104 - ISOKINETIC PROCEDURE ON SHOLDER MULDIRECTIONAL INSTABILITY

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INTRODUCTION

This protocol of treatment with Isokinetic Dynamometry on Multidirectional Instability of shoulder came out in order to re-establish with the best efficiency possible and specificity of the musculature of Rotator Cuff; [19] the training type isokinetic makes possible to activate the greatest number of motor units and overload systematically the muscles with their capacities of production of power during the movement, even in the articular angles relatively weaker; [7] giving to the shoulder articular stability preventing the episode of subluxation in a safe and fit manner [19] and considering the osteomioarticulars structures implied of the patients' shoulder.

The protocol allows to quantify the differences of Torque Peak, Total Work and External Rotator / Internal Rotator Relation (ER/IR) [7,19] of the Isokinetic pre-treatment and post-treatment of the instable shoulder. Verify whether the recuperation of the Torque Peak and of the Total Work was reached, rebalancing the dynamic coaptator musculature of the shoulder (External Rotator, ER and Internal Rotator, IR). [8] The advantages of Isokinetic exercises on the conventional recuperation process, represent itself due to its feature of maximum overload into all the angles of the arc of movement, the solicitation of the muscle in 100% of its capacity, whatsoever the length of the handle that is being developed the tension with is an excellent option for the reconditioning and strengthening muscular,[7] within weight determined and controlled by the proper patient, according the percentages showed by this protocol of isokinetic treatment.

METODOLOGY

This observational and descriptive study was carried out in the Isokinetic Assessment and Reabilitation Centre, held by Physiotherapy Clinic of the Tuiuti University of Paraná (TUP), from November 2001 to September 2002, and followed until March 2004. Four female patients were assessed and treated isokinetically, with Bilateral Multidirectional Instability of the shoulders, so eight shoulders treated, average age of 25 (4,2 ó).

Every patient was undergone, at least, 10 episodes of subluxation on the shoulder. They were right-handed dominancy and with treatment for conventional physiotherapy already applied but with no improvement in the instability picture.

The differences between the torque peak (N.m), total work (joules) and the ER/IR relation (percentage) of the muscular group internal rotators (IR) and external rotators of the shoulder were analyzed before and after the application of the isokinetic treatment. Mann-Witney's test was applied statistically, considering values of (P<0,05), these values can be seen in timetable 1and 2.

The female patients answered some filing questions, signed a permission term in order to publish results and images on scientific purposes. These patients were undergone to an Isokinetic Dynamometer make Cybex, Norm model. Developing internal and external rotation in concentric contraction of the shoulder in 45º transversal plain [14,21,22] evolving to abduction of 45º frontal plain, 90º abduction frontal plain and 90º abduction frontal plain in concentric and eccentric contractions. After accomplishing 24 sessions, 6 sessions each position, each session with 10 series of 6 to 8 repetitions, using 60% to 80% of the initial isokinetic assessment. Before the beginning of each session the patients had a heating in a cicloergometre (superior limb), within 10 minutes. The evolution of the positions was based on the biomechanics of the shoulder preventing the pinçamentos, and working the percentage of strength determined along all the width of the patient's movement. It started with intermediate and low velocities, distributed in a session with 10 series, using increasing and decreasing velocities of 60º/s, 120º/s, and the second series with high velocities of 240º/s and 300º/s. the first and second sessions were accomplished within 6 repetitions, and 60%. The third and fourth were accomplished within 8 repetitions and intensity of the exercise 60% of the maximum isokinetic strength of the initial assessment. The fifth and sixth sessions were made up of 8 repetitions and 80% of intensity. The criteria was the same for the three positions, adding in the fourth position in abduction of 90º frontal, sessions of eccentric contraction and concentric contraction, considering any velocity variations of 30º/s, 60º/s e 90º/s obeying the same criteria for the alteration of other variables. The control of intensity of the exercise was done through the graphic visualization in the display of the isokinetic set. The patient was motivated and the same time controlled the strength applied to the exercise, getting a proprioceptive control and emphasized more the musculature treated at that width of movement with strength and work deficit. The time interval between a series and the next is of 20 seconds; after the end of the session a stretching of the muscles related was done with scapular wrist. The protocol is compound of 3 assessments: an initial, an intermediate, and a last one at the end of the treatment; the frequency of the sessions was of 3 times a week. The intermediate assessment was used only for control and cares.

RESULTS

The female patients did not show any width restriction of movement (WRM) reaching 90° to ER (External rotation) and 70° to IR (Internal rotation), values reached according to the literature by normal subjects or with non-restrictive pathologies. [8,11] However, they presented weakness and pain associated at the end and beginning of the ER and end and beginning of the IR.

The results showed a better performance of the ER and IR along all the arc of movement long. Improving the ER/IR, reaching meaningful results for recuperation of the TP and TW during all the width of movement of these two muscle groups. The ER/IR had a meaningful improvement (p<0,02) of 11% in average, the TP of the ER and IR also showed a meaningful strength increase of 3,5% and 11% respectively, as well as the TW, that presented a meaningful improvement of 4,3% (p<0,02) to ER and 17% (p<0,04) to IR.

In the relation ER/IR (External Rotator/Internal Rotator) the average found was of 107%, a high RE/RI relation,

showing unbalance with reduction of strength of the IR. After the isokinetic treatment we got a final average relation RE/RI of 99%, so a medium improvement in the strength of the IR significantly (p<0,02) of 8% (Table 1). There was not any loss of strength of the ER, what could also reduce the relation. The Torque Peak of the IR measured in (N.m) got better significantly (p=0,01 and p=0,02) ranging of 1% to 21% in every velocities and concentric and eccentric contractions (Table 1), with exception of 240º/s improving 43%, without significant degree. The Total Work of the IR measured in (Joules), had a meaningful improvement (p=0,04) of 12% to 55% in velocities of 300º/s, 60º/s concentric and 60º/s eccentric contraction, without significant degree for 120°/s and 240°/s (Table 1). The Total Work was the variable that reached the highest average improvement between the variables studied of 26%. The Torque Peak (N.m) of the ER showed an average recuperation of 11%, getting meaningful improvements (p=0,03 and p=0,02) respectively for the velocities of 240°/s and 300°/s, and increase of 8% not meaningful in eccentric contraction. There was an average significant reducing of 5% in the strength in velocity of 120°/s and of 60°/s (Table 2). The ER showed chiefly a visual improvement in the work curve, in high velocities in the armada position. The patients reported that the luxations usually happened in fast movements in armada position (abduction / external rotation) that was by this simulated protocol seeking the specificity of the movement.

O Trabalho Total (Joules) dos RE apresentou uma melhora significativa (p=0,02) média de 7% na velocidade de 120º/s e 300°/s. Manteve-se estável em 60º/s na contração concêntrica e excêntrica. Em 240°/s houve melhora de 32%, porém sem significância estatística. (Tabela 2).

The Torque Peak on these extremities, the beginning of the ER and IR, was gotten better recovering this way the Work Total in all the width of the movement, and the patients did not report anymore there to be the presence of pain in the final or initial angulations of the movements.

The female patients undergone to the protocol of treatment reported a progressive improvement of the instability of shoulder. Extending for the whole treatment and holding until the period of accompanying of eighteen months, after the end of the isokinetic treatment. No patient presented lesion or luxation during the assessments and or treatment. Finally, at the end of the treatment, it directed to the maintenance of the muscle reinforce practicing exercises with elastic.

DISCUSSION

The isokinetic Assessment has been revealing its efficiency to quantify the unbalances, for instance, between External and Internal Rotators (ER/IR), detecting the articular instability that cannot be realized by complementary exams as XR, magnetic resonance or electromyography. The isokinetic treatment has been showing its primordial importance upon reaching the objectives proposed in Torque Peak relation, Work Total, Potency, and Movement Width, quantifying them in a precise, reproducible way and without risks of lesion for the patient with instability, and several episodes of subluxation or luxation. The balance between ER/IR improves the articular stability, this way the studies for this application of this protocol justify themselves,[8] the superiority of muscle strength of the Internal Rotators in relation to the External Rotators, is an indispensable condition for the stability of the shoulder.[17] So tried and found through isokinetism, a shorter and more efficiency manner of specific muscle strengthening [19] based on the studies with meaningful increases of concentric and eccentric torque peak with isokinetic training. [10,16,24] the assessed patients used to show a RE/IR relation of 107% considered high, [15, 23] reaching after application of isokinetic treatment a relation of 99%, ER/IR relation next to the stated by other authors, for the normality is of 60% to 80% of the ER in relation to the IR (ER/IR). [15, 23] During the isokinetic assessments and the accomplishing of the protocol of treatment, the patients reported sensation of subluxation or pain present in high velocities as in 240°/s and 300°/s in the position of armada (90° to 70° from the external to internal rotation), this position gets related to the position of subluxation usually occurring also in high velocity [20].

This protocol of treatment for instability of the shoulder improved the patients' IR and ER treated, getting better articular dynamic stability during all the arc of movement long. The gotten results in the whole work may not alter the ER/IR relations as expected, but they improve the muscle work during all the width of movement long, and increasing the muscle contraction and strength along all the angulation worked, improving this way the curve of work.

In another research, with isokinetic treatment on Multidirectional Instability with 6 female patients, complementary radiological exams showed normal results and without alterations [8]. It also used strengthening of the muscles responsible for the external rotation and internal rotation, flexibility and extension, abduction and adduction of the shoulder, confirming the positiveness of the results gotten [8]. Our research emphasized only the ER and IR muscles, for they are considered dynamic transversal coaptators of the shoulders [11], improving the capacity of centering the humeral head without wasting efforts and gaining dynamic stabilization of this joint. Another research emphasize this argument, that is, it shows the transmission of the resulting strength of the strengthening fo the ER and IR, improving the strength of the muscles of the flexibility significantly, extension, abduction and adduction of the shoulder, so it improves all the musculature of the shoulder without having to strength isolated muscle groups. On the contrary it does not occur as the strengthening of isolated muscle groups, abduction and adduction, flexibility and extension, we will get only improvement of the strength in the position worked, and it will not reflect to the other movements.[16]

The initial application of the treatment in plain scapular occurred due to the characterization of a better congruency of the bone parts and to the neuter position of the hip joint, resulting in an intermediate position of the bands of the capsule and of the scapula-humeral musculature, [18] this position does not provoke prisoning or impingement of the structures supra-humeral and it is well supported by the patients, this way indicated to the treatment [3, 21, 14, 22]. The plain of transversal 45°, with the arm in antepulsion of 45° and abduction of 60°, determine that the arm adopts a different rotation. This position corresponds to the state of balance of the peri-articular muscles of the shoulder: that's why it is adopted in order to immobilize the fractures of the humeral diafise, [11] and adopted by us for the protocol of isokinetic treatment.

The plain frontal abduction 45º is a plain derived from the transversal plain with the same objectives, nevertheless displaying the tendons and bands to a greater gradual tension inclusive of impingements, for a progression to the plain of frontal 90º that corresponds to the common throwing position in sport activities, [4, 6] as well in diary activities as drying the hair with a hairdryer, reaching objects at high places, put clothes on the clothesline etc. The position of abduction in frontal 90° answers better the muscle function in its assessment for activities of lifted arm, so it is necessary the specific muscle strengthening, in which it is showed also as a lesion position,[1] but necessary for the treatment according to specificity of the movement. This variation and progression of exercise plains was also stimulated due to the theory: when the humeral is moved to far from the body in flexion, abduction or abduction with flexion, the proportion of length/tension of the muscles controlling the movements of the shoulder change. These changes in the proportion of length/tension certainly puts muscle groups in advantage or disadvantage when tested in different positions; similar to these proportions of length/tension the relations of bands and articular capsules change and they can alter the support points of the joint in which the humeral head move itself in the glenolden fosse, thus when the extremity is moved in different plains the tension in the articular capsule and the band may cause more effect and more high moments of torque; [20] the selective positioning would add precision and standardization to this procedure and a program of treatment following this progression would be a well-off asset in the patient's clinic.[20] the graphic visualization of the movement executed by the isokinetic dynamometer allows the control of the muscle strength necessary and objective of the treatment; it functions as indicator of points of major need of application of the strength to be done to correction of muscle deficiency on the width of the movement, this way the intensity of the exercise was controlled, and so serving as neuromuscular proprioception; this one being an indispensable complement to restoration of the

stability and without being negrected.[8] The execution of the movement with graphic visualization offers meaningful results in increase of strength once compared to the non graphic visualization of the exercise.[12]

When one uses isokinetic devices for treatment the patients often start with the highest velocity, that the movement can be accomplished, generating a torque taken, according to the patients' progress the velocities are gotten short in order to apply greater efforts on the musculature involved, this would support the clinical practice of the treatment by the spectrum of velocity, when the patient makes progress from high to low velocities to increase the load quickly into the issues involved.[20] However, with this protocol intermediate velocities were applied to patients leading to high and then low, passing from concentric to eccentric contraction. In the mechanism of trauma of the subluxation or luxation one has high velocity and conjoint strength of the agonist musculature ongoing the freanator and stabilizing action of the antagonist musculature, allowing so any lesions.[1] Due to the patients' mechanism of lesion, pain and insecurity was thought of intermediate velocities that not require so much strength as slow velocities and nor so much proprioceptive control as within high velocities.

During a program of muscle strengthening; an improper synchrony and a muscular activity diminished must be corrected.[9] The improvement of the stability can also have been reached by insertion of eccentric contractions to the protocol of treatment, improving the proprioception, freanage and modulation of the movements of the shoulder, once that antagonist musculatures work eccentrically.

The results of this isokinetic treatment in multidirectional instability show meaningful increase in the torque peak, work total, and improvement in the ER/IR relations, resulting in a greater performance of the dynamic coaptator musculature of the shoulder. The isokinetic treatment is one more method of treatment of shoulder that can be associated to exercises of proprioception complementing the patients' diary activities or to other protocols of shoulder. One method more of treatment on the multidirectional instabilities of the shoulder tending to abbreviate the treatments of quantifiable forms and more controllable.

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Variables	% of the difference and significance degree				
Torque Peak	**120º/s**	**240º/s**	**300º/s**	**60º/s**	**60º/s Exc**
Mann-Witney	*	NS	*	*	*
% of differ. after the treatment	6%	43%	21%	-1%	5%
Total Work	**120º/s**	**240º/s**	**300º/s**	**60º/s**	**60º/s Exc**
Mann-Witney	NS	NS	**	**	**
% of the difference	24,2%	55%	16,8%	20,4%	12,3%
Relations	**120º/s**	**240º/s**	**300º/s**	**60º/s**	**60º/s Exc**
Mann-Witney	*	*	*	*	**
% of the difference	-7,5	-14,2	-18,3	-6,3	7,2

Table 1. Average percentages of the results in relation of torque peak (N.m), total work (joules) of the internal rotators and ER/IR relation, after isokinetic treatment. *: meaningful difference (p< 0,02)**: meaningful difference (p< 0,04) NS: non-meaningful difference

Variables	% of the difference and significance degree				
Torque Peak	**120º/s**	**240º/s**	**300º/s**	**60º/s**	**60º/s Exc**
Mann-Witney	*	**	*	*	NS
% of the differ. after treatment	-2 %	21 %	4 %	-9 %	8 %
Total Work	**120º/s**	**240º/s**	**300º/s**	**60º/s**	**60º/s Exc**
Mann-Witney	*	NS	*	*	**
% of the differ. after treatment	6,3 %	32,1 %	7,7 %	-1,1 %	0 %

Table 2. Average percentage of the results in relation of torque peak (N.m), total work (joules) of the external rotators, after isokinetic treatment. *: meaningful difference (p< 0,02)**: meaningful difference (p< 0,04)NS: non-meaningful difference

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ISOKINETIC PROCEDURE ON SHOLDER MULDIRECTIONAL INSTABILITY

This observational and descriptive study used the Isokinetic Dynamometry on subjects with Bilateral Multidirectional Instability of shoulder as physiotherapy treatment. It focused assessing and treating through strengthening the dynamic coaptator musculature of the shoulder, external rotators (ER) and internal rotators (IR), seeking greater stability for the joint. This study quantified such variables: Torque peak (TP) in (N.m), Total Work (TW) in joules and the Relations ER/IR (ER/IR), showing the width of the movements and angularities associated to the pain. A protocol of isokinetic treatment, made up of 24 sections and three assessments, was applied: initial, intermediate and final. This protocol for muscular strengthening of the ER and IR of the shoulder was applied on four female patients, average age 25, right-handed dominancy, being eight shoulders treated applying an average of 10 episodes of subluxations, and that undergone a conventional physiotherapy procedure without any improvement of the clinical picture. The results showed a better performance of the ER and IR along with all the arc of movement long. Therefore, getting better the ER and IR, reaching meaningful results for recuperation of the TP and TW during all width of movement of these two muscular groups. The ER/IR had a meaningful performance (p<0,02) of 11% in average, the TP of the ER and IR also presented a significant gain of strength of 3.5% and 11% respectively, such as the TW that presented a significant improvement of 4.3% (p<0,02) to ER and 17% (p<0,04) to IR. The patients undergone to the protocol of treatment related an improvement of articular stability, which was held all the treatment long, besides the period of accompanying of eighteen months after the finish. No patient presented lesion during the assessments and treatment. All of them reported feeling stronger, more confident on the articular stability, and losing the fear of getting a lesion, reaching efficiency in effectuating their diary tasks.

Key words: Isokinetic, Subluxation, Multidirectional Instability, Shoulder

TRAITEMENT ISOCINÉTIQUE DE L'INSTABILITÉ MULTIDIRECTIONNELLE DE L'ÉPAULE

Cette étude d'observation déscriptive a utilisé la Dynamométrie Isocinétique comme traitement em physiothérapie sur des individus atteints de l'Instabilité Multidirectionnelle Bilatérale de l'Épaule. Elle a visé l'évaluation et traitement à travers le renforcement de la musculature de réduction dynamique de l'épaule, rotateurs externes (RE) et rotateurs internes (RI), cherchant une plus grande stabilité pour l'articulation. Dans cette étude on a quantifié les variables : Pic de torque (PT) en (N.m.), Travail total (TT) en joules et les Relations RE/RI, présentant l'amplitude des mouvements et les replis angulaires associées à la douleur. On a appliqué un protocole de traitement isocinétique composé de 25 sessions et trois évaluations : initiale, intermédiaire et finale. Ce protocole pour le renforcement musculaire des RE et RI de l'épaule a été réalisé pour quatre patients du sexe féminin, moyenne d'âge de 25 ans, dominance dextre, le traitement appliqué sur huit épaules, une moyenne de 10 épisodes de sous-luxations et qui ont subi du traitement de physiothérapie conventionnelle sans présenter d'amélioration du cadre clinique. Les résultats ont démontré une meilleure performance des RE et RI pendant tout l'arc de mouvement. On a amélioré la RE/RI, arrivant à des résultats significatifs pour la récupération du PT et TT pendant toute l'amplitude de mouvement de ces deux groupes musculaires. La RE/RI a subi une amélioration significative (p<0,02) de 11% en moyenne, les PT des RE et RI ont aussi présenté du gain de force significatif de 3,5% et 11% respectivement, ainsi que le TT, qui a présenté une amélioration significative de 4,3% (p<0,02) pour RE et 17% (p<0,04) pour RI. Les patientes soumises au protocole de traitement ont rapporté de l'amélioration de la stabilité articulaire, qui a perduré pendant le traitement entier et jusqu'à la période d'accompagnement de dix-huit mois après l'achèvement. Aucune patiente n'a présenté de lésion pendant

les évaluations et le traitement. Toutes ont rapporté se sentir plus fortes, plus confiantes dans la stabilité articulaire, en perdant la peur d'une nouvelle lésion et atteignant une amélioration dans la réalisation de ses activités quotidiennes.

Mots clé : Isocinétique, Sous-luxation, Instabilité Multidirectionnelle, Épaule.

TRATAMENTO ISOCINÉTICO EN LA INSTABILIDAD MULTIDIRECCIONAL DEL HOMBRO

Este estudio de observación descriptiva utilizó la Dinamometria Isocinética en los individuos con la Instabilidad Multidireccional Bilateral del Hombro, como tratamiento de fisioterapia. Visó a evaluar y tratar través el fortalecimiento de la musculatura reductora dinámica del hombro, rotatorios externos (RE) y rotatorios internos (RI), buscando una mayor estabilidad para el articulación. En este estudio se cuantificaron las variables: Pico de torca (PT) en (N.m), Trabajo total (TT) en joules ((julios) y las Relaciones RE/RI, presentando la amplitud de los movimientos y al doblez de los ángulos asociados al dolor. Fue aplicado un protocolo de tratamiento isocinético compuesto de 24 sesiones y tres evaluaciones: inicial, intermediaria y final. Este protocolo para el fortalecimiento muscular de los RE y RI del hombro se efectuó en cuatro pacientes del sexo femenino, edad mediana de 25 años, dominancia diestra, siendo que ocho hombros tratados con una media de 10 episodios de subluxaciónes y que pasaron por tratamiento de fisioterapia convencional, sin mejorar el cuadro clínico. Los resultados revelan un desempeño mejor de los RE y RI durante todo el arco de movimiento. Mejorando la RE/RI, alcanzando resultados significativos para la recuperación del PT y TT durante toda la amplitud de eses dos grupos musculares. La RE/RI, tuve una mejora significativa ($p<0,02$) de 11% en media, los PT de los RE y RI también presentaron gaño de fuerza significativo de 3,5% y 11% respectivamente, así como el TT que presentó una mejora significativa de 4,3% ($p<0,02$) para RE y 17% ($p<0,04$) para RI. Las pacientes sometidas al protocolo de tratamiento relataron una mejoría de la estabilidad articular, que perduró por todo el tratamiento y hasta el período de acompañamiento de dieciocho meses después del término. Ninguna paciente presentó lesión durante las evaluaciones y el tratamiento. Todas relataron sentirse más fuertes, con más confianza en la estabilidad articular, perdiendo el miedo de se lesionar, alcanzando mejora en la realización de las actividades diarias.

Palabras llave: Isocinético, Subluxación, Instabilidad Multidireccional, Hombro.

TRATAMENTO ISOCINÉTICO EM INSTABILIDADE MULTIDIRECIONAL DE OMBRO

Este estudo observacional descritivo utilizou a Dinamometria Isocinética em indivíduos com Instabilidade Multidirecional Bilateral de Ombro, como tratamento fisioterapêutico. Visou avaliar e tratar através de fortalecimento da musculatura coaptadora dinâmica do ombro, rotadores externos (RE) e rotadores internos (RI), buscando maior estabilidade para a articulação. Quantificaram-se neste estudo as variáveis: Pico de torque (PT) em (N.m), Trabalho total (TT) em (joules) e as Relações RE/RI (RE/RI), apresentando a amplitude dos movimentos e angulações associadas com a dor. Foi aplicado um protocolo de tratamento isocinético, composto de 24 sessões e três avaliações: inicial, intermediária e final. Este protocolo para fortalecimento muscular dos RE e RI do ombro efetuou-se em quatro pacientes do sexo feminino, idade média de 25 anos, dominância destra, sendo oito ombros tratados, com uma média de 10 episódios de subluxações e que passaram por tratamento fisioterapêutico convencional sem melhora do quadro clínico.Os resultados demonstram um melhor desempenho dos RE e RI, durante todo o arco de movimento. Melhorando a RE/RI, alcançando resultados significativos para recuperação do PT e TT durante toda amplitude de movimento destes dois grupos musculares. A RE/RI teve uma melhora significativa ($p<0,02$) de 11% em média, os PT dos RE e RI também apresentaram ganho de força significativo de 3,5% e 11% respectivamente, assim como o TT, que apresentou uma melhora significativa de 4,3% ($p<0,02$) para RE e 17% ($p<0,04$) para RI. As pacientes submetidas ao protocolo de tratamento relataram melhora da estabilidade articular, que perdurou por todo o tratamento e até o período de acompanhamento de dezoito meses após o término. Nenhuma paciente apresentou lesão durante as avaliações e o tratamento. Todas relataram sentirem-se mais fortes, mais confiantes na estabilidade articular perdendo o medo de lesionar-se, alcançando melhora na realização de suas atividades diárias.

Palavras chave: Isocinético, Subluxação, Instabilidade Multidirecional, Ombro.