96 - HEADING: ACTIVITY ELECTROMYOGRAPHIC OF MUSCLE ERECTOR OF THE SPINE IN THE LIFTING OF WEIGHT IN TWO POSITIONS.

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1.INTRODUCTION

Among of humans the daily activities in life there is the act of raising objects, either by removing of the floor (demanding a bigger bend foward of the trunk previously) or of tables and chairs. Through the day, we repeatedly realize this movement of lifting heavy objects, without noticing how much effort it takes from our body to realized the entire process of raise and support the object weight [1].

Several recent studies on the epidemiology of the lower back pain conclude that lifting is main risk factor for this disorder [5]. The lumbar pain is one of the biggest injuries that attemp manual workers this occur because of the strong lifting [6]. A significant percentage of the population suffers consequences of performing this movement without safety. They suffer from intense pains that many times cause the workers to take some time off of their job. Of all pains in the back, 80% - 90% are resulted of defective mechanical and posture habits [1].

As CHAFFIN (1984) apud [1] the NIOSH (National Institute will be Ocupational Safety and Health) says, the number of injuries in the workplace and the number of lost hours related to the injuries per hour/man in the work, increases significantly when: voluminous and heavy objects are raise from the ground and with frequency, the object is too far away from the person's body while doing the activity.

As FREIVALDS et al.(1984) apud [1] the National Safety Council in 1979 observed that the heavy load lifting results in 25% of all loss of time in the accidents in the industry due to the high one stress that is imposition to the muscles system.

TROUP (1965) apud [1] said that in England more than 20% of the work related accidents result in lower back injuries and amongst these 20%, of 50% / 60% are resultant of weight lifting.

The objective of the study is to observe the electromyographic activity of the lower back (erector of the spine), to the level of L3 during squat and stoop in volunteers, in order to consider the less damaged position for the lower back.

2.DEVELOPMENT

The third lumbar vertebra contain a more developed posterior arch since it serves of muscle substitute on one hand, betwen the lumbar fascicles of the great back one that if insert in L3, and on the other hand, ascending in direction to the dorsal back, the fascicles of prickly which lower insertion is situated accurately in the prickly apophysis of L3. This way, the third lumbar vertebra represent a fixed point of dorsal muscular action, playing a primordial role in the vertebral statics which had its situation in the vertex of lordosis lumbar [7].

Movements of flexion, extension and bending, develop a compressive load out of the axle [2].

EAGLE (1979) cites the research of HICKEY and HUKINS (1980) apud [8] that observed that the riskiest movements for the lower back are to bend over and to turn. The twist and bending over, causing nuclear profusion of the lower back cause the annular failure and the act of lacerating.

The act of bending the spine imposes stress on the ligament spinal posterior and the intervertebral disc on the posterior portion, what generates injuries to these structures [5].

The pressure peak is generally higher in the level L2 - L3 than on the L4 level - L5, as much in the neutral position as in the extended position. The average peak of pressure for all the axial compressives loads is higher on the extension than on the neutral position both in L2 - L3 and in L4 - L5 [8].

Higher pressures on the facets joints occur with the combination of force, flexion and compression of the vertebrae [2].

Transverse forces, that are perpendicular to the direction of staple fibres, can produce injury to the disc. The application of correct techniques of lifting can be considered positive against the above tensional forces [8].

The different positions of the body affect intensity that it will affect the back. These loads are minimum during the permanence of the leaning upon individual with a good support, he remains low during a correct lifting, and increase loads when sitting down [8].

The resultant lower back injuries caused by weight lifting are mainly consequence of the size of the load raised and the distance that the weight is find away from the body [2].

The overload mechanisms will probably injure the structures responsible for lumbar pain as the vertebral structures (ligaments, intervertebral disc, vertebra) and musculotendinous structures (muscle, musculotendinous junction, tendinous insertion) [5].

During the squat, the lesser disc compression of that 3400N is widely accepted, and the maximum value allowed is 6400N. In a lifting situation a truly relation exists between the weight and the position of the object and the position of the object and the torque of the lower back [6].

A Compressive force of 3 - 5 kN, as the ones that occurs on the lifting of one weight are high enough to cause imperfections in women older than 20 years old and men other than 40 [9] and probably in younger men with repetitively loads [10]. The biggest numbers of lower back pain cases are attributed to the extreme compression during the weight lifting [11].

The correct position for lifting is the one where the trunk is erect, the knees are flexed, the load is close to the body and the movement occurs in only one point. This technique minimizes the load imposed to the lower back [2].

Many factors during object lifting and moving load objects away from the body can change the way the lower back is affect: the position of the object in relation to the center of movement of the trunk; the size, weight, the density and the form of the object; the degree of flexion and rotation of the trunk [2].

The fluid flow is caused by the alteration of the pressure on the disc. The high pressure causes the expulsion of the fluid of the disc, while the low pressure (for example: when lying down) allows the proteoglicanos of the disc to absorb the fluid of the fabric adjacent. A flexion position increases this fluid exchange, once they cause a bigger fluid expulsion of the disc than the erect positions [8].

A healthful intervertebral disc function hydrostaticment, which means flexible under light weight and rigidity under heavy. When the disc is overloaded with compression, the pulposo nucleus has the function of uniformly distributes the pressure through the disc and acts as a shock absorber. The disc is flattened and widened and the nucleus laterally becomes enlarged as the disc loses liquid. This pressures the fibers of the ring and transforms the vertical compressive force into tense overload on the fibers of the ring. This overload is of 4 / 5 times the axial load applied [2].

During the compression, the disc loses liquid and the angle of staple fibres increases. The pressure is 30 to 50% greater than the load applied for unit of area. The disc is very resistant to the power of the compression affects and rarely fails. The body's spongy bone yields and break before occurs any damages to the disc [2].

3.MATERIAL and METHODS

Twenty volunteers participated on the study, all male described in table 1, healthy, had been clarified about the experiment and submitted to the reading and signature of assent term.

During the accomplishment of the experiment, specifics stretches were realized to the volunteers in the beginning and end of the sections in order to protect the volunteers, preventing irreversible injuries, increasing the general flexibility of a body part before vigorous exercises and preventing or minimizing the risk of musculotendinous injuries [12]. The stretches focus was on the muscles of the posterior region of the lumbar and thigh. Stretch that was realized: The volunteer in dorsal decubitus with the bent knees and supported feet, first pulls a knee, later the other in the direction of the chest, around crosses the hands of the thighs and pulls them for the chest, raising sacrum of the table [12].

The load applied in the experiment was stipulated in 20%, of the total corporal weight of each individual, promoting a safe edge for the accomplishment of the movement [3], table1.

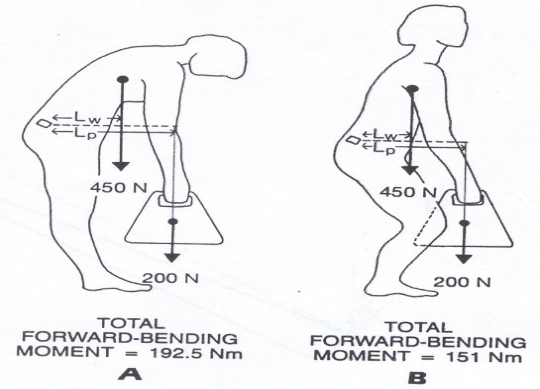
table 1

	Valid N	Mean	Std.Dev.
Age (years)	20	25,5500	2,99956
Weight (Kg)	20	76,3300	10,58022
Stature (m)	20	174,7500	6,99530
Load (Kg)	To Do 20%		

To guarantee the validity and precision of the electromyografic signals, it was applied a procedure for minimize the impedance of the skin which consist of shaving the hair and cleanness of the skin with alcohol. After this preparation, a pair of passive electrodes of surface of the Ag/AgCl type (Meditrace), was placed on the lumbar region more specifically in the erector muscle of the spine (to the level of L3), in the right side in accordance with the author [13].

An accelerometer (model ADXL20È, Analog Devices), with broadband of 200Hz and sensitivity of 315mV/g (g=aceleração of the gravity), whose total mass was of 1,5 gram was adhered to the basket for identification of the beginning and the end of the raise phase and descending until the ground.

For the accomplishment of the test, the individuals had to locate in front of a load basket that was position on the ground, and had to be raised. Two distinct forms of raised had been applied in order to compare the results between them. One involved the flexion of the knee praised for literature as the correct form of rise (squat). And another by raised the load only with the vertebral movement of flexion of the trunk and return without moving the joint of the knee (stoop) [4,2].



NORDIN; FRANKEL, 1980.

The sequence execution of the two forms experimented was randomly choose. The verbal command for execution of the movement, was giving by the same operator and the rank and disposal of the electrodes for the collection of the electromyografic signal, were responsibility of a second operator who also took care of all the volunteers in a standard way so the study could have consistent.

The standard plastic basket was same for all the individuals. The test was realized in two stages with squat and stoop positions, as they show the figures below.

It was calculated the value of RMS (root mean square) of the signal, took from the first second of the ascending time. The quantification of parameter RMS was carried through by the formula:

$$EMG_{VE} = \sqrt{\frac{1}{T}\int_{0}^{T} x^2(t)dt}$$

Where, x(t) is the space of signal in the segment of duration T.

For analysis statistics t-student was used the applicatory Statistics version 6.0 with the test, with level of significance of $p < 0.05$.

4. SHOWING AND DISCUSSION OF RESULTS

Table 2 and figure 1 present the results of RMS for the correct lifting (squat) and incorrect (stoop).

Table 2

	Valid N	Mean	Std.Dev.
Stoop	20	0,2747	0,08451
Squat *	20	0,2274	0,07463

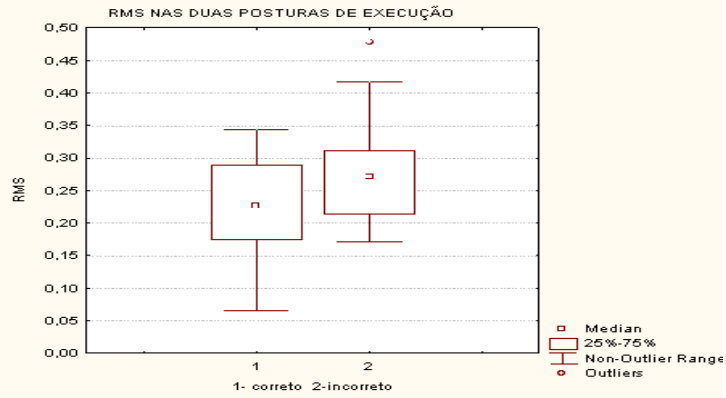


Figure 1- significant difference p<0,05

The correct position for lifting the weight is the one where the back remains erect, the knees are flexed, and the next weight is closed to the body and the movement occurring in only one point. This technique minimizes the pressure imposed to the lumbar back [2].

Once, a study revised 27 articles comparing the two types of lifting already mentioned. They found difficulty to compare the studies due to questions between the forms analyzed (EMG, intra-abdominal pressure, intra-discal pressure) and the variables (horizontal, vertical distance, speed, the weight had to be placed in the front or between the feet). They found out, that there are no biomechanics evidences to conclude that the squat technique would be most ideal [5].

Studies with the population had shown that the degeneration of the lumbar disc is rare between people who habitually stay in positions that correct the lumbar back; such positions instinctively are taken by children and many adults [8].

5.CONCLUSION

As a conclusion, we found out that there is a bigger electromyografic activity on the erector muscle of the spine on level of L3 during the lifting using stoop technique in comparison with squat, on the volunteers studied in this research.

We suggest new studies with a bigger number of volunteers, using both the sexs and different ages and using a estimate of the intra-discal pressure through programs computerized for a better results.

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ACTIVITY ELECTROMYOGRAPHIC OF MUSCLE ERECTOR OF THE SPINE IN THE LIFTING OF WEIGHT IN TWO POSITIONS.

SUMMARY

Among the humans daily activities is including the act of raising objects, like removing things of the floor, tables and chairs [1]. This act can lead to lumbar injuries depending on the size of the load raised and the distance that the weight if finds of the objective body [2]. The purpose of this study is to observe the electromyographic activity of the lumbar back, in healthy men, during the lifting of weight in two positions; correct and incorrect. The relevance of this work is to investigate the differences between the two movements, to better guide the patients in relation to theirs daily activities. Twenty male volunteers had participated on the study and they all signed the assent term. Electrodes of surface had been adhered in the erector muscle of the spine. The applied load was stipulated in 20% of the total corporal weight of each volunteer, promoting a safe edge for the accomplishment of the movement [3]. Volunteers were positioned in front of a loaded basket on the floor and they had to raise it. Two distinct forms of raising the basket were applied. One form involved the flexion of the knees keeping the back as erect as possible (squat or leg lift)), praised for literature as the correct form. The other involved raising the load with only the movement of bending foward and standing up without moving the knees joint (stoop)[4]. The RMS of the EMG signal was calculated based on the first second of the concentric phase. For analysis statistics of t-student was used the applicatory Statistics version 6.0 with the test, with level of significance of $p< 0.05$. The electromyographic activation in the muscle analized with level of L3 was significantly lesser during the load rise of correct form ($p = 0,009$). We suggest new studies with bigger number of volunteers, with both the sexs and different ages, beyond an estimate of the intra-discal pressure through applicatory with models. Key-Words: Lifting, Lumbar, Electromyography

ACTIVITÉ ELECTROMYOGRAPHIQUE DE LA MUSCULATURE ÉRECTRICE DE L'ÉPINE DORSALE PENDANT L'ÉLÉVATION CORRECTE ET INCORRECTE DE POIDS EN VOLONTAIRES

RÉSUMÉ

Pendat les activités quotidiennes des êtres humains il y a l'action d'éléver des objets, en les prenant du plancher, des tables ou des chaises [1]. Les lésions qui en résultent sont, d'abord, des conséquences du poids de la charge élévée et de la distance entre le poids et le corps [2]. Le but de cette étude est d'observer l'activité électromyographique de la colonne lombaire, chez des hommes sains, pendant l'élévation des poids en deux positions : l'une correcte et l'autre incorrecte. L'importance de ce travail consiste dans l'étude de la grandeur des différences entre les deux mouvements pour mieux orienter les personnes en ce qui concerne leurs activités qotidiennes. De cette recherche ont participé 20 volontaires, du sexe masculin, qui ont signé un document d'accord. Des électrodes de surface ont été collés à la musculature érectrice de l'épine. La charge appliquée a été stipulée en 20% du poids corporel total de chaque individu, pour prevoir une marge sûre pour l'exécution du mouvement [3]. Les volontaires se sont mis devant une corbeille, placée sur le sol, contenant la charge à être soulevée. Deux formes d'élévation différentes ont été exécutées. L'une avec flexion du genou, le tronc le plus droit possible, correctement comme preconisé par la littérature spécialisée. L'autre a été faite avec l'élévation du poids, faisant seulement le mouvement de flexion du tornc et le retour à l'ortostatisme sans le mouvement de flexion du genou [4]. On a calculé le RMS du signal EMG pendant le premier second de la phase concentrique. Pour l'analyse statistique on a utilisé l'applicatif Statistique version 6.0 avec le test t-student, au niveau de signifiance de $p< 0.05$. L'activation électromyographique dans la musculature analysée au niveau L3 a été significativement mineure pendant l'élevation de la charge de manière correcte ($p = 0,009$). On suggère de nouveux études avec un plus grand nombre de participants volontaires, des deux sexes et de plusieurs âges, et une stimative de la pression intradiscale à travers applicatifs avec des modèles. Mots-clés : élèvement, électromyographie, lombaire

ATIVIDADES ELECTROMIOGRAFICA DE LA MUSCULATURA ERETORA DE LA ESPINHA LEVANTAMENTO DE PESO CORRECTO E INCORRECTO EM VOLUNTARIOS

EI RESUMEN

En las actividades diarias de los seres humanos esta incluido levantar objetos,sea desde el suelo, mesas o sillas [1]. Las lesiones lumbares resultantes del levantamiento de peso son, primariamente, consecuencia de la magnitud de la carga ergida y la distancia en la que el peso se encuentra del cuerpo [2]. El objetivo de este estudio es observar la actividad electromiográfica de la columna lumbar en hombres saludables, durante el levantamiento de peso en dos posturas, correcta e incorrecta. La relevancia de este trabajo es investigar la magnitud de las diferencias entre los dos movimientos para orientar mejor a los pacientes en relacion a sus actividades diarias.Participaron del estudio 20 voluntarios de sexo masculino que fimaron un consentimento. Electrodos de superficie fueron adheridos en la musculatura erectora de la espina. La carga aplicada fué estipeulada en 20% del peso corporal total de cada individuo, promorrendo un marger seguro para la realzacion del movimento [3]. Los voluntarios se posicionaron en frente a una cesta, sobre el suelo, conteniendo la carga a ser elevada. Dos formas de elevación distintas fueron realizadas. Una forma envolvia la flexion de la rodella manteniendo el tronco lo mas erecto posible, preconizado en la literatura como la forma correcta. Y la otre constituía una elevación de carga apenas com un movimiento de flexion de tronco y retorna al ortostatismo sin movimientos de la articulacion de la rodella [4]. Fue calculado un RMS de señal EMG en el primier um segundo de la fase concêntrica. Para analisis estadishica fue utilizado y aplicado estadistica 0version 6.0 y test t-student, com nivel significativo de $p < 0.05$. La activacion electromiografica en la musculatura analizada a nivel de L3 fue significativamente menor durante la elevacion de carga de forma correcta ($p= 0.009$).Sugerimos nuevos estudios com un mayor numero de voluntarios, de ambos sexos y diferentes edades, apesar de una estimativa de presion intradiscal atraves de aplicativos com modelos. Palabra-llave: Levantamiento, electromiografia, lumbar

A ATIVIDADE ELETROMIOGRÁFICA DA MUSCULATURA ERETORA DA ESPINHA NO LEVANTAMENTO DE PESO CORRETO E INCORRETO EM VOLUNTÁRIOS.

Nas atividades diárias dos seres humanos está incluído o ato de levantar objetos, seja retirando-os do chão, mesas ou cadeiras [1]. As lesões lombares resultantes de levantamento de peso são, primariamente, conseqüência da magnitude da carga erguida e da distância que o peso se encontra do corpo [2].O objetivo deste estudo é observar a atividade eletromiográfica da coluna lombar, em homens saudáveis, durante o levantamento de peso em duas posturas; correta e incorreta. A relevância deste trabalho é investigar a magnitude das diferenças entre os dois movimentos para melhor orientar os pacientes em relação às suas atividades diárias. Participaram do estudo 20 voluntários, do sexo masculino, tendo assinado o termo de consentimento. Eletrodos de superfície foram aderidos na musculatura eretora da espinha. A carga aplicada foi estipulada em 20% do peso corporal total de cada individuo, promovendo uma margem segura para a realização do movimento [3].Os voluntários se posicionaram em frente a uma cesta, sobre o solo, contendo a carga a ser elevada. Duas formas de elevação distintas foram realizadas. Uma forma envolvia a flexão do joelho mantendo o tronco o mais ereto possível, preconizado pela literatura como a forma correta. E a outra constituía na elevação da carga apenas com o movimento de flexão de tronco e retorno ao ortostatismo sem movimento da articulação do joelho [4]. Foi calculado o RMS do sinal EMG no primeiro segundo da fase concêntrica. Para análise estatística foi utilizado o aplicativo Estatística versão 6.0 com o teste t-student, com nível de significância de $p< 0.05$. A ativação eletromiográfica na musculatura analisada no nível de L3 foi significativamente menor durante a elevação de carga de forma correta ($p = 0,009$). Sugerimos novos estudos com um maior número de voluntários, de ambos os sexos e diferentes idades, além de uma estimativa da pressão intradiscal através de aplicativos com modelos. Palavras-chave: Levantamento; Eletromiografia; Lombar.