



ELECTROMYOGRAPHIC COMPARISONS OF ABDOMINAL MUSCLES BETWEEN SEATED LEG TUCKS AND HANGING LEG RAISES

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Abstract

The present study was carried out to compare electromyographically the muscle activation in abdominal muscles between seated leg tucks and hanging leg raises. Six athletically active males (range 18-22 years) i.e. age group from 20.33 ± 1.37 years volunteered to participate in this study. The subjects were randomly selected. Biograph infinity version 5.0 was used to analyze the muscle activation in the upper and lower abdominal muscles. To analyze the difference in muscle activation in hanging leg raises and seated leg tucks paired t test was applied in both the groups differently using SPSS. The level of significance was set at 0.05. The results revealed that in comparison to seated leg tucks the muscle activation of the upper abs (t value=4.74, p -value=.01 at 5 df) and the lower abs (t value=5.04, p -value=.00 at 5 df) during the execution of hanging leg raises were statistically different than the seated leg tucks.

Keywords: EMG, Seated Leg Tucks, Hanging Leg Raises, Upper Abs, Lower Abs

People spend millions of money each year in the quest for a "flat" stomach. Although toned abdominal muscles may look attractive, these core muscles actually serve a very important role in helping to "stabilize" the back. The abdominal muscles and back muscles are key components of the muscular network providing the strength and stability to keep the body upright and for movement (Hodges 1999). Abdominal strengthening exercises are widely used for training both in athletic programs (competitive sports and fitness) and rehabilitation. The importance of the abdominal musculature in trunk movement and spine stability, as well as its role in the prevention and treatment of low back pain

Electromyography is unique in revealing what a muscle actually does at any moment during movement and postures. Moreover, it reveals objectively the fine interplay or coordination of muscles: this is patently impossible by any other mean" (Basmajian,"Muscles Alive, Their function revealed by Electromyography")

Surface Electromyography (SEMG) is a non-invasive technique for measuring muscle electrical activity that occurs during muscle contraction and relaxation cycles. . Surface electromyographic (EMG) has been the most widely used instrument for the study of muscle activation during the exercises.(Monfort & Sanchez,2009)

As Basmajian (1967) suggests the SEMG signal not only indicates the status of a muscle, but also tells us about the status of the nervous system serving the muscle" (Donaldson ,2003) SEMG is a painless and non-invasive way of recording muscle activity (Morrish,1999). SEMG is able to document muscle function by its ability from muscles contracting during movement and show muscle imbalance between muscles during movement (Souza, Baker et al.2001). It has been shown that SEMG can show abnormal muscle subsituation during abdominal movement (O'Sullivan, Twomey et al. 1998; Hungerford, Gilleard et al. 2003; Teyhen, Milten-berger et al.2005)

The average athlete often trains the abdominal muscles inadequately as compared to other muscle groups. Although adequate muscle tone in the abdominal region is important , abdominal exercises can be harmful to the spine if performed incorrectly.The purpose of the study was to analyze and compare the upper abdominals and lower abdominals activation during sitting tucks on bench and hanging knee tucks. it has come as source of great interest whether hanging knee tucks has better chances of muscle activation in comparision sitting tucks on bench as the former is performed with the muscles being activated against gravity, but the latter is known to one of best toning exercises for abs.

METHODOLOGY:

Six athletically active males with a mean age of 20 years (range 18-22 years) with no previous history of abdominal trauma volunteered to participate in this study. Subjects were examined visually to determine suitability for this study. A single investigator evaluated each volunteer's abdominal musculature to determine if sufficient definition existed to allow electrode placement. This method facilitated accurate electrode placement.

PROCEDURES:

Proper skin preparation is important to get a good signal and avoid artifacts. Before applying artifacts, it was ensured to make the skin clean and dry. Conductive electrode paste or cream was applied on the centre of electrodes before applying them to the skin. Then the electrodes were placed on the examinees, and it was ensured that the electrodes were placed firmly on the skin and made certain that there was a good contact between the skin and electrodes.

EXERCISE PERFORMANCE:

Seated leg tucks (SLT)

Sit on a bench with the legs stretched out in front of you slightly below parallel and your arms holding on to the sides of the bench. Your torso should be leaning backwards around a 45-degree angle from the bench. This will be your starting position. Bring the knees in toward you as you move your torso closer to them at the same time. Breathe out as you perform this movement. After a second pause, go back to the starting position as you inhale. Repeat for the recommended amount of repetitions. ([Seated Leg Tucks Exercise Guide and Video](#), n.d)

Hanging Leg Raises (HLR)

Hang from a chin-up bar with both arms extended at arms length in top of you using either a wide grip or a medium grip. The legs should be straight down with the pelvis rolled slightly backwards. This will be your starting position. Raise your legs until the torso makes a 90-degree angle with the legs. Exhale as you perform this movement and hold the contraction for a second or so. Go back slowly to the starting position as you breathe in. Repeat for the recommended amount of repetitions. ([Hanging Leg Raise Exercise Guide and Video](#), n.d).

RESULTS:

To analyze the difference in muscle activation in upper abs and lower abs differently in hanging leg raises and seated leg tucks paired t test is applied in both the groups differently. As the subjects are same in both the exercises, hence paired t test has to be applied, as another condition of test is that if the subjects are same, paired t test should be applied.

The results are presented in tables and interpretations are given accordingly.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 raises upper abs hanging leg	671.19	6.00	122.15	49.87
upper abs seated leg tucks	319.56	6.00	79.17	32.32
Pair 2 raises lower abs hanging leg	811.62	6.00	150.15	61.30
lower abs seated leg tucks	452.42	6.00	82.90	33.84

Paired Samples Test

	Paired Differences			t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean			
Pair 1 raises - upper abs hanging leg	351.63	181.72	74.19	4.74	5.00	.01*
Pair 2 raises - lower abs hanging leg	359.21	174.65	71.30	5.04	5.00	.00*

*Significant at 0.05 level

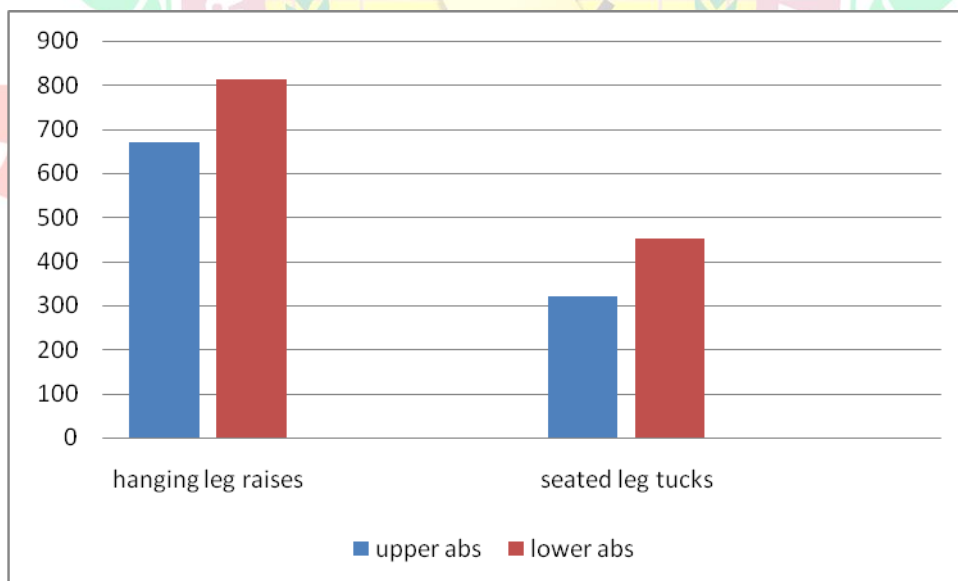
Degree of freedom= 5

It can be seen that the value of t_statistic for upper abs between hanging leg raises and upper abs seated leg tucks is 4.74. This t value is significant as the p value is .01 which is less than .05. Thus the null hypothesis of equality of muscle activation between the two different muscle groups in upper abs on the same subjects is rejected. therefore it can be concluded that the muscle activation between both the exercises is not the same.

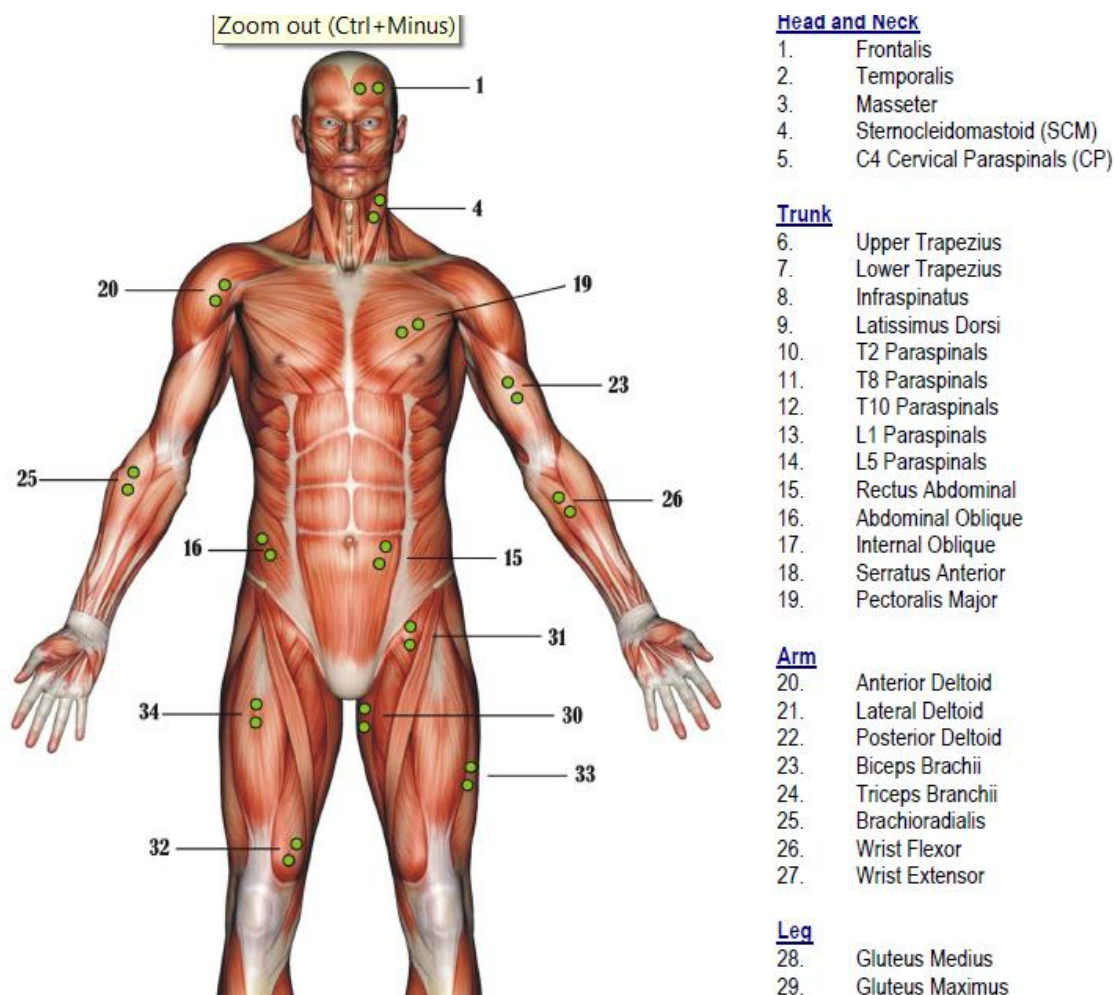
Further, by looking to the values of the mean muscle activation of the upper abs during both the exercises, as the null hypothesis has been rejected, it can be concluded that the muscle activation of the upper abs during the execution of hanging leg raises is more than the seated leg tucks.

It can be seen that the value of t_statistic for lower abs between hanging leg raises and seated leg tucks is 5.04. This t value is significant as the p value is .00 which is less than .05. Thus the null hypothesis of equality of muscle activation between the two different muscle groups in lower abs on the same subjects is rejected. therefore it can be concluded that the muscle activation between both the exercises is not the same.

Further, by looking to the values of the mean muscle activation of the lower abs during both the exercises, as the null hypothesis has been rejected, it can be concluded that the muscle activation of the lower abs during the execution of hanging leg raises is more than the seated leg tucks.



Graph 1- depicting the mean values of the two exercises in upper abs and lower abs i.e., hanging leg raises and seated leg tucks in the upper abs and lower abs.



DISCUSSION AND FINDINGS:

The purpose of the study was to analyze and compare the upper abdominals and lower abdominals activation during sitting leg tucks and hanging leg raises.

It is concluded from the above findings that significant differences were found between sitting leg tucks and hanging leg raises in the upper abdominals and the lower abdominals.

(Monfort & Sanchez,2009)Research confirms that the use of inclined boards as compared to flat boards elicits greater activity of the abdominal muscles. The most demanding exercise is pelvic tilting with the knees and hips bent while hanging from a chin-up bar

(Escamilla et al.,2006) also confirms the above fact .Upper and lower rectus abdominis EMG activities were greatest for the Ab Slide, Torso Track, crunch, and Ab Roller, while external and internal oblique EMG activities were greatest for the Ab Slide,

Torso Track, crunch, and bent-knee sit-up. Pectoralis major, triceps brachii, and latissimus dorsi EMG activities were greatest for the Ab Slide and Torso Track. Lumbar paraspinal EMG activities were greatest for the Ab Doer, while rectus femoris EMG activities were greatest for the bent-knee sit-up, SAM, AbTwister, AbRocker, and AbDoer.

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