The effect of trunk kinesio taping on static and dynamic balance and functional mobility in children with cerebral palsy

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The effect of kinesio taping of trunk on Static and Dynamic Balance and functional mobility in Children with Cerebral Palsy

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Abstract

Background Cerebral palsy (CP) is a non-progressive neurological disease that movement disorders related to balance and mobility are common motor problems in these.

Aim The aim of this study was to investigate the effect of kinesio taping of trunk on Static and Dynamic Balance and functional mobility in Children with Cerebral Palsy.

Methods In an experimental study with pre-test and post-test, from January to May 2017 in rehabilitation centers of East of Tehran, thirty eight children with spastic cerebral palsy who suffered from spastic cerebral palsy were randomly divided into trial and control groups. In the trial group, kinesio taping with 30% tension was fastened from the origin to the insertion of the paravertebral muscles on the chest and lumbar regions. In the control group, the kinesio taping was given as Sham without any tensile. Berg balance scale (BBS), forward functional reach (FFR) and timed up and go (TUG) were used for evaluation of dynamic balance, static balance and functional mobility respectively. In two groups, variables of study were evaluated pre intervention, immediately, 48 hours after intervention and 48 hours after being removed kinesio tape.

Results According to results, in the trial group, a significant increase in the mean score of the dynamic balance test ($p<0.001$) as well as the functional mobility test score ($p<0.001$) was observed. Also, over time, dynamic balance test ($P=0.001$) and functional mobility ($P=0.001$) had significantly changes. Repeated measures analysis of variance between two groups showed that duration of static balance test in different evaluation times did not changes significantly ($p=0.09$).

Conclusion According to the results of this study, Kinesio taping is effective in improving dynamic balance and functional mobility of spastic cerebral palsy. Therefore Kinesio taping can be used by occupational therapists in the neurorehabilitation of spastic cerebral palsy as a complementary therapy.

Keywords: cerebral palsy, kinesio taping, balance, functional mobility

Introduction

Cerebral palsy (CP) is a movement disorder which is caused by a lesion to the upper neuron motor of a growing brain which leads to a wide range of sensory and movement problems for the child [1]. CP is one of the causes of childhood disability which affects the movement and physical condition, and results in the limitation of different activities and participations of the child [2]. Children with CP are divided into spastic, athetoid, ataxic, and hypotonic based on the type of movement disorders [3]. Children with CP, especially spastic, have a wide range of movement problems. Muscle stiffness and lower mobility of the joints affect the movement of these children and disturb their balance [4]. one of the most common disorders in these children is stretch control, so that they encounter the problem of integrity of senses while they are standing upright. This further brings them some acquisition and evolution disorders and causes some delays in their motor skills [5, 6]. Stiffness and weakness of muscles, in mild cases, can affect backward balance, and in severe cases, can cause forward and lateral balance. Therefore, children with CP have low physical activities. They also have some problems in functional activities and participation in their daily life, especially in such kind of activities as walking independently, running and climbing the staircase [5, 7]. In a study, Ross et al indicated that reduction of dynamic balance in children with spastic CP is the main factors in the disruption of their walking. Therefore, targeting this issue can be a good topic for treatments [8]. In another study, it was indicated that central nervous system defects and some symptoms, such as spasticity, along with muscle imbalance and biomechanical changes in stature can cause some disorders in the balance of children with CP [9]. Biomechanical

change of joints affect the posture of these children, therefore, it affects all the organs which are involved in balance, such as upper limbs, lower limbs, and trunk of children with CP [9, 10].

Balance means the ability of keeping a specific state which is one of the necessary components of movement and functional skills. Dynamic and static equilibrium reactions are weaker in children with CP in comparison with healthy children [11]. Different kind of therapeutic interventions are carried out with the aim of strengthening muscles and equilibrium reactions of children with CP [12]. One the recent methods in treating neurological disease, such as CP, is kinesiotaping technique which is used for improving functional mobility, enhancing balance skills, and helping to improve muscle performance [13, 14].

Current knowledge about equilibrium reaction motions points that sensory inputs, especially deep senses, are so significant for equilibrium motions. Therefore, the position of joints and organs in a functional state make the child able to apprehend the body image and body awareness, which are necessary for voluntary movements [15]. Kinesiotaping supports joint function by affecting muscular function, improving deep senses, naturalizing muscular tone, correcting improper positions, and stimulating skin receptors [16]. It also can enhance deep sense feedbacks in order to protect the natural stature of the body [17]. Using kinesiotaping method in combination with normal rehabilitation programs of children with CP can positively affect the skin receptors of sensory motor systems, and consequently, improve the voluntary control and equilibrium coordination [18]. For this reason, it can be used as an alternative intervention method [19]. Therefore, the aim of this study was to study the effects of kinesio taping of paravertebral muscles on static and dynamic balance and functional mobility of children with spastic CP. We hypothesized that KT would improve balance and functional mobility of children with CP. The aim of this study was to investigate the effect of kinesio taping of trunk on static and dynamic balance and functional mobility in children with cerebral Palsy.

Materials and Methods

Subjects

Thirty eight children with aged 7 to 14 years who suffered from spastic CP and were able to stand and least 2 to 3 steps with minimal balance participated in this study. The inclusion criteria for entering the study were: 1- children with spastic CP, 2-the ability to keep balance in standing position independently, 3-the ability of taking at least three steps without using any support, 4-the

mental ability to respond the verbal instructions of the examiner. The exclusion criteria for this study are: 1-allergy to kinesiotaping, 2-no timely referrals for evaluations, 3-the outburst of side effects which affect lower limbs of the child. The samples are distributed randomly by lottery in two treatment (20 subjects) and control (18 subjects) groups.

Kinesio Taping techniques

In this study, Four taping conditions were applied to each subject: (1) without taping (WT); (2) immediately under taping (IT) ;(3) 48 h after taping and with the tape (AT) ;(4) 48 h after separating taping from the body without the tape. Subjects were assessed in each condition by BBS, TUG and FFR. Kinesio tape was applied on the paravertebral muscle on upper and lower back. Standard 5 cm Master of Muscle Kinesiology used for this study. The Y-strip was applied on the posterior part of the trunk and paravertebral muscles its insertion to origin with 30 % stretch tension in order to improve the function of these muscles. But the control group received the kinesiotaping in a sham mode and without any tension (Figure1).

Figure1. Kinesio Taping technique that used in this study

Outcome measures

Berg balance scale (BBS), Timed Up and Go (TUG), and Forward Functional Reach test (FFR) are used for evaluating the dynamic balance, functional mobility, and static balance respectively. In both groups, the variables were evaluated before intervention kinesio taping, immediately after intervention of kinesiotaping, 48 hours after intervention, while kinesio taping was still stacked to the muscle, and 48 hours after separating it from the body.

Ethical consideration

This study is confirmed by the ethical committee of Baqiyatallah University of Medical Sciences (Ethics code: IR.BMSU.REC.1396.630).

Statically analysis

In order to check the normality of data, Kolmogorov-Smirnov Test was used. For analyzing intra and inter group differences, parametric variance analysis with frequent measurements was used.

Moreover, for inter and intra group comparisons, the correlated t test and independent t test were used, respectively. Statistical analysis was performed with the SPSS software (version20), with P-values less than 0.05 considered statistically significant.

Results

Anthropometric features of both groups are indicated in Table 1. Variance analysis results with frequent measurements indicated that after kinesio taping interventions in treatment group, the duration of TUG functional test changes significantly (P = 0.001).

The trend of these TUG value changes in different steps is indicated in Figure2. Furthermore, in inter-group comparisons, the results indicated that in treatment group, the passage of time caused a significant decrease in duration of TUG test. More specifically, in comparison with the first step, the duration of the test in steps two and four decreased significantly. While in comparison of step three with step four, it can be seen significant duration decreases in TUG test (Table2).

Figure2. The trend of duration changes in different steps of TUG test

Variance analysis results with frequent measurements indicated that the duration of FFR functional test has no significant changes in two groups and in different times (P = 0.092). The trend of FFR value changes in different steps is indicated in figure3. In an inter-group comparison, no difference is indicated between treatment and control groups. In the experimental group, the passage of time caused an insignificant decrease in the duration of FFR test in all steps. Apart from comparing different steps in each groups, the comparison of different steps in each group with the other group indicated a significant difference between two control and experimental groups (Table3).

Figure3. The trend of duration changes in different steps of FFR test

The results of variance analysis with frequent measurements indicated that the duration of dynamic balance test have a significant difference with BBS test (P = 0.001). It means that kinesio taping intervention has a significant effect on dynamic balance of children with CP in different steps. The trend of BBS value changes in different steps is indicated in Figure4. In an inter-group comparison, it is indicated that there is no difference between the steps of control group. It means that the sham intervention had no significant effect on the dynamic balance of control group. On the other hand, in the experimental group, the passage of time caused a significant increase in the duration of BBS test.

Figure4. The trend of duration changes in different steps of BBS test

Moreover, the comparison of different steps of each group–an intra-group comparison– indicated that in the first step (P=0.624) and second step (P=0.135), there is no difference between experimental and control group. But in the third (P=0.023) and fourth step (P = 0.012), there can be seen a significant difference between two group.

Discussion

The results of the current study indicated that there is no significant difference in mean functional mobility of the experimental group before and after the kinesio taping intervention, and also between two groups. This means that kinesio taping intervention has a positive effect on functional mobility of children with spastic CP and caused a significant decrease in the duration of TUG test. Consequently, it improves the functional mobility of children with CP. However, the analysis indicated that the type of group plays no role in the results. Analyzing the interaction of two groups indicated that the mean of TUG scores between two groups was significant; it reveals that passage

of time increases the effectiveness of kinesio taping intervention and this effect is not instantaneous; it is permanent and affects the functional mobility. The more we get away from the time of kinesio taping intervention, its positive effects on functional mobility remains. Because, in analyzing the trend of changes in different steps of experimental group, all of the changes were statistically significant, and the passage of time caused a significant decrease in the duration of TUG test. On the other hand, there is no significant difference between the steps of control group, except the last step. Therefore, based on these results, it seems that kinesio taping intervention has a significant effect on lumbar paravertebral muscles of children with spastic CP. It also decreases the duration of TUG test and, consequently, affects the functional mobility of spastic cerebral palsy children. Our results are consistent with the results of Shamsoddini [19], Kara [20] and Dacosta [16]. They claimed that the instantaneous effects of kinesio taping intervention decreases the duration of TUG test [16].

Considering static balance, the results indicated that in FFR functional test, there is no significant difference between two groups in different times. It means that the therapeutic intervention has no significant effect on static balance of cerebral palsy children. Although there can be seen some increasing changes in experimental group, these changes are not statically significant. Therefore, static balance is not affected by kinesio taping intervention. In the comparison of different steps of experimental group, it is indicated that kinesio taping sticks caused some instantaneous and permanent effects on the static balance, but these effects are not statically significant. Moreover, in the comparison of two treatment and control groups, it is indicated that there some differences exist, but they are not statistically significant, and have no effect on static balance of cerebral palsy children. The results of current study are consistent with the results of Losa [21] and Dacosta [16]. Losa claims that using kinesio taping is an important step in child rehabilitation. But it has more effects on dynamic parts, rather than the static parts [21]. considering the dynamic balance, the results indicated that there is a significant difference between the dynamic balance of groups before and after the intervention. It means that kinesio taping intervention improves dynamic balance. Moreover, analyzing mean of BBs test indicated that there are significant differences between two groups in different times. So that the passage of time in the experimental group causes a significant improvement in the BBS scores. Therefore, the passage of time increases the effects of kinesio taping intervention on dynamic balance of children, and consequently, the more kinesio taping sticks on the organ, the dynamic balance of the child improves. On the other hand, the passage of

time has no significant effect on dynamic balance of the control group. In an inter-group comparison of experimental group, it is indicated that there exists a significant difference between different steps. It means that kinesio taping sticks cause an improvement in the dynamic balance of children after from the time of sticking till 48 hours. The results of the current study are consistent with the results of Losa [21] and Dacosta [16]. In a study, Losa claimed that kinesio taping can help children in utilizing their skills. Although, using this method for children are not suitable in high involvements. Kinesio taping of paravertebral muscles improves the dynamic balance and functional mobility of spastic cerebral palsy children. This results are different in each step and create significant and improving change. These results are both instantaneous and short-term and improve the dynamic balance and functional mobility of children with spastic CP. In Conclusion, According to the results of this study, Kinesio taping is effective in improving dynamic balance and functional mobility of spastic CP. Therefore Kinesio taping can be used by Physical and occupational therapists in the neurorehabilitation of spastic CP as a complementary therapy.

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Conflicts of Interest

The authors declared no conflict of interests.

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Table 1. Anthropometric properties in two groups

Groups	BMI(kg/m^2)	Height (Cm)	Weight (kg)	Age (year)
Control group	18.14 ± 3.48	144.2 ± 17.9	38.47 ± 12.86	10.79 ± 1.93
Treatment group	18.19 ± 3.25	144 ± 17.8	38.27 ± 12.86	10.77 ± 1.76

Values are expressed as mean±SD.

Table 2. Comparison of TUG values for each step in two groups

Variable	Groups	Step 1	Step 2	Step 3	Step 4
TUG	Control	22±11.8	22.13±11.8	22±12.5	23.33±11.6
	Treatment	21.73±13.6	14.24±7.6	12.9±6.9	5.9±12
	p	0.955	* 0.040	*0.022	*0.003

Values are expressed as mean±SD. TUG: and timed up and go; Confidence level: $P \leq 0.05$

Table 3. Comparison of FFR values for each step in two groups

Variable	Groups	Step 1	Step 2	Step 3	Step 4
FFR	Control	65.1±7.44	65.07±7.57	65.03±7.42	65.13±7.44
	Treatment	66.23±10.24	70.53±10.77	73.17±14.5	75.9±21.6
	p	0.73	0.11	0.06	0.07

Values are expressed as mean ±SD. FFR: forward functional reach; Confidence level: $P \leq 0.05$

Table 4. Comparing BBS values in each step in two groups

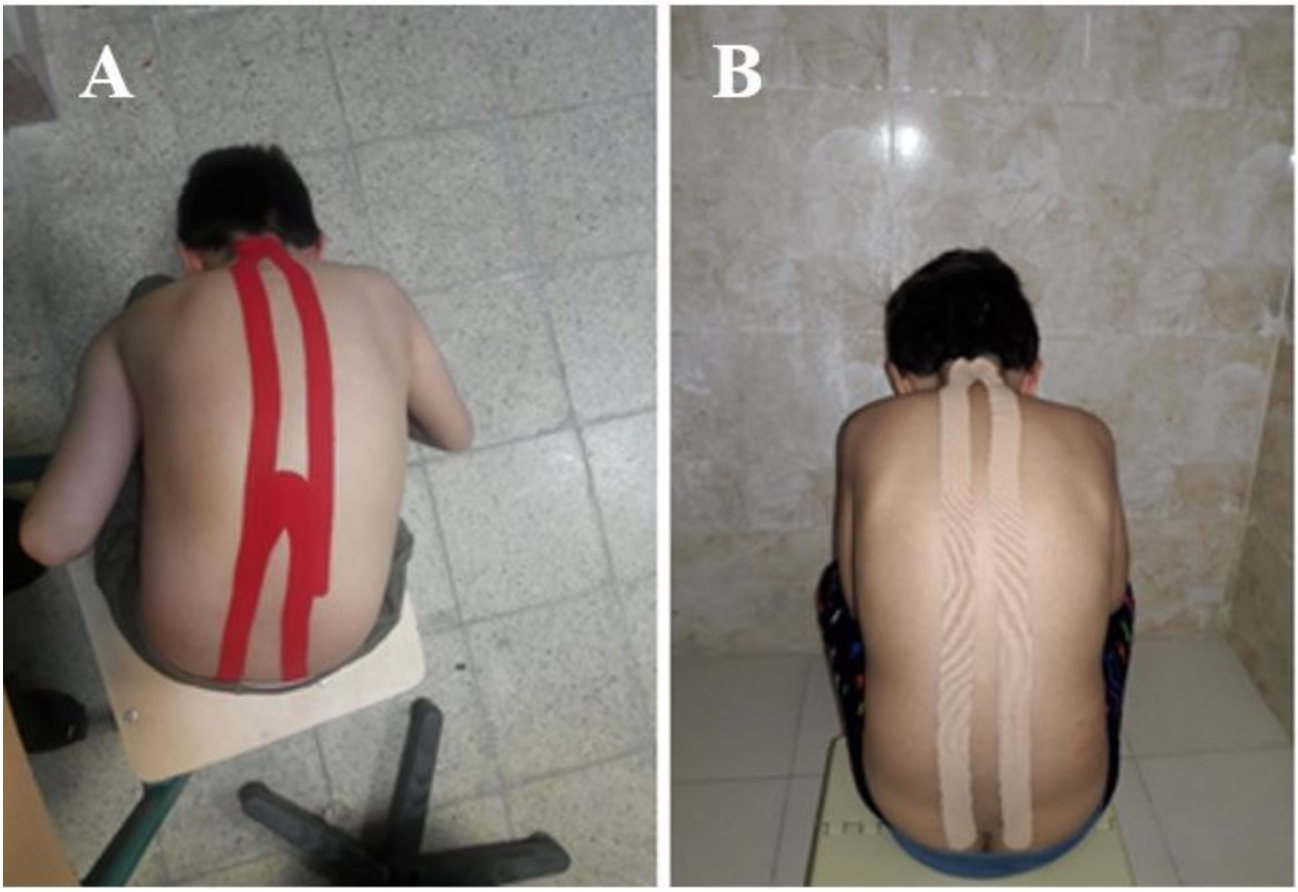
Variable	Groups	Step 1	Step 2	Step 3	Step 4
BBS	Control	40.46±7.58	40.46±7.64	40.33±7.67	40.46±7.53
	Treatment	38.8±10.6	44.66±7.29	46.93±7.32	47.53±6.84
	p	0.62	0.13	*0.02	*0.01

Values are expressed as mean±SD. BBS: berg balance scale; Confidence level: $P \leq 0.05$

Table 5. Time values of variables in two groups and at four different time

		TUG		FFR		BBS	
		Trial	Control	Trial	Trial	Control	Trial
Compare between stage 1 and 2	t	4/001	-0/26	-1/694	0/564	-5/634	0/000
	p	0/001*	0/80	0/112	0/582	0/001*	1/000
Compare between stage 1 and 3	t	4/501	0/000	-2/194	1/382	-5/608	1/468
	p	0/001*	1/000	0/046*	0/189	0/001*	0/164
Compare between stage 1 and 4	t	4/486	-3/005	-1/772	-1/534	-5/534	0/209
	p	0/001*	0/009 *	0/098	0/99	0/001*	1/000
Compare between stage 2 and 3	t	2/945	0/211	-1/392	0/193	-2/963	1/000
	p	0/011*	0/836	0/186	0/849	0/010*	0/334
Compare between stage 2 and 4	t	3/249	-2/806	-1/609	-0/564	-3/395	0/000
	p	0/006*	0/014 *	0/130	0/582	0/004 *	1/000
Compare between stage 3 and 4	t	2/295	-2/117	-0/731	-1/382	-2/358	-1/468
	p	0/038*	0/053	-1/694	0/564	0/033 *	0/164

Confidence level: $P \leq 0.05$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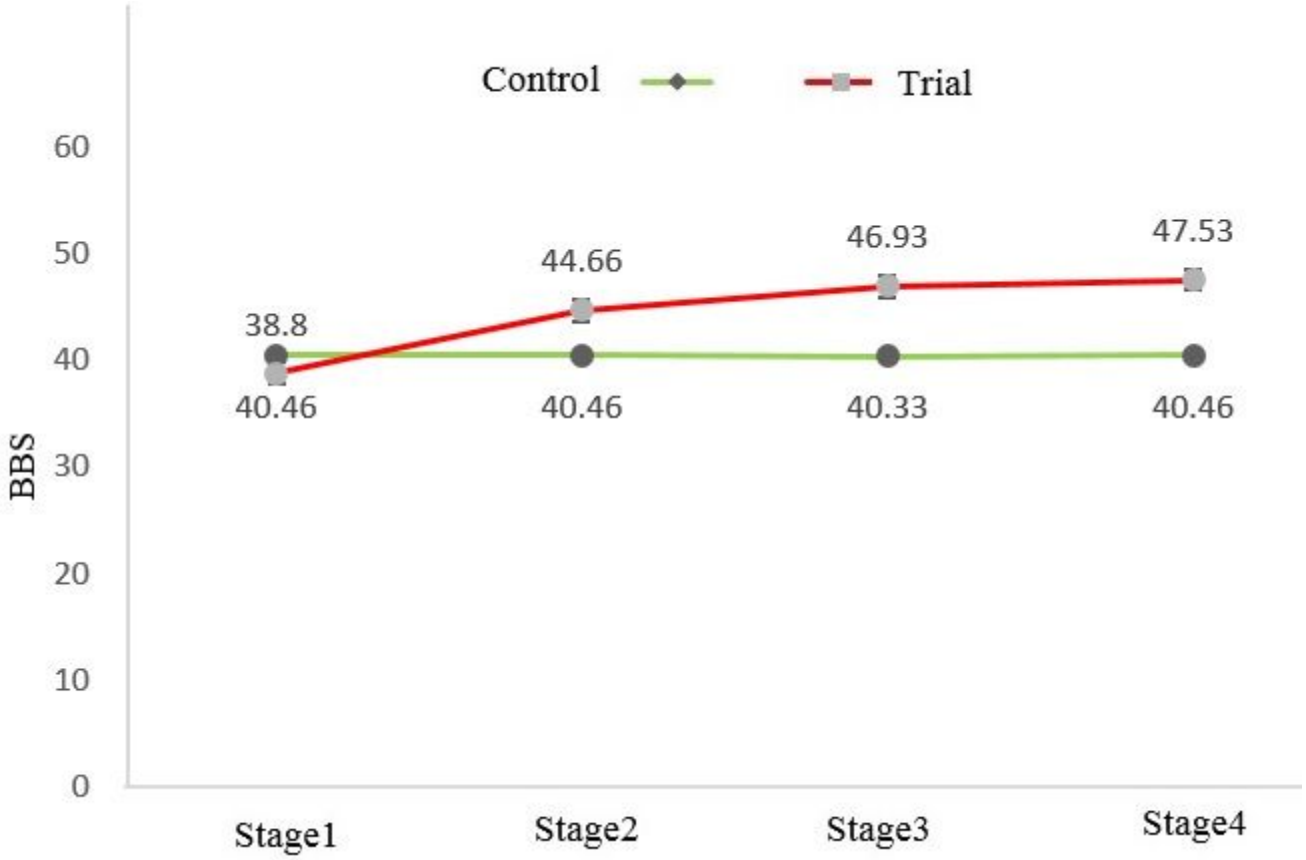
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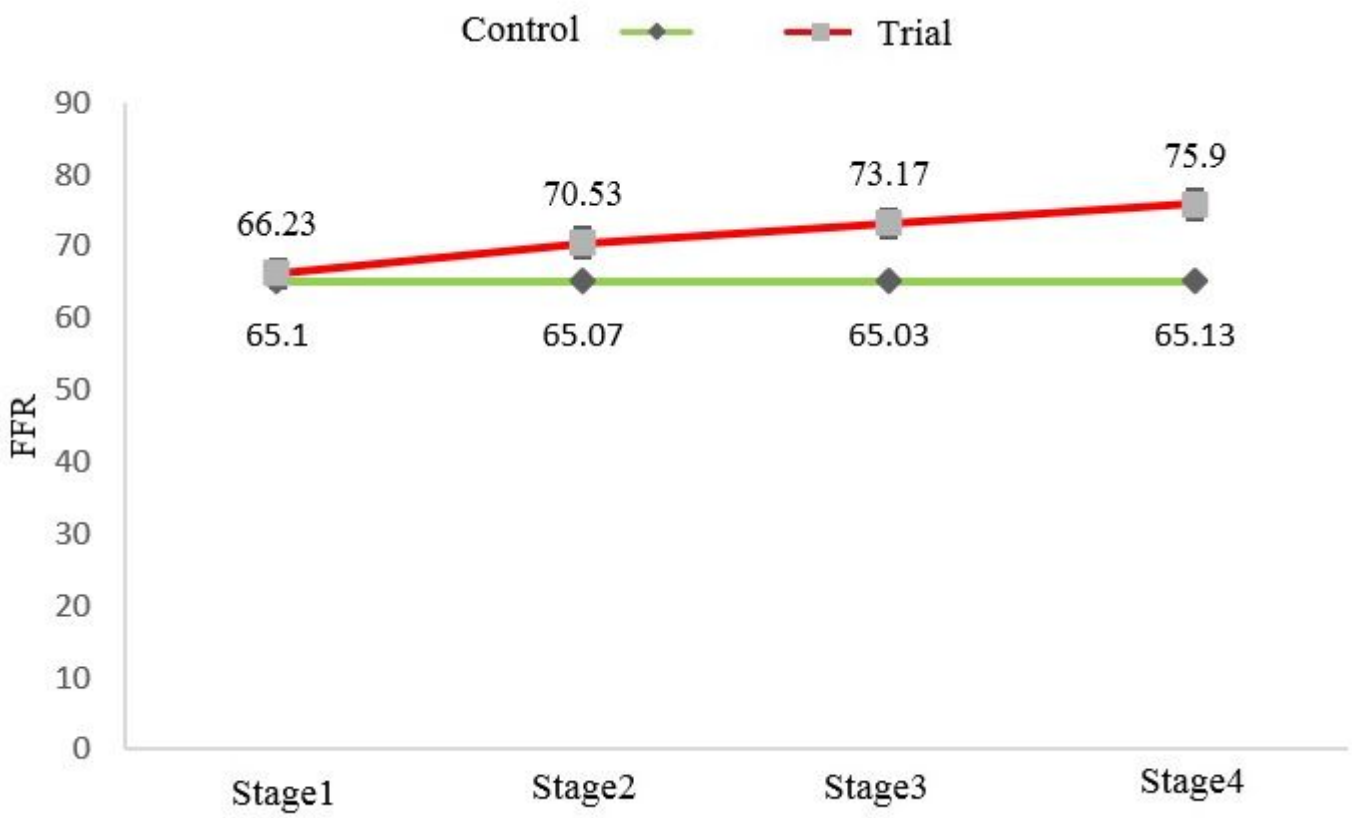
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Stage1
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