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Effectiveness of assistive devices on activity of daily living (ADL) and quality of life (QoL) in children with post-polio paralysis

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Abstract---Objective: To assess the effectiveness of assistive devices to enhancethe activity of daily living (ADL) and quality (QoL) of life in post-polio paralyzed childrenvisitingthe rehabilitation centre of Peshawar, Pakistan. Methodology: It was an interventional study, before and after using the AT, carried out in the PIPOS rehabilitation centre, Peshawar, from 2021 January to July.A total of 246 children of age 10-15 years were recruited.Both the genders, male(159) and female (87) with post-polio paralysis, were included.Before the intervention, verbal consent was taken from all these children, semi-structured questionnaire was developed to see the effect of the assistive device usage before and after 6 months to check the quality of ADL and QoL.The SUNNAAS index for ADL and WHO-BREFindex for quality of life (QoL) were used. The analysis was done on STATA version 14.0. Results: Male 95 and female 65 children participated in our study. The meandifference was -8.658 was analyzedfor the SUNNAS index of ADL, and the mean of -22.479 and SD 6.350 for the WHO index of QoL were analyzed at a 95% confidence interval. Two paired t-test was significant, with a value of 0.000 P-value for both the indices. Conclusion: It was concluded that assistive devices improved the ADL and QoL of these children after using assistive devices.There is a strong association between the assistive device and ADL and QoL.

***Keywords*---**Post-Polio Paralysis, ADLs, QoL, Rehabilitation Centres, Assistive Devices, WHO, KAFO, AFO, FO, SUNNAS.

Introduction

Poliomyelitis (polio), caused by poliovirus, is a highly infectious disease affecting children (5 years), invading the nervous system and causing paralysis.[1] Till now, no treatment resulting in the cure of infection is available. Diagnosis at an early stage and support treatments such as rest, pain control, proper nutrition, physical therapy, and assistive devices to prevent deformities can reduce the possible long-term symptoms due to muscle loss.[2]The primary purpose of early orthopaedic surgery was simply to correct limb deformities, which usually led to the recurrence of deformity because of spasticity.The patient usually requires extensive care and support.[2]Physical disabilities are the main cause of deformity in children, and world incidence is between 2% to 3% per thousand live births. Around 80% of children with disability live in developing countries and states. Only fewer children are getting rehabilitation services. The caregiver is the ultimate need of lifelong requirement for physically disabled children to maintain their quality of life.[3]Orthoses deliver a positive role in polio-affected patients' therapeutic care. The aim mostly is to stabilize the knee and prevent excessive recurvatum by helping the patient mobility.[3] Rehabilitation, The Activities of Daily Living (ADL) and WHO Quality of life (QoL) are required to treat basic functional, psychosocial, socialand environmentalrequirements.

[4]The term "activities of daily living," or ADLs, basically refers to everyday life tasks. The patients need help to perform daily life activities from caregivers or assistive devices and, in some cases, both. Neurological and musculoskeletal conditions lead to decreased ADL.[5]The World Health Organization (WHO) defined Quality of Life (QoL) as "an individual's perception of their position in life, in the context of the culture and value systems in which they live, and to their goals, expectations, standards and concerns". QoL comprises multiple aspects, including psychological health, physical wellbeing, social relationships, and environmental conditions.[6]Assistive technology (AT) is an interdisciplinary area of knowledge which offers products, resources, methods, strategies, practices and services that promote the functionality of people with disabilities, impairments, or reduced mobility, aiming at their autonomy, independence, quality of life (QOL) and social inclusion.[7]

Assistive devices and environmental modifications can improve, support, and maintain ADL.[8] Assistive Technology (AT) are specially designed devices available for children that require individual assistance to achieve ADL. Its primary goal is to maintain, improve, and promote physical activity and independence.[9]The 2030 Agenda for Sustainable Development Goals (mediator of ADL & AT) provides a powerful framework for mainstreaming disability.[10] Globally, 15% of the population live with impairment, with 190 million (15 years) having significant problems in functioning. The rapid Assistive Technology Assessment (RATA) Survey assesses AT's requirements and unmet demands. It recognizes the barriers to access AT in Pakistan's population. [10]Pakistan till now has been unable to control polio where the situation is worsened by ongoing conflicts, applied ban by militants on the immunization and lack of security.[11]Pakistan supports developing ADLs and carries out mobility training to design awareness sessions about challenges. Education centres for disabled children at Al-Barkat Rehabilitation,[12,13] Community Rehabilitation Committee (CRC) are reliable

centres in Pakistan to help children with ADLs.[14,15] The UNICEF developed a regional mapping study on disability-inclusive education to provide the key policies, practices and strategies to ensure children with disabilities learn in inclusive settings in Pakistan.[16,17]Less literature may be due to the complications interrelated with the association of the AT demands, physical problems, service application, coordination and service delivery regarding the post-polio paralyzed children with ADL and QoL. Moreover, insufficient knowledge is available in developing countries regarding post-polio paralysis. Therefore, this study aimed to measure the ADLs and QoL specific to the post-polio paralytic patients to determine the effectiveness of assistive devices in improving their living.

Methodology

An interventional study was carriedout in the Pakistan Institute of Prosthetic and Orthotic Sciences (PIPOS), Peshawar's rehabilitation centre, from January 2019 to June 2021. APre and Post Interventional study (before and after study)was carried out atthePakistan Institute of Prosthetic and Orthotic Sciences (PIPOS)**.** The study duration was 6 months,from January to June of 2021.Based on the search and a WHO document detailing the total number of polio cases in the country is 834. It also mentions that 70% of them develop disabilities. Taking the confidence interval of 95% and alpha of 5%. The sample size was calculated to be 246.Confidence limits as % of 100: 5% were taken. Post-Polio paralytic patientsaged 5-15 years were included in our study and had no history of orthotic intervention.

Patients with multiple deformities and major bilateral paralysis were excluded from the study.Data was collected through an approved and validated tool (Questionnaire). The patients meeting the inclusion criteria were asked for consent, and after the consent, they were included in the study. Patients denying the consent were excluded from the study. The questionnaire was filled by asking the questions from the study participant before application of Assistive intervention to get the baseline information. The questionnaire was filled second time after one month of the patient using assistive devices. All the patients, irrespective of providing or denying consent for the study, were treated according to their needs.Data from the completed questionnaire was entered in STATA version 14.0. Mean, Standard deviation, Frequencies and percentage were calculated. Effectiveness of the AT was measured using the paired/correlated t-test,i.e., between baseline and end-line ADL score measured using SUNNAAS index[18]. QoL was measured before and after using AT by the WHOQOL-BREF index. WHOQOL-Bref index scoreis an abbreviated version of the WHOQOL-10.

More recently, WHOQOL-BREF, an abbreviated 26 item with 4 domains that are physical health (seven items), psychological (six items), social relationships (three items), and environment (eight items) assessment, has been developed.WHOQOL-100is a 100-question assessment that currently exists in directly comparable forms in 29 languages.English versions of the WHOQOL-BREF were used in this study. The English version has displayed good criterion and content validity and test-retest reliability[19,20]. Each item of the WHOQOL-BREF is scored from 1 to 5 on a response scale, which is stipulated as a five-point ordinal scale. The scores are then transformed linearly to a 0–100-scale. The questionnaire also has good

internal consistency. The QOL assessment used a recommended time frame of 4 weeks. Questions were administered face-to-face and read to all participants in English or Urdu by a trained research assistant. Data were collected in the rehabilitation centre that is PICOS. The ethical report was taken from Khyber Medical University (KMU), Peshawar, Pakistan.

Results

The participants were children of age groups05-15 of both genders. The mean score before and after the use of assistive devices using WHO was 70.621_+93.101 with SD 6.350, as the mean value for the SUNNAS before and after the score was 19.268_+27.928. With the SD 4.061. The p-value t-test was highly significant, that is, 0.000 with a 95% confidence interval.

Variables		f (%)
Age Groups	05-09 years	155 (63.0)
	10-12 years	71 (28.9)
	13-15 years	20 (08.1)
Gender	Male	159 (64.6)
	Female	87 (35.4)
Devices	FO uni	05 (2.0)
	AFO uni	50 (20.3)
	AFO bil	05 (2.0)
	KAFO Splint uni	04 (1.6)
	KAFO uni	120 (48.8)
	KAFO bill	44 (18.0)
	KAFO/AFO	12 (4.9)
	HKAFO bill	06 (2.4)

Table 2: Gender Age Group

Gender of Patient	Group of Ages			Total
	05-09 years	10-12 years	13-15 years	
Male	95	52	12	159
Female	60	19	08	87
Total	155	71	20	246

Table 3: t-test SUNNAS before and SUNNAS after

Variable	Obs	Mean	Std. err	Std. Dev	95% conf.interval		t-test	p-value
					upper	lower		
SUNNAS-e	246	19.268	0.352	5.535	18.57	19.96	-33.43	0.000
SUNNAS-r	246	27.926	0.260	4.080	27.41	28.43		
diff	246	-8.658	0.258	4.061	-9.16	-8.14		

Table 4: t-test WHO before and WHO after

Variable	Obs	Mean	Std. err	Std. Dev	95% conf.interval		t-test	p-value
					upper	lower		
WHO-BREF-e	246	70.62	0.77	12.08	69.10	72.13	-55.51	0.000
WHO-BREF-e	246	93.10	0.57	09.06	91.96	94.23		
diff	246	-22.47	0.40	6.35	-23.27	-21.68		

Discussion

The barriers thatneed to be bridged should be understood from children's perspectivesto develop suitable support for contribution to pediatric rehabilitation.[23]AT are adapted, built,and designed to assist an individualin fulfilling a specificresponsibility. Individuals with impairmentsdepend on AT to allow them to perform ADLs and engage productively and energetically in the community to better their QoL.[24] Foot orthoses (FO), Ankle Foot Orthoses (AFO), Knee Ankle Foot Orthoses (KAFO) and Hip Knee Ankle Foot Orthoses (HKAFO)can be used to optimize the alignment of the lower limb. Bilateral or unilateraluse of these devices to facilitate ease of function, prevent deformity in the lower limb and improve efficiency.[25]Provision of assistive technology is not about isolated activities such as design or supply of products or delivery of services. Although research addressing separate components of provision is necessary, there is a growing need for research that applies a system perspective to guide the development of holistic strategies for cost-efficient provision.Appropriate AT should meet the user's needs and environmental conditions; provide proper fit and support; be safe and durable; be available in the country,and obtain and sustain services at the most economical and affordable price. However, as already pointed out, safety and function should never be compromised.[26]If an AT was helpful, children would wear/use it even if their disability was mild or non-existent. However, the scientific evidence is not sufficient to allow strong conclusions regarding the effectiveness of prosthetic and orthotic interventions.[27] The important role of the professional was highlighted in negotiating all the factors to consider in the AT selection and provision process. Adaptation of the AT Device Selection Framework is suggested to facilitate application to low resourced contexts, such as South Africa. Assistive technology selection is a complex process with factors about the assistive technology users (child and family) and the rehabilitation professional recommending the assistive technology influencing the process.[28]The AFO (unilateral/bilateral) are sufficiently stiff to effectively support the foot in the swing without hampering the ankle during stance. A study showed a significant improvement in walking speed and energy cost (12%). The AFO had no functional benefit in terms of a reduced energy cost of walking for three patients who coherently demonstrated no pathological plantarflexion during swing without their AFO.[29]In our study, AFO unilateral (20.3%) and bilateral use (2.0%).WhereasKAFO splint unilateral was (1.6%), KAFO unilateral was (48.8%), KAFO unilateral was more popular in our study for the lower limbs.Townsend et al. recommended using AFOs and knee ankle-foot orthoses (KAFO) to ensure joints are aligned and prevent valgus forces at the knees in supported standing.

Design, indications, and cost should be considered when choosing an orthosis to understand the biomechanics of the various joints of the lower limb during normal gait.[30] Swedish studies revealed a higher satisfaction rate in children who use the device as intended than in thosewho underutilized the device.[31]Furthermore, in a study conducted in India, various splints prescribed were by the patients' needs.[32]Furthermore, awareness and increased knowledge of post-polio paralysis and contact with the clinics/rehabilitation centres, and demands for daily living have improved individuals to use AT seems to be a positive factor for a change in life. [33]A study done in Sweden found that the majority with polio successfully reduced the appearance of disability and increased independence. They have learnt to walk after removing practically their AT, their independence in daily activities even with problems. Performance in daily activities was also connected with experiences of creativity. [34]According to our findings, there is an improvement in the quality of life of the children who actively usedAT daily that are approximately similar to the findings by other studies, use of ATdoes not always improve the wellbeingof an individual as it is a complex phenomenon and its use hadrevealed a complex relationship between functional limitations and AT usage.

Mobility limitations are only one aspect of that proportion that candiminish positive outcomes. [35]According to research literature from a study, the important task in rehabilitation was supporting children to continue independence that must be well-maintained and associated with variousstrategies to diminishstrain in daily living.This study showed the effective use of AT in ADL and QOL. In another study, the main goal of the intervention was to givethe participantsa customized in-home assessment of their AT, problem needs, home modification, and task performanceto help them according to theirdemands. These participants also showed a positive response to AT.[36]In a study, participants reported better average WHOQOL scores forPhysical health, psychological health, Social Relationship and Environmental health, which has not been reported before. A possible explanation could be that most ofthe participants lived with their families and received regularly help and support.

Several studies reported that social support is important for people who have contracted a disease. Social support and patients' ability to manage stressors and adjust to a disability may minimize the importance of physical ability and therefore play an important role in maintaining mental health.[37]AT greatly enhances the quality of life of children and their families. Unfortunately, this potential remains unfulfilled for most children with disabilities, as inadequate access to AT excludes them from education, health, and social services. The quantity, quality, affordability, and variety of AT products available in most countries are limited. Since behaviors and attitudes are important in the mental and physical development of children with disabilities and can also affect how AT is selected and used. The number and diversity of ways a child's development and inclusion can be supported and encouraged are as diverse as children themselves.[38] In the period before receiving their device, participants described feeling a sense of hopelessness related to their inability to participate fully in community activities and were confined to their home,which was improved substantially when they received an AT. Studyingat Columbia may

also be attributed to efforts by the government to promote the rights of persons with disabilities in the countryand disability awareness programs. This suggests that access to AT also contributes to reducing discrimination.[39]

Conclusion

It was concluded that the intervention used through assistive devices positively affected the ADL and QoL of the children visiting the rehabilitation unit.Local professionals were able to deliver high-quality prosthetic and orthotic services that were free of cost, and these health workers helped them utilize these devices. There is a lack of Rehabilitation, Prosthetic and orthotic education that needs to be adjusted to the developing countries' regulationsand recognized as allied health professions to increase effective person-centred rehabilitation. The disability should be not considered a social stigma.

Strengths and limitations

The findings of these results provide literature about the effectiveness of the assistive devices concerning daily activity living and quality of life. For this study, only one rehabilitation centre was selected to see the effect of the assistive devices,which was not enough to explain the ADL and QoL with the utility of AT in-depth as the sample size was not enough.

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