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Effect of Core Training Using Stable V/S Unstable Surface on Strength, Balance and Endurance in Normal Individual

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Abstract: ***Background: Core is the kinetic link that facilitates transfer of torques and angular momentum between lower and upper extremities. Objective: To study the effect of core training on core strength, endurance and balance using stable v/s unstable surface. Outcome measure: Biofeedback, SEBT. Methodology: 30 participants were divided in two groups for stable and unstable training, 4 weeks intervention was carried out. Result: statistically significant improvement of core strength, endurance and balance was seen on stable and unstable surface training. Conclusion: Stable and unstable surface training both are effect in improving strength, endurance and balance , unstable surface training was better.***

Keywords: core training, strength, endurance , balance .

1. Introduction

Strength is ability of contractile tissue to produce tension and resultant forces based on the demand placed on them [(7)]. Core muscle strength is an important prerequisite for several sports (e.g. tract, field, climbing , etc) and everyday activities (e.g. sitting, standing, walking in an upright position)[(1).]

Anatomically , the core can be described as a muscular box with the abdominals in the front, para spinals and glutes in the back, the diaphragm as the roof, and the pelvic floor and hip girdle musculature as the bottom[(2).] Functionally, the core can be thought of as the kinetic link that facilitates the transfer of torques and angular momentum between the lower and upper extremities that is of vital importance for sport-specific and everyday activities in different age groups. In fact, data from a cross-sectional study indicate significant relationships between variables of core muscle strength, sprint, throw, and jump performance in young healthy individuals [(3,4).] With reference to these findings, it seems plausible to argue that core strength training may have the potential to improve core muscle strength as well as health-related (i.e., strength, flexibility) and skill-related (i.e., balance, coordination, speed) components of physical fitness in youth.

Endurance is ability to perform low intensity, repetitive or sustained activity over a prolong period of time [(7)].when a person is able to accomplish or withstand a higher amount of effort than their original capacities their endurance is improved. Endurance can be slowly increasing the amount of repetition are taken rapidly muscle strength improves while less endurance is gained [(8)] . increasing endurance has been proven to release endorphins resulting in a positive mind.

Balance is the ability to move body in equilibrium with gravity via interaction of the sensory and motor system [(7).] Borghuis et al. stated that “Efficient movement function and maintenance of balance during dynamic tasks are more complex than merely adequate force production from core muscles” [(10).] for this to occur every muscle action must be coordinated appropriately at the right time with the right amount of force to produce the motion or stabilization needed [(11, 12)] .

However, there is evidence in the literature ,that reduced loads combined with high repetitions still represent a sufficient training stimulus which is why strength training performed on different physical fitness in youth [(6).]

Most of the studies target core training on stable surface as done by S and C research columnist ,according to them “Training in more stable environments (i.e. machines rather than free weights, or barbells rather than dumbbells) involves greater externally-applied forces. These greater externally-applied forces are only partly reflected in greater internal muscle forces (and possibly even less in trained individuals), because of the greater antagonist and stabilizer activation in unstable environments This suggests that more stability is better for enhancing force production, when stability is not a factor. Even so, levels of force production are probably not an important mechanism by which stability-specific strength gains occur.”. We are Regular subjected to physical activity on stable as well as unstable surfaces, e. g train travelling, sports activity, etc. Where in core strength, endurance and balance are required but fitness in normal individuals many times are overlooked . Hence purpose of study is train core muscles on stable and unstable surface and compare it's effect for strength, endurance and dynamic balance on normal individual .

2. Methodology

Type of study was comparative interventional study, random sampling method using chit picking was carried out. Sample size was 30 which were divided into two groups (15 stable surface training, 15 unstable surface training) within the age group of 18 to 23 years.

Subjects was educated about core muscle basic anatomy , structure and function in daily living. . Informed written consent was obtained from subjects before participating in

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the project. These health-related (i.e., strength) and skill-related (i.e., balance, endurance) components of physical fitness were assessed using physical fitness tests (core endurance test , SEBT, core strength test. Any subjects with resent spinal injury, spinal surgery, systemic disorder, Pregnancy, Regular exercise , Low back pain were excluded from the study. Training was conducted for 3 days/week for 4 weeks for 35 minutes (training included –warm up=10 minute, protocol=20minute, cool down=5 minute) to induce training-related changes in measures of strength, Endurance and balance.

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3. Results and Analysis

Data was entered in "Graphpad instat" software and after checking for normality , statistical test was used. Test Mann whitney and Wilcoxen was used for non parametric , Unpaired T testand Paired T test was used for parametric.

Within the group readings:

		MEAN pre	*MEAN post*	*SD Pre*	*SD post*
Strength	Stable	6.929	9.541	0.5509	0.6099
	Unstable	7.156	10.18	0.7967	1.056
Endurance	Stable	5.733	7	0.7037	0.7559
	Unstable	5.6	7.733	0.5071	0.5936
Balance: Anterior	Stable	28.8	28.667	1.32	1.234
	Unstable	28.6	33.133	1.882	2.264
Posteromedial	Stable	24.867	27.533	1.642	1.187
	Unstable	25.4	30.133	2.354	1.959
Posterolateral	Stable	30.2	33.8	1.265	1.699
	unstable	32.333	37.533	2.82	2.588

Between the group readings:

		MEAN	*SD*
Strength	Pre	9.541	0.6033
	Post	10.18	1.056
Endurance	Pre	7	0.7559
	Post	7.733	0.5936
Balance :anterior	Pre	28.667	1.234
	Post	33.133	2.264
Posteromedial	Pre	27.533	1.187
	Post	30.133	1.959
Posterolateral	Pre	33.8	1.699
	Post	37.533	2.588

4. Discussion

The aim of the study was effect of core training using stable versus unstable surface on strength ,endurance and balance on normal individual. The present results are in accordance with the literature regarding the effect of core training on stable and unstable surface on physical fitness in youth. Following 4 weeks of core training showed that there was significant improvement in core muscle strength ,endurance and balance in normal individual. According to Urs Granacher core strength training resulted in significant increases in proxies of physical fitness in adolescents. However unstable surface as compared to stable surface had only limited additional effect.

Exercise targeting core muscles in core training on both stable as well as unstable surface : Push ups works on abdominals; Bridging works on rectus abdominis , erector spinae , glutes; Planks works on erector spinae , rectus abdominis , transverse abdominis; Side planks works on obliques ,internal core muscle; Crunches works on rectus abdominis , external and internal obliques muscle; Obliques crunches works on external and internal obliques muscle.

Core strength is improved by multiple sets and long contraction time . According to table there was improvement in core strength in both stable as well as unstable surface. On comparing stable with unstable surface training, core strength was better in unstable surface(Mean :pre=7.156, post= 10.18) than stable surface(Mean :pre=6.929, post= 9.541). Muscle strength is a broad term that refers to the ability of contractile tissue to produce tension and a resultant force based on demands placed on the muscle. Thus core muscle training on strength causes change in skeletal muscle adaptation like Muscle fiber hypertrophy, Decrease in: capillary bed density , mitochondrial density and volume as well as in neural system like Motor unit recruitment, Increase in: rate of firing , synchronization of firing[7].

Core endurance is improved by multiple repetition at a given time. According to table ,there was improvement in core endurance in both stable as well as unstable surface. On comparing stable with unstable surface training, core endurance was better in unstable surface(Mean :pre=5.6, post=7.733) than stable surface(mean: pre=5.733, post= 7). Core endurance is necessary for caring out daily activity smoothly and for longer duration. Thus core muscle training on endurance causes change in skeletal muscle structure like Increase in : capillary bed density, mitochondrial density and volume but no change in neural system[7].

Balance is improved by long duration stability training. According table there was improvement in balance (anterior , posteromedial , posterolateral respectively) in both stable as well as unstable surface. On comparing stable with unstable surface training, balance (anterior , posteromedial , posterolateral) was better in unstable surface(Mean :pre= 28.6, 25.4, 32.33 ,post= 33.133, 30.133, 37.533 respectively) than stable surface (Mean: pre=28.8,24.867,30.2, post= 28.667, 27.533,33.8 respectively) respectively. According to kibler, the core acts as an anatomical base for motion of the distal segments and its governing musculature works synergistically to produce force, reduce force and provide dynamic stabilization throughout the kinetic chain [2]. The abdominal muscles consisting of the transverse abdominis, internal and external obliques and rectus abdominis all contract to provide stabilization for the spine and therefore a stronger base of support for lower extremity movement. Core training causes increase in strength and endurance as seen in above paragraph which help core balance improvement post training. Central nervous system and Peripheral nervous system is able to process the forces acting both internally and externally on the body and control the active system at an appropriate level of intensity to resist the forces that threaten dynamic stability.

Seen in the relation between stable and unstable surface core training , results show unstable surface more effective in improving strength , endurance and balance of core muscle as seen in table. According to ACE (physical therapy & sports medicine institute) on unstable surface there is an increase in difficulty level of the overall routine, it is believed that this increase difficulty will yield a range of physical benefits such as increased strength and power.

5. Conclusion

Training of core muscle on stable and unstable surface leads to improvement in strength, endurance and balance. Comparatively unstable core training showed better results than stable core training.

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6. Future Scope

This study can be performed on different age groups , different occupation groups, large population .

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