



OSTEOARTHRITIS CAUSES QUADRICEPS AND HAMSTRING DYNAPENIA AS MEASURED WITH DINABANG

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INTRODUCTION

In the world osteoarthritis is 300 million [5].

Aprox 50.000 in Uruguay



Area: 176.400 km
Population: 3,3 million

INTRODUCTION

Knee Osteoarthritis (KOA) affects the strength of both the flexion movement performed by Hamstring (H) muscles and the extension by Quadriceps (Q).

Dynapenia is usually detected clinically by manual muscular testing, resulting in a subjective score such as the Lovett scale [1]. The word “dynapenia” is been used since 2008 [2] and increasingly thereafter to refer to a loss of strength (dyna=strength and penia=poverty, low content).

In order to quantify dynapenia, clinicians can either use standard dynamometers for static measurements or new devices designed specifically for the purpose, such as DINABANG® [3][4] which includes power and torque measures.

Clinical observations of patients with KOA, who develop less strength [5], led us to formulate the hypothesis that the Lovett subjective scale could be further refined using a quantitative evaluation.

OBJECTIVE

To compare the maximal isometric strength of Hamstrings and Quadriceps in patients with knee osteoarthritis and healthy volunteers.

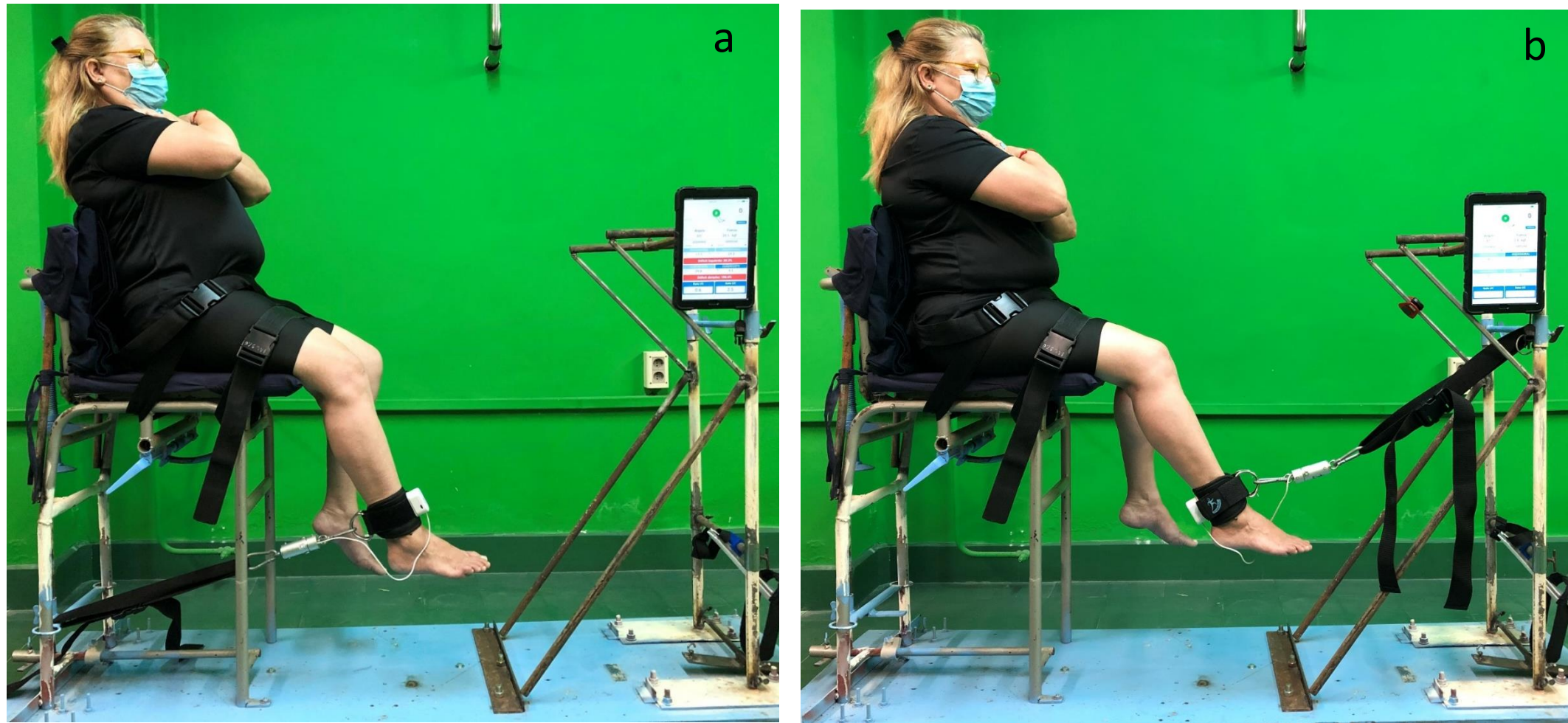
MATERIAL AND METHODS

We measured the H and Q strength of 20 subjects, in both lower limbs of 12 Healthy Volunteers (HV) age $64,9 \pm 6,4$ years, BMI $26,5 \pm 3,5$ and 8 KOA patients (KOA_p) $63,4 \pm 10,1$ years, BMI $28,3 \pm 3,7$ with mild to moderate symptomatic unilateral primary KOA, according to Kellgren Lawrence II-III radiological classification.

They all signed an informed consent as approved by the Ethics Committee (2910-21 of 29 October 2021) of the “Hospital de Clínicas Dr. Manuel Quintela”

To standardize all measurements, we used a specially designed chair (Fig.1) called CHAKADINA [7] and DINABANG® to determine with three consecutive trials the maximum isometric strength of H and Q muscles, tending towards knee flexion and towards knee extension respectively at a 60 degree angle approximately [6].

Fig.1 KOA patient positioned in CHAKADINA for Q and H maximal isometric strength measurement.



(a) Quadriceps strength measurement as the patient attempts knee extension, with DINABANG[®] secured just above malleolus to a rear fixed point. DINABANG[®] includes a Kaltenborn belt secured in CHAKADINA to a fixed point, (Inertial Measurement Unit IMU), and bluetooth connection to friendly user interface in a mobile or tablet (appreciable in both pictures). **(b)** Hamstring strength measurement, patient attempting knee flexion, Kaltenborn belt secured in the CHAKADINA to a forward fixed point. Healthy volunteers were also positioned and measured under identical conditions as KOAp.

RESULTS

Flexion strength was $190,5 \pm 50,7$ N for HV and $130,3 \pm 37,5$ N for KOAp (Fig.2).

The loss of strength of KOAp compared to HV was 32 % in hamstring force.

Extension strength was $310 \pm 120,8$ N for HV and $190 \pm 53,0$ N for KOAp (Fig.2).

The loss of strength of KOAp compared to HV was 39 % in quadriceps strength.

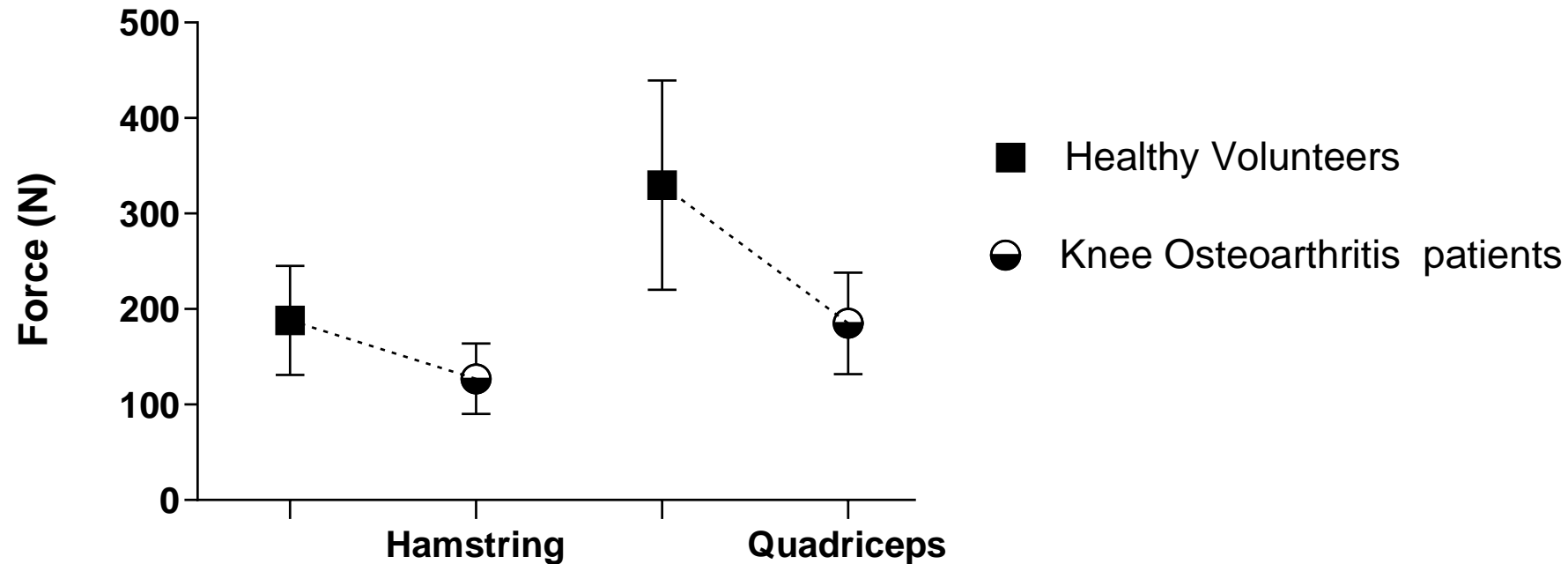


Fig 2: Mean and Standard Deviations of the maximal isometric force of Quadriceps and Hamstring, healthy volunteers and Knee Osteoarthritis patients.

DISCUSSION AND CONCLUSION

KOA considerably diminishes the strength of both lower limb main movements: flexion and extension.

Quadriceps loss appears somewhat more dramatic (39% loss) than Hamstring (32% lower).

Generally, the rehabilitation team concentrates its efforts on recovering Q strength, neglecting the recovery of the H strength [6]. This modifies the H/Q strength ratio, which in turn alters the arthrokinematics of the knee, making it less stable during gait [5].

Several papers have described the loss of muscular strength in KOAp due to the consequences of pain and other proprioceptive processes within the joint and around it [5]. Our results represent an attempt to quantify such loss, or **dynapenia**.

Future Developments

Improve of Programs Rehabilitations of KOA will be necessary to reach:

Normal Arthrokinematics

Better H/Q Strength Ratio

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