

# Effectiveness of Tailored Telerehabilitation on Functional Capacity and Balance In Pediatric Kidney Transplant Recipients: A Pilot Controlled Clinical Trial

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## ABSTRACT

**Background:** Pediatric recipients after a successful kidney transplant (KT) are encouraged to return to normal life as they are in a growing phase and have physical inactivity during the dialysis period. However, chronic use of immunosuppression and physical inactivity negatively affects functional capacity and balance even after the surgery. Exercise training appears to be safe and promising in this population. Therefore, the primary aim of this study was to explore the effects of tailored telerehabilitation on functional capacity and balance in pediatric patients with KT.

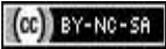
**Methodology:** A total of 8 children with stable graft function with a minimum 1 year of transplantation, from one of the tertiary hospitals of western India, were randomly allocated into two groups via enveloped method: standard care (SC) and telerehabilitation group (TRG). The SC group received standard care with no change in their regular activities. TRG received tailored telerehabilitation as a playful activity for 45 minutes twice a week for six weeks. Outcome measures include 10 repetition maximum, a pediatric balance scale, and a six-minute walking test (6MWT) to assess muscle strength (quadriceps group), balance, and functional capacity respectively.

**Result:** There were statistically significant improvements in the post-test 6MWT and muscle strength in TRG except for balance. The post-test comparison between the two groups revealed a significant difference in favor of TRG in all measured variables.

**Conclusion:** Tailored Tele-rehabilitation contributed to the improvement of functional capacity and muscle strength in pediatric patients with kidney transplantation.

**KEY WORDS:** kidney transplantation, physical activity, functional capacity, balance.

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## INTRODUCTION

Kidney transplantation, other than being viewed as the best treatment for End-stage kidney disease, contrasted with dialysis techniques, considers a superior personal satisfaction an account for the pediatric population. Anyway, after a productive kidney transplantation because of the past dialysis meetings and because of various reasons like inadequacy and food needs, they are less dynamic which could construct hopelessness and mortality [1,2].

Fundamental investigations have shown that KT beneficiaries with low physical functioning and frailty, a multi-layered build of weakness that incorporates physical function measures, are most likely to be hospitalized early and die after KT [3]. This way, recently there has been creating interest in growing the thought of KT new kids in town and recipients by organizing markers of physical function into research and clinical examinations [4]. Nevertheless, thought ought to in like manner be paid to the potential for improper results while coordinating extents of physical function into the clinical route, as those with low capacity would regardless benefit from KT [5,6].

Tailored exercise training has all the earmarks of being safe and promising in this population. Resistance exercise can increase muscle size, capacity, and metabolism, A high-impact workout that is aerobic exercise gives cardio-vascular advantages, like oxygen consumption limit enhancements and heart insurance. Agility endurance exercise works on neuromuscular control, upgrades balance, and works on overall strength and endurance. A combination of agility endurance and strength training in a single session may prove beneficial. It has not been fully studied in children with post-transplant recipients yet [7].

Tele-rehabilitation is the delivery of rehabilitation over a telecommunication network and the internet. It allows the patients to interact and can be used to both assess patients and deliver therapy. Further being cost-effective and time-saving as well as comforting to the subjects in terms of environment and surrounding atmosphere.

## METHODOLOGY

After getting ethical approval from IKDRC-ITS ethics committee, a total of 8 children with stable graft function with a minimum of 1 year of transplantation from one of the tertiary hospitals in western India were randomly allocated into 2 groups with enveloped methods: SC and TRG. Basic demographic data and anthropometric data were collected.

**Table 1:** Combined agility endurance and resistance exercise protocol.

	Agility Endurance	Resistance
Arm Exercise	Front and lateral shoulder raise Overhead shoulder press	Wall push-ups Biceps curl Triceps extension
Trunk Stabilizer (Bridging)	Bridging (Make this exercise a competition for children)	Chest press Superman's position
Hip Flexor And Ankle Dorsiflexor	Spot marching, Jumping from one circle to another	Cycling Stair climbing Step up & down Lateral step up
Knee Extensor	Sit to stand	Leg extension with free weights
Knee Flexor And Ankle Plantar Flexor	Step up and step down	Leg press Spot Jumping Heel raise
Hip Adductor And Abductor	Lateral walk	Side leg raise
Whole-Body	Dancing	

**Inclusion criteria:** Both Male and Female, age range 6-18 years, minimum one year of transplantation, provided informed acceptance from parents or guardians, Patients who have smartphone and data connectivity, Positive consent of Tele-rehabilitation from the pediatric unit.

**Exclusion criteria:** All the genetic and congenital-related disorders.

The SC group received standard care with no change in their regular activities and was advised to be active. TRG received tailored telerehabilitation as a playful activity, including combined agility endurance and resistance exercise via video conference. supervised rehabilitation was done twice/week but they were asked to exercise regularly. The exercise program was executed according to ACSM guidelines and FITT principle.

**Frequency:** 6 weeks (twice/week)

**Intensity:** Based on the 0-10 Borg scale (score between 5-7)

**Time:** 30-45 min

**Type:** Agility endurance and resistance exercises

## OUTCOME MEASURES

**Pediatric balance scale:** The PBS, including 14 items with 5 level grading, assesses the functional activities that a child must safely and independently perform at home, school, or in the community. The performance of each task is rated on a scale from 0 to 4. The tasks range from timed sitting balance to standing on one leg and are ranked from 0 (unable to perform) to 4 (able to perform a task as instructed without difficulty). The scoring criteria for an item incorporate qualitative and quantitative measures that consider normal variability in performance.

**6MWT:** The patient was asked to walk at their comfortable speed on a 30-meter-long track continuously for 6 minutes. If the patient feels giddiness, or any kind of discomfort they were allowed to take a break. Pre/post vitals and Total walked distance in 6 minutes were collected.

**10 RM Test:** This test was performed in a sitting position to find out the strength of the quadriceps muscles of the dominant leg. Weight was tied to the ankle joint and patients were asked to perform 10 repetitions. The maximum weight that can be lifted 10 times was noted.

## RESULT

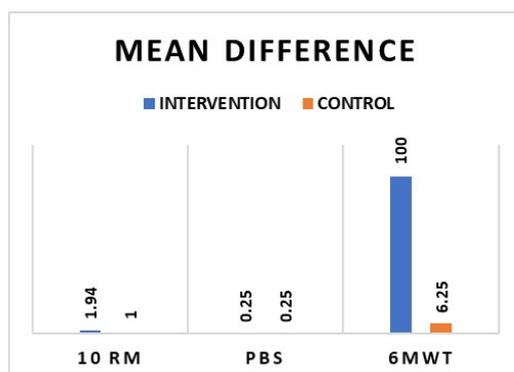
Statistical analysis was performed using SPSS version 20. Total of 8 subjects out of 12 completed 6 weeks of a rehabilitation program. In this study, TRG received a telerehabilitation program (n=4) and the SC group was advised to be active in daily life (n=4). Paired and unpaired t-tests were used within the group and between the group respectively. The result data shows the value of the mean, and standard deviation (SD). Statistical significance was set at  $p < 0.05$ .

Table 2 shows the mean, SD & p-value of the TRG and SC group, there were statistically significant improvements in TRG except for balance within the group analysis. Also, the post-test comparison between the two groups revealed significant differences in favor of TRG in all measured variables. Graph 1 shows a significant mean difference between the control and intervention groups except for balance.

**Table 2:** Statistical analysis of TRG and SC within the group and between the group.

Outcomes		TRG			SC			Between the group
		Mean	SD	p	Mean	SD	p	p
6MWT	Pre	380	55.5	0.02*	411.25	40.07	0.82	0.04*
	Post	480	42.4		405	38.72		
10RM	Pre	3.56	1.17	0.03*	2.38	1.08	1	0.0008*
	Post	5.5	0.88		2.38	0.47		
PBS	Pre	55.75	0.6	0.35	53.25	1.25	0.7	0.005*
	Post	56	0		53	1.41		

Level of significance set at  $p < 0.05$ , \* shows significant values



**Graph:1** mean the difference between SC and TRG

## DISCUSSION

In this review, we endeavored to explore the remedial impacts of agility endurance and resistance exercise in post-renal transplant pediatric patients concerning functional capacity and balance. The fundamental discoveries of this study recommend that the agility endurance and resistance exercise 2 times/week alongside the standard clinical consideration can create a huge improvement in functional capacity in pediatric post renal transplant patients. Balance was not improved because it was not hampered at the baseline.

People with post-renal transplants have announced extreme constraints in day-to-day living exercises as well as personal hardships including depression, anxiety, and mood swings before transplantation because of dialysis sessions. Active work is accepted to impact general well-being subsequently, the utilization of planned, organized and repetitive movement can help to improve both mental and physical working status [8].

The result of the ongoing review might be credited to the sort of activities that incorporated a group activity comprised of loaded multi-joint functional activities that were intended to consolidate the key undertakings expected for the day-to-day living presentation during walking, step climbing, and general portability.

Amira et al, expressed that, sit-to-stand, front step-ups, and high-stooping and side long strolling are viable techniques to upgrade motor performance and functional capacity [9].

Sietsema et al, referenced that resistance training with a combination of endurance exercises can add to an expansion in maximal oxygen-carrying limit and exercise resilience in patients with renal transplantation [10].

As we have used telecommunication, it has been a very comfortable medium for the children and their parents to communicate with us easily. Also, it reduces time to travel and frequent follow-up. As the intervention was done in a group, they enjoyed each other's company and it was a bit of competition for them to perform well.

## CONCLUSION

From this entire contain of results and discussion, it shows that Tailored Tele-rehabilitation contributed to the improvement of functional capacity and muscle strength in pediatric patients with kidney transplantation. Further studies are recommended to investigate if the program can yield further improvements in QoL.

**Limitation:** The main limitation is the small sample size and person-to-person monitoring was not possible because of the mode of rehabilitation also there was a lacking of long-term follow-ups.

## ABBREVIATIONS

**KT:** kidney transplant

**SC:** standard care

**TRG:** telerehabilitation group

**6MWT:** 6-minute walk test

**ACSM:** American College of Sports Medicine

**QoL:** quality of life

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**Conflicts of interest: None**

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