

ORIGINAL ARTICLES

ISOKINETIC ASSESSMENT OF KNEE FLEXOR/
EXTENSOR MUSCULAR STRENGTH IN ELDERLY
WOMEN

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OBJECTIVE: To assess knee flexor-extensor muscular strength in elderly women with no previous history of musculoskeletal disorders on the lower limbs using an isokinetic dynamometer, in order to obtain data that could be used as a comparative parameter in the evaluation of elderly women with knee disorders, thus facilitating a better rehabilitation of these patients.

METHODS: Twenty-six volunteers aged 75 to 83 years were studied using a Cybex® 6000 isokinetic dynamometer. The chosen angular velocity was 60 °/s, and concentric exercise was used for either flexion or extension. The studied parameters were: peak torque, angle of peak torque, and flexor-extensor torque rate.

RESULTS: There were no differences between dominant (D) and nondominant (ND) knee peak torque values. This was true for both flexor (D = 42.46 ± 9.09 Nm / ND = 40.65 ± 9.38 Nm) and extensor (D = 76.92 ± 13.97 Nm / ND = 77.65 ± 15.21 Nm) movements. The descriptive statistical analysis of the values obtained for the flexor-extensor peak torque rate and for the angle of occurrence of peak torque was the same for the dominant and nondominant sides.

CONCLUSIONS: The values of peak torque for the contralateral side can be used as a reference during rehabilitation of elderly women with acute disease of the knee, and the angular velocity of 60 °/s is proper and safe for isokinetic assessment of elderly people.

DESCRIPTORS: **Isokinetic. Knee. Torque. Muscular strength. Elderly.**

INTRODUCTION

The elderly population is growing world-wide¹⁰. This epidemiological reality requires a deeper knowledge of their musculoskeletal systems¹. Since muscular deficiency is a frequent cause of instability and unbalance, proper muscular assessment is important for preservation of joint stability and for preventing falls and disability^{6,9}.

Isokinetic assessment is the most accurate method for evaluation of muscular activity¹¹. The measurement is made using a dynamometer with a

computerized system that permits arcs of movement at a constant angular velocity that has been determined previously. Isokinetic assessment is used for the assessment of muscular equilibrium and for rehabilitation of injuries⁷. However, there are only a few published studies about isokinetic assess-

ment for the flexor and extensor muscles of the knee in elderly people^{1,3}.

The purposes of this study were: a) to assess the flexor-extensor group of muscles of the knee in elderly women through isokinetic dynamometer; b) to ascertain definitively whether the angular velocity of 60°/s is safe and repeatable for isokinetic assessment in this group of patients; and c) to obtain data that could be used as a comparative parameter in the evaluation of elderly women with disorders of the knee, contributing to better rehabilitation of these patients.

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METHODS

Twenty-six volunteer women aged 75 years or more with no musculoskeletal disorders in lower limbs were studied. They underwent a computerized isokinetic assessment of the flexor and extensor muscles of the knees using a CYBEX® 6000 dynamometer. The study was approved by the local committee, and informed consent was obtained from the volunteers before inclusion.

The medium age was 77.85 ± 2.81 years, ranging from 75 to 83 years. Medium weight was 63.96 ± 10.12 kg, ranging from 48 to 100 kg, and medium height was 1.55 ± 0.06 m, ranging from 1.44 to 1.66 m. The dominant side, which was considered the preferable one for kicking by the volunteer⁷, was the right side for 88.46% of the volunteers.

Criteria used for the selection of the volunteers

The criteria used for the selection of volunteers in this study were: a) age = 75 years b) female; c) sedentary life-style (no more than 1 hour of physical activity/week)^{2,3}; d) no history of pain in any knee with limitation of the habitual activities for more than 48 hours during the last 2 years; e) no history of previous musculoskeletal disorders^{4,14}; no nervous diseases or previous fractures in the lower limbs⁵; f) no instability in any planes or angular deviations in the knees (varus or valgus larger than 10 degrees)¹⁶; g) no use of a pharmacological substance that might affect the mechanism of muscular contraction¹⁴; h) no previous isokinetic assessment; i) no unbalancing systemic disease, such as cardiac diseases and hypertension.

Protocol used for the isokinetic assessment

The flexion and extension tests

were carried out using an angular velocity of 60 %s. At least 5 minutes of exercise was performed on a flat mat with a walking speed that was previously determined. In order to limit knee movement, the test was performed with the volunteer sitting, with the belts positioned on the thorax, abdomen, thigh, and above the knee on the side that was being evaluated⁸. The force due to gravity was corrected for by an intrinsic device of the dynamometer⁵. Each volunteer executed 4 valid repetitions for each test. In order to isolate the movements of the knee as much as possible, the volunteers were told not to hold on to the lateral supports during the test^{11,14}. The tests were performed bilaterally, always beginning on the dominant side. The following parameters were evaluated: a) peak torque, in their absolute values; b) angle of occurrence of peak torque; and c) flexor-extensor peak torque rate. All the values obtained corresponded to concentric contractions.

Statistical analysis

The statistical analysis was performed using nonparametric tests. The comparison between the dominant side and the nondominant one was made using the Wilcoxon test. The level of significance used in every comparison was 5% (P = 0.05%).

RESULTS

There were no statistically significant differences between the values of peak torque and the angle of occurrence of peak torque for the dominant and nondominant sides. This was true for both flexor and extensor movements (Tables 1 and 2). The descriptive statistical analysis of the values obtained for the flexor-extensor peak torque rate was the same for the dominant and nondominant sides (Table 3). The values for peak torque corrected for corporal weight that were found in the isokinetic assessment followed the

Table 1 - Peak torque of the knee at 60 %s (Nm).

Muscles	Dominant side (n=26)			Nondominant side (n=26)		
	aver.	min-max	SD	aver.	min-max	SD
Flexor	42.46	28 - 60	9.09	40.65	26 - 58	9.38
Extensor	76.92	58 - 118	13.97	77.65	56 - 127	15.21

SD - Standard Desviation

Table 2 - Angle of peak torque of the knee at 60 %s (°).

Muscles	Dominant side (n=26)			Nondominant side (n=26)		
	aver.	min-max	SD	aver.	min-max	SD
Flexor	31.46	20 - 46	7.23	31.54	17 - 47	8.58
Extensor	56.96	42 - 71	7.55	54.31	43 - 76	8

SD - Standard Desviation

Table 3 - Flexor-extensor relationship (%).

vELOCITY	Dominant side (n=26)			Nondominant side (n=26)		
	aver.	min-max	SD	aver.	min-max	SD
60 %s	55	39 - 75	8.67	52.12	40 - 80	9.47

SD - Standard Desviation

same pattern of the absolute values obtained, so the inclusion of these corrected values in the analysis was not necessary.

DISCUSSION

We were challenged to determine the angular velocity that would be used in our study. We needed to find an angular velocity that would allow us to perform proper evaluation without risking the physical integrity of volunteers. We adopted the angular velocity of 60 °/s, because it is appropriate for the assessment of peak torque in elderly people, and it is one of the safest angular velocities for the patellofemoral joint¹⁵. In addition, using this angular velocity would allow us to compare our results with other data in literature^{12,18}.

The results showed that there were no statistically significant differences between the values of peak torque and of the angle of occurrence of peak torque for the dominant and nondominant sides. This was true for both flexor and extensor movements. These results were similar to those reported for young women¹⁸ and are very important, since data in the literature show that peak torque is the best correlated measurement in isometric exercise¹³.

Therefore, the results allow us to use the values of peak torque of the non-affected side as the preferable reference parameter during the rehabilitation of elderly people who have experienced trauma to the knee.

However, it is essential to emphasize that this comparison should not be extended to patients with chronic diseases on the knee. Since these diseases often occur bilaterally, it would be a mistake to assume that an injured contralateral lower limb is a measure of normality. The complaint of pain during isokinetic assessment for patients with patellofemoral disease might result in an inappropriate evaluation of the real functional capacity of these patients, and consequently, in inappropriate rehabilitation programs.

The descriptive statistical analysis of the values obtained for the flexor-extensor peak torque rate was the same on the dominant and nondominant sides. The extensor peak torque was almost the double that of the flexor peak torque. These results are similar to those reported in literature¹².

We had difficulty comparing the results obtained in our study with those in literature, since there are only a few available studies on isokinetic assessment of the flexor and extensor muscles of the knee among elderly

people^{1,3}. There are even fewer studies on elderly women. The lack of a standard angular velocity for this kind of assessment is a further problem, with evaluations obtained using many different angular velocities, making any comparison between them unfeasible.

The knee joint, due to its anatomical and functional characteristics, is one of the most mechanically overloaded joints and the most unstable one in the musculoskeletal system, which makes it the most susceptible joint to lesions. The older the patient, the higher the frequency of this kind of disorder. For this reason, we point out the need for obtaining data that could be used as a standard parameter for elderly women with disease of the knee, thus allowing for a proper follow-up and a better assessment of the degree of recovery in these patients in order to optimize the rehabilitation programs.

CONCLUSIONS

We concluded from our study that the values of peak torque for the non-affected side can be used as a reference during the rehabilitation of elderly women with acute disease of the knee and that the angular velocity of 60 °/s is proper and safe for isokinetic assessment among elderly people.

RESUMO

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AQUINO MA e col. – Avaliação isocinética do torque muscular flexor-extensor do joelho em mulheres com idade entre 75-83 anos. **Rev. Hosp. Clín. Fac. Med. S. Paulo** 57(4):131-134, 2002.

OBJETIVO: Avaliar, isocineticamente, o torque dos músculos flexores e extensores dos joelhos de mulheres idosas sem afecções do sistema músculo-esquelético em membros inferior-

res, obtendo dados que possam servir como parâmetro de comparação na avaliação de mulheres idosas portadoras de afecções nos joelhos, colaborando para uma melhor reabilitação dessas pacientes.

CASUÍSTICA E MÉTODOS: Vinte e seis voluntárias foram avaliadas. O estudo foi realizado através de um dinamômetro isocinético marca CYBEX® modelo 6000 na velocidade angular de 60°/s. O tipo do exercício

utilizado foi o concêntrico, tanto para a flexão quanto para a extensão do joelho. Os parâmetros avaliados foram o torque máximo, o ângulo de ocorrência do torque máximo e a relação flexão/extensão do torque máximo.

RESULTADOS: Os resultados demonstraram não haver diferenças entre os valores do torque máximo do lado dominante (D) e do lado não dominante (ND). Isto foi verdadeiro tanto para o movimento flexor (D= 42,46 ±

9,09 Nm / ND= 40,65 ± 9,38 Nm), quanto para o movimento extensor (D= 76,92± 13,97 Nm / ND= 77,65 ± 15,21 Nm). Também, a estatística descritiva dos valores encontrados para a relação flexão/extensão do torque máximo e para o ângulo de ocorrência do

torque máximo foram semelhantes nos dois lados avaliados.

CONCLUSÕES: Os valores do torque máximo do lado contralateral podem ser usados como referência durante a reabilitação de mulheres idosas portadoras de doença articular agu-

da no joelho e a velocidade angular de 60°/s é adequada e segura para a avaliação isocinética em idosas.

DESCRITORES: Isocinético. Joelho. Torque. Força muscular. Idoso.

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