Effects Of Physioball Exercises Vs.Neuromuscular Electrical Stimulation On Abdominal And Core Musculature In College Students

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Abstract:
BACKGROUND AND PURPOSE: Core muscles endurance can be improved by various methods. This study is done to check the results of NMES and physioball exercises on core and abdominal muscles in college students.
MATERIALS AND METHOD: A sample size of 12 (n=12) students were taken and divided into two groups (n1=6) (n2=6) of 6 each. The first group was the NMES group and the second group was the physioball group. The first group was given electrical stimulation on core muscles for four weeks and the second group performed exercises on physioball for four weeks. The outcome measures include modified sorensen test, curl-up test and unilateral stance test before and after the intervention period was completed.
RESULTS: The results showed significant improvement in scores of modified sorensen test, curl-up test and unilateral stance test in NMES group and physioball group.
CONCLUSIONS: The NMES group showed more improvement in balance and core muscle endurance than the physioball group.

***KEYWORDS*: core muscles, strength, NMES, physioball exercises**

INTRODUCTION

Core muscles function as a segmental link among the upper and lower extremity and perform the role as the fulcrum, while the upper and lower extremity acts as movable levers.Thus the core stability is an important factor in maintaining the balance during physical activity and performance. Insufficient core strength can result in injuries to the lower body and poor balance during the performance. “Core is responsible for maintaining the balance and a strong core is necessary for good balance”. Decreased coordination in core muscles and reduced synergy between stabilizers of the trunk and hip can result in reduced efficacy of movement, and compensatory movements which can further lead to strain and overuse injuries. [1]

Muscle atrophy or insufficient core strength may be responsible for increased risk of pain in the lower back. Many exercises are designed to target core muscles. Various approaches and variations made in core muscle exercises in the past few years to increase activation of core muscles. [2]Swiss ball exercises and neuromuscular electrical stimulation(NMES) are among these approaches which are used to improve core muscle activity.

Betterments which are obtained from performing core training exercises on Swiss-ball include facilitation of stability in spine and balance have been accentuated by investigators to increase strength, stamina, endurance, flexibility, and control over neuromuscular region as a worthwhile and entertaining method to avoid injury and pain in lower back [3]. Swiss ball has its widespread implementation in recreational and rehabilitation approaches. Because circular edges of the Swiss ball offer more difficulties to the balance, coordination and trunk movement control. While examining detailed biomechanics during performing exercises on stable ground,it is observed that these exercises result in better balance among muscle stress and lower compressive stress. Performing strengthening exercises for the upper body on the Swiss ball puts tension on the muscles which stabilizes the spine which results in achieving beneficial effects on endurance training. Studies have shown that some selective movements of the upper and lower trunk are hampered and lead to balance disabilities following stroke and many studies have suggested that exercises which are performed on physio ball lead to improved activity of trunk muscle in patients having stroke. Swiss ball exercises activate the trunk musculature which further helps in preserving the core stability. [4]

Another form of treatment which is used in various musculoskeletal conditions is Neuromuscular Electrical Stimulation. Electrical muscle stimulation (EMS) is a device which produces muscle contraction with the help of application of electrical impulses. Impulse is given through electrodes which are applied on the skin and this impulse is similar to action potential which is generated during voluntary contraction of muscles.It produces synchronous contraction of muscles which means that all the motor units show stimulation simultaneously.

EMS is responsible for showing both neural and muscular adaptations and is used for strengthening purposes. EMS is also used to stop disuse atrophy of muscle after musculoskeletal injuries.

NMES involves applying of preset stimulus on superficial skeletal muscles with the help of surface electrode which is placed on belly of muscle and is responsible for initiation of visible contractions.Russian current has its wide usage in rehabilitation programmes as compare to other forms of NMES.[5,6]

NMES can be used to maintain strength of muscle and prevent muscular atrophy in case of some injury or surgery where performing exercises is not possible. A previous study has shown about 30-40 percent of im[provement in strength of the athletes after NMES

training which suggested that NMES training might be more beneficial as compared to traditional exercise for improvement of strength. [7]
Based on the available literature it is proven that performing exercises on swiss balls will improve the strength and endurance of core muscles. There is also evidence available which has shown the effects of NMES in improving strength of core muscle and endurance. But so far no study has been made to check the effects of neuromuscular electrical stimulation and swiss ball exercises on the endurance and strength of core muscles. Hence, this study is needed to check the effects of NMES and swiss ball exercises on strength and endurance of core muscles and find out which of the among two approaches will show better results in endurance and strength of core muscles.

AIM AND OBJECTIVE OF THE STUDY
Aim: Aim is to check the impact of NMES and physioball exercises on core and abdominal muscles among college students.
Objectives:
- To Compare core endurance in the physioball group and NMES group.
- To Compare balance in the physioball group and the NMES group.

METHODOLOGY
Study Design: Prospective pilot study
Sample size: (N= 12) divided into two groups.

- Group 1(n1=6) -NMES intervention group
- Group 2 (n2=6) - Physioball exercise group.

Place: Galgotias University
Sampling method: Simple random sampling
Time period of study: From clearance of RRC-May 2021

INCLUSION CRITERIA:

- College students from 18-25 age group[5].
- Sedentary lifestyle[7].
- Not involved in any exercise program within the previous six months[7].

EXCLUSION CRITERIA:

- Low back injury[8].
- core muscle strengthening program within previous six months[7].
- Low back pain[9].

OUTCOME MEASURES:
1 Curl-up test
2 Modified sorensen test
3 Unilateral stance test

DATA ANALYSIS Data analysis performed under Social Science Packaging Software SPSS 21.0 version. Paired t test within the group was used to compare the pre and post readings. The graphical representation is done using MS EXCEL 2016

RESULT
The results are very clear and show that there is indeed a difference in the endurance and balance of core musculature of group 1 and group 2 after the intervention is completed as shown in the following tables:
Table 1 shows the statistics of age in both groups 1 and 2.
Table 2 shows the frequency of genders of both the groups 1 and 2.
Table 3 shows the before and after intervention scores of Group 1 and Group 2 through paired t-test and it shows that the p-value is less than 0.005 Group 1 and hence it is significant for Group 1. Hence Group 1 is more effective than Group 2.

ABBREVIATIONS USED IN THE TABLES ARE AS FOLLOWS:
GROUP 1: NMES intervention
GROUP 2: physioball
UST1 stands for Unilateral stance test before the intervention
UST2 stands for Unilateral stance test after the intervention
USTKB1 stands for Unilateral stance test with knee bend before the intervention
USTKB2 stands forUnilateral stance test with knee bend after the intervention
CUT1 stands for Curl-up test before the intervention
CUT2 stands for Curl-up test after the intervention
MST1 stands forModified sorensen test before the intervention
MST2 stands for Modified sorensen test after the intervention

TABLE NO.1: DESCRIPTIVE STATISTICS OF AGE OF GROUP 1 AND GROUP 2

	GROUP 1		GROUP 2	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
AGE	21.5	1.5	21.8	1.57

TABLE NO.2: DESCRIPTIVE FREQUENCY OF GENDER OF BOTH THE GROUPS

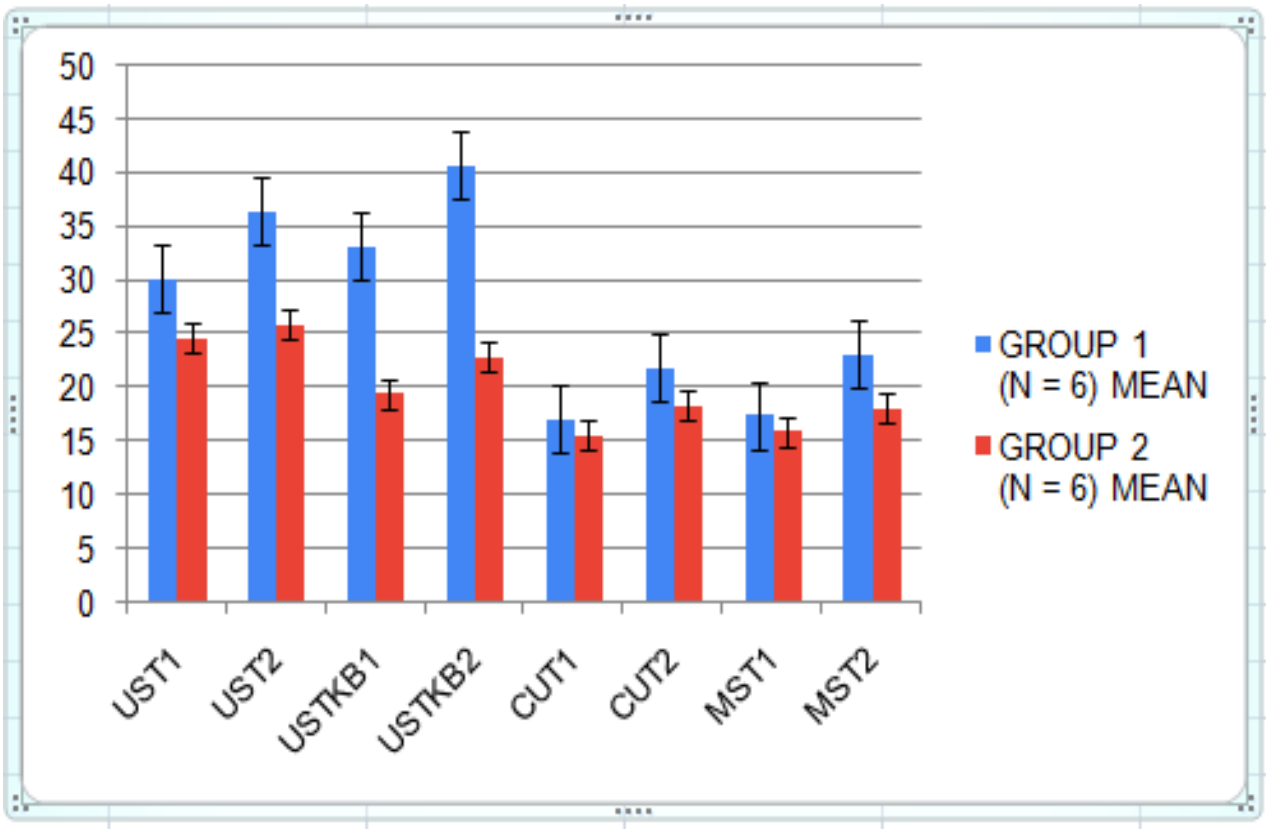
Gender	**Group 1**	**Group 2**	**Frequency**
MALE	2	3	5(41.7%)
FEMALE	4	3	7(58.3%)

TABLE NO.3 : MEAN OF BEFORE AND AFTER INTERVENTION SCORES OF BOTH GROUPS (PAIRED T TEST)

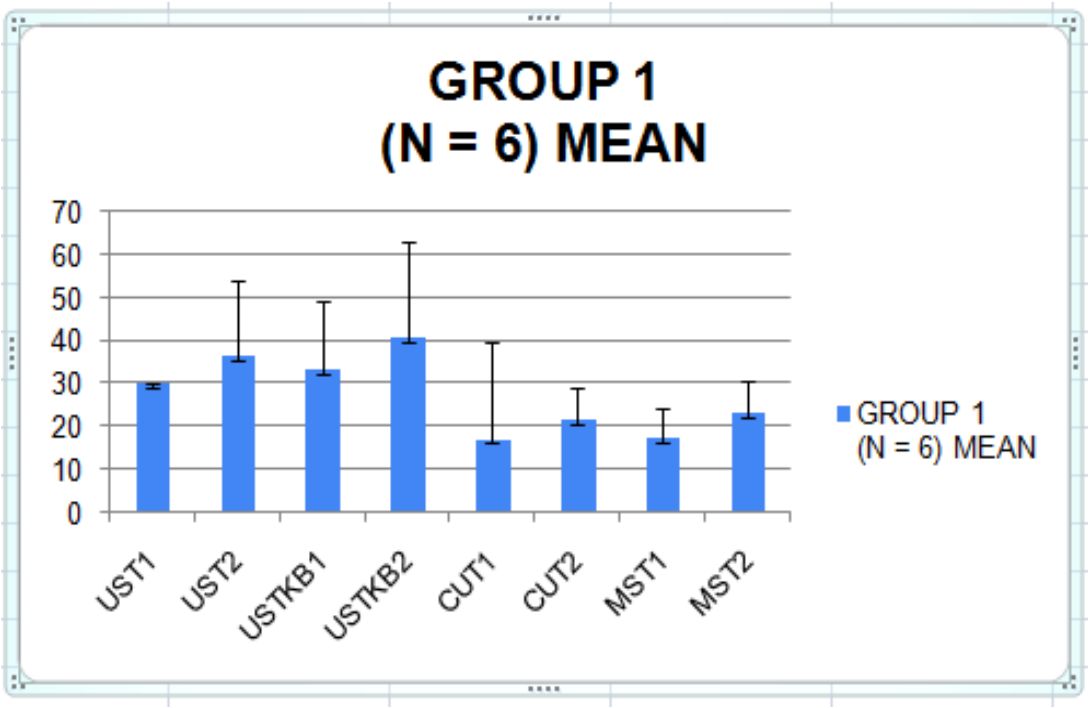
VARIABLES	**GROUP 1 (N = 6)**			**GROUP 2 (N = 6)**		
	MEAN	**SD**	**P VALUE**	**MEAN**	**SD**	**P VALUE**
UST1	30.167	17.6682	.002	24.667	18.0960	.135
UST2	36.500	16.1338		25.833	17.4976	
USTKB1	33.167	22.4715	.005	19.500	11.3974	.001
USTKB2	40.667	22.7215		22.833	10.9255	
CUT1	17.167	7.3326	.001	15.667	6.0553	.005
CUT2	21.833	6.6156		18.333	6.8896	
MST1	17.500	7.7136	.001	16.000	5.6569	.101
MST2	23.167	7.4677		18.167	5.0365	

UST1 - Unilateral stance test before the intervention UST2-Unilateral stance test after the intervention USTKB1 - Unilateral stance test with knee bend before the intervention

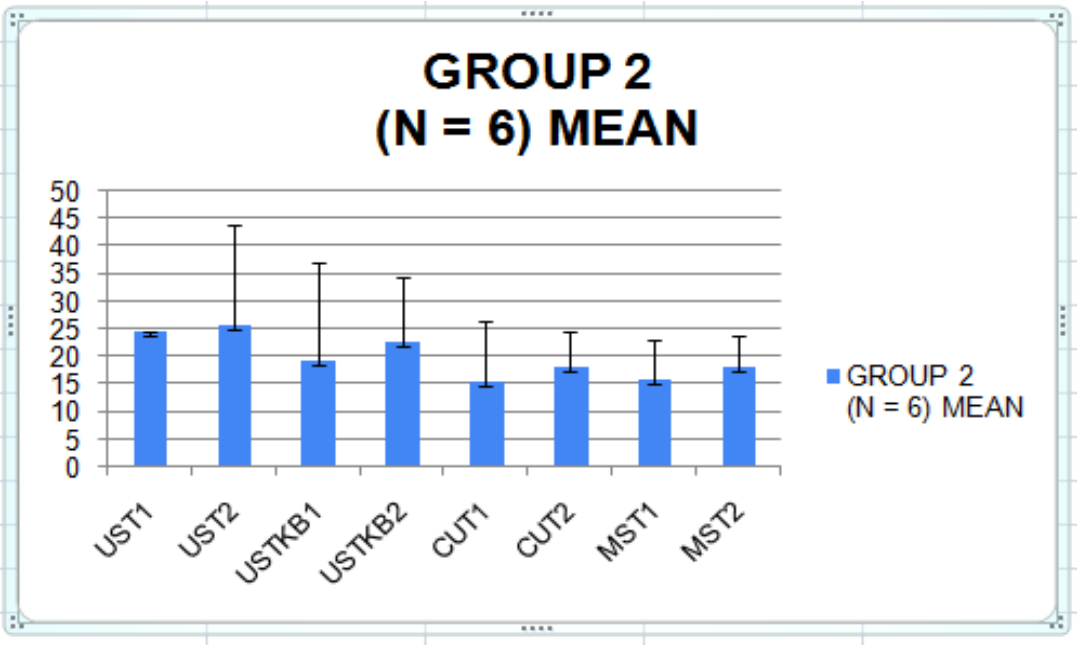
USTKB2 -Unilateral stance test with knee bend after the intervention CUT1 -Curl-up test before the intervention CUT2 -Curl-up test after the intervention MST1 -Modified sorensen test before the intervention and the significance level was assumed as <0.005



GRAPH SHOWING MEAN OF BEFORE AND AFTER INTERVENTION SCORES OF BOTH GROUPS



GRAPH SHOWING MEAN OF COMPARISON OF BEFORE AND AFTER INTERVENTION SCORES OF GROUP 1



GRAPH SHOWING MEAN OF COMPARISON OF BEFORE AND AFTER INTERVENTION SCORES OF GROUP 2

DISCUSSION

This research was done to check effects of physioball exercises and NMES over balance and endurance of core musculature. The subjects who volunteered for the study were distributed into two groups, one group performed exercises on a physioball and another group was given electrical stimulation on core muscles. Both the groups underwent special tests before and after the application of interventions and both of the groups showed significant improvement in the tests performed to check balance and endurance of the core muscle group but there seems to be more improvement in the balance and endurance of the core muscles in the group to which NMES was given.

The above study shows improvement in balance of individual performing exercises on swiss ball which is similar to the study done by Asghar, A. et al in 2019, in this study, it was concluded that swiss ball exercises showed considerable improvement in functional movements and balance of upper & lower limbs[10]. The study also resembled the study of Elanchezhian, C. et al, which was done in 2019. It was shown in that study that performing exercises on swiss ball are very effective for developing the activity in the trunk muscle and strengthening the core musculature of the trunk[11]. This study also showed similarity to the study of Muniyar, K. D. et al in 2018 in their study it was concluded that performing exercises on swiss ball improves balance and coordination and also improves trunk and postural control, and sitting and dynamic balance[4].

In this study, it was also observed that application of neuromuscular electrical stimulation showed significant improvement in endurance and balance of the participants as well. This study is similar to the study of Pavlovic, R. et al which was done in 2016, In their study, it was concluded that electrical muscle stimulation is an alternative method to develop strength in muscles[12]. The strength of the NMES group improved in this study which is also similar to the study done by Porcari, J., Ryskey, A., & Foster, C. in 2018 in which it was concluded that applying electrical stimulation on high intensity will result in improvement in muscular strength and muscular endurance of abdominal musculature[7].

In this study, it was observed that the group which underwent NMES showed greater improvement in endurance of the core muscles and balance of the participants as compared to the group which performed exercises on physioball and this result was supported by the study of Hainaut, K et al, which was done in 1992. In this study, it was concluded that neuromuscular electrical stimulation specifically activates the large motor units, these units are comparatively problematic to initiate within the voluntary contraction[13]. This study showed results which were similar to the study done by Alon, G. et al in 1987 in which it was concluded that applying electrical stimulation alone gave better results than performing exercises alone or not performing exercises at all[14].

In earlier studies, effectiveness of NMES and physioball exercises were proved on the core muscles. But in this study, the effects of both the interventions are compared which was not done earlier and it is clearly shown in this study that NMES is more efficient in improving core muscles endurance and balance as compared to the traditional exercises i.e., physioball exercises.

CONCLUSION

Consequently, this study has shown that both the groups had significant improvement in their balance and endurance of core muscles which is evident in the outcome measure used in this study i.e., modified sorensen test, unilateral stance test and curl up test. But there was more improvement in balance and endurance of core muscles in the NMES group. It is also shown in statistical analysis that group 1 is statistically more significant as compared to group 2. Thus we rejected the null hypothesis and accepted the alternate hypothesis which stated that there is a significant variation between NMES group and physioball exercise group on balance and core endurance as NMES group showed more improvement.

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