-QoL-BREF: World health organization questionnaire for quality of life assessment, the brief version, QoL: Quality of life, LLD: Limb length discrepancy

Table 6: Mean score of the domains and the total score of QoL WHO QoL-BREF according to operation site.

	Leg		Thigh	
	Mean	SD±	Mean	SD±
General QOL (5)	4.08	0.66	4.50	0.93
General health (5)	4.33	0.65	3.88	1.25
Physical score (35)	27.33	3.25	25.50	5.96
Psychological score (25)	15.33	1.15	15.25	2.12
Social Relationships score (15)	12.33	1.15	12.25	1.95
Environment score (40)	31.91	3.36	31.00	7.09
Total score (125)	95.33	7.11	92.37	13.65

SD: Standard deviation, WHO-QoL-BREF: World health organization questionnaire for quality of life assessment, the brief version, QoL: Quality of life

Ramaker *et al.* aimed their study to identify if leg lengthening is harmful to a child's mental health. The Ilizarov procedure was used to treat 26 patients who were 6–17 years of age. A control group of healthy children with age- and gender-matching was also included in the study. Before and after surgery, patients and parents received semi-structured interviews and psychometric tests. There was no demonstrable gain in physical capacity and their psychological QoL had not significantly changed after surgery.[13]

Chhina *et al.*, in their study on 39 children with a diagnosis of LLD and their ages ranged between 8 and 18 years, together with interviewing their parents (n = 40), found that LLD can significantly affect children's HRQL. Furthermore, the information obtained from their patient-reported outcome measure on how different treatment options could affect children with LLD confirms that HRQL may be used to educate parents and kids on the possible repercussions of various treatment options.[14]

Oostenbroek *et al.* reported that correcting LLD of 25% or higher of the original limb length proved to be associated with an increased likelihood of developing complications that may have an adverse effect on patients' QoL. They had 37 children aged 6–17 years who were treated by the Ilizarov technique for lengthening; out of them, 10 had an unsuccessful outcome and additional surgical procedure was necessary to reduce their complications.[15]

The results of the present study should be interpreted with a number of limitations. The study included a low number of patients. Furthermore, the nature of this study has an inherited limitation of being conducted in a single center. Finally, the study did not compare patients' QoL before and after treatment.

CONCLUSION

Ensuring the improvement of QoL after treatment of LLD is a crucial goal to be considered before commencing any surgical procedure. Therefore, the authors recommend further investigation, which includes a greater number of patients and compares patients' QoL before and after treatment. This may help select the appropriate procedure for the suitable patients.

AUTHORS' CONTRIBUTIONS

MOO: Study design, literature review, and data collection. YAD: Data collection and manuscript writing. YAK: Data collection, manuscript writing, and review. AA: Data analysis and manuscript writing. FSH: Supervision, original data review, and manuscript editing. MMZ: Supervision, manuscript review, analysis review, and manuscript editing. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

ETHICAL APPROVAL

Ethical approval was obtained from King Saud University Medical City Institutional Review Board on 8/12/2021 and renewed on 27/11/2022. No. E-21-6394.

DECLARATION OF PATIENT CONSENT

The authors certify that they have obtained all appropriate patients consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

FINANCIAL SUPPORT AND SPONSORSHIP

This study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

REFERENCES

1. Kayani B, Pietrzak J, Hossain FS, Konan S, Haddad FS. Prevention of limb length discrepancy in total hip arthroplasty. Br J Hosp Med (Lond) 2017;78:385-90.
2. Ephraim PL, Dillingham TR, Sector M, Pezzin LE, Mackenzie EJ. Epidemiology of limb loss and congenital limb deficiency: A review of the literature. Arch Phys Med Rehabil 2003;84:747-61.
3. Michielsen A, van Wijk I, Ketelaar M. Participation and health-related quality of life of Dutch children and adolescents with congenital lower limb deficiencies. J Rehabil Med 2011;43:584-9.
4. Boonstra AM, Rijnders LJ, Groothoff JW, Eisma WH. Children with congenital deficiencies or acquired amputations of the lower limbs: Functional aspects. Prosthet Orthot Int 2000;24:19-27.
5. Lavigne JV, Faier-Routman J. Psychological adjustment to pediatric physical disorders: A meta-analytic review. J Pediatr Psychol 1992;17:133-57.
6. Sakkers R, van Wijk I. Amputation and rotationplasty in children with limb deficiencies: Current concepts. J Child Orthop 2016;10:619-26.
7. Niemelä BJ, Tjernström B, Andersson G, Wahlsten VS. Does leg lengthening pose a threat to a child's mental health? An interim report one year after surgery. J Pediatr Orthop 2007;27:611-7.
8. Pawik Ł, Pawik M, Wrzosek Z, Fink-Lwow F, Morasiewicz P. Assessment of the quality of life in patients with varying degrees of equalization of lower limb length discrepancy treated with Ilizarov method. J Orthop Surg Res 2021;16:62.
9. Ohaeri JU, Awadalla AW. The reliability and validity of the short version of the WHO quality of life instrument in an Arab general population. Ann Saudi Med 2009;29:98-104.
10. Vitale MA, Choe JC, Sesko AM, Hyman JE, Lee FY, Roye DP Jr., *et al*. The effect of limb length discrepancy on health-related quality of life: Is the "2 cm rule" appropriate? J Pediatr Orthop B 2006;15:1-5.
11. Coppola C, Maffulli N. Limb shortening for the management of leg length discrepancy. J R Coll Surg Edinb 1999;44:46-54.
12. Vogt B, Gosheger G, Wirth T, Horn J, Rödl R. Leg Length discrepancy-treatment indications and strategies. Dtsch Arztebl Int 2020;117:405-11.
13. Ramaker RR, Lagro SW, van Roermund PM, Sinnema G. The psychological and social functioning of 14 children and 12 adolescents after Ilizarov leg lengthening. Acta Orthop Scand 2000;71:55-9.
14. Chhina H, Klassen AF, Kopec JA, Oliffe J, Iobst C, Dahan-Oliel N, *et al*. What matters to children with lower limb deformities: An international qualitative study guiding the development of a new patient-reported outcome measure. J Patient Rep Outcomes 2021;5:30.
15. Oostenbroek HJ, Brand R, van Roermund PM, Castelein RM. Paediatric lower limb deformity correction using the Ilizarov technique: A statistical analysis of factors affecting the complication rate. J Pediatr Orthop B 2014;23:26-31.