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EFFECTIVENESS OF LONG-TERM USE OF MINIMALIST FOOTWEAR ON PAIN, FUNCTION AND MECHANICAL LOADS IN KNEE OSTEOARTHRITIS

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SUMMARY

Based on our previous studies^[1,2] and theses, this current clinical trial shows the effect of long-term use of inexpensive and minimalist footwear on the clinical and functional aspects of knee osteoarthritis (OA) and gait biomechanics of elderly women.

INTRODUCTION

OA is the most common joint disease in musculoskeletal system. The knee OA is one of the most prevalent forms of this degenerative joint affection and is associated with high mechanical loads, pain, functional impairment and a high economic cost for the health system. Recent studies^[1,2] have shown an important reduction of joint overloads during locomotion in elderly women with knee OA after short-term use of minimalist shoes. Hence, this randomized clinical trial aimed at investigating the effect of long-term use of an inexpensive and minimalist footwear on the clinical and functional aspects of OA and gait biomechanics of elderly women with knee OA.

METHODS

Twenty-four elderly women with knee OA grade 2 or 3 (Kellgren and Lawrence) were randomized into blocks and blinded allocated to either the intervention group (IG; n = 12), which has received a pair of minimalist footwear on the first day to use it for six months, for at least six hours daily. The intervention shoes - Moleca[®] - is a women's double canvas, flexible, flat walking shoe without heels, with a 5-mm anti-slip rubber sole and a 3-mm internal wedge of ethylene vinyl acetate (Figure 1). The patients allocated to the control group (CG; n = 12) did not receive the intervention footwear. The use of rescue medication - paracetamol (500 mg, up to 4 times a day) was allowed to both groups. No physical therapy or acupuncture treatment was allowed during the intervention period. Both the hours of daily use of the footwear intervention and the amount of rescue medication taken were recorded in a diary. Every two weeks, a physiotherapist (PT 1) made phone calls to all patients in order to verify adherence to treatment.



Figure 1: Intervention shoe

Three assessment processes were performed according to Trombini-Souza et al. (2012)^[3]: (A) a medical examination carried out by a rheumatologist who was blind to the patient's allocation; (B) WOMAC (Western Ontario and McMaster Universities Osteoarthritis) questionnaire to assess the pain, disability, and joint stiffness in knee OA; the algofunctional Lequesne Index of severity of OA; the walking distance assessed by means of the Six-minute Walking Test all performed by a blind assessor (physical therapist - PT 2); (C) biomechanical gait analysis using the inverse dynamic approach to calculate the knee adduction moment (KAM) (PT 2). In C process we six infrared cameras (OptiTrack FLEX: V100; Natural Point, Corvallis, OR, USA) and a force plate (AMTI OR 6-7 1000, Watertown, MA, USA) embedded in the center of a 10-meter walkway. Patients of both groups were assessed at the baseline and at the end of six months (end of intervention). The WOMAC subscale pain score was adopted as primary outcome and the secondary outcomes were: global WOMAC score; joint stiffness and disability WOMAC scores; Lequesne score; walking distance in the Six-minute Walk Test; clinical assessment, amount and frequency (number of days) of paracetamol (500 mg) intake over six months, and knee adduction moment. The statistical analysis was based on intention-to-treat analysis, as well as general linear models of analysis of variance for repeated measure to detect treatment-time interactions ($\alpha=5\%$).

RESULTS AND DISCUSSION

The primary outcome (WOMAC subscale pain) decreased 61.9% in the IG. This variable was chosen as primary outcome because its capability to show changes post-treatment in rheumatology [4]. In this same group, we observed an increase in WOMAC function subscale (44.9%), and WOMAC total score (49.3%), as well as in Lequesne total score (38.7%) at the end of intervention. Although the CG has also shown similar results compared to the IG in the aforementioned variables, the CG has increased significantly the rescue medication intake after the third month.

The IG maintained the same knee loading (KAM) compared to baseline assessment (Fig.2). In addition to that, we observed a 20.2% decrease ($p=0.003$) in the knee load at midstance, and a 12.7% decrease ($p=0.034$) in the KAM angular impulse. On the other hand, the CG showed an increase of 20.6% ($p=0,030$) at the KAM first peak after the six-month period (Fig.2).

The maintenance of the KAM peaks and KAM impulses, as well as the decreasing of the magnitude of this variable during midstance in the IG can explain the pain and function improving. On the other hand, similar improve in pain and function obtained by the CG can be explained by the increased analgesic medication intake.

The increase in the first peak of the KAM in CG after six-month period can be explained by the decreasing of the inherent pain's protective mechanism due to the analgesic effect caused by rescue medication [5]. This biomechanical result can accelerate the degradation process of the intra-articular structures followed by deficits in function and pain.

Then, considering our results, we can suggest an advantage of Moleca compared to no intervention associated with higher intake of paracetamol. Moreover, this mechanical intervention has a positive differential, since the patients do not reduce their protection mechanism caused by analgesic drug intake that, consequently, may contribute to increase joint overload throughout the natural course of the knee OA.

CONCLUSIONS

The Moleca shoe can be indicated as a mechanical conservative treatment for patients with knee OA since it contributed to decrease knee pain, improve its function and decrease knee loads during gait.

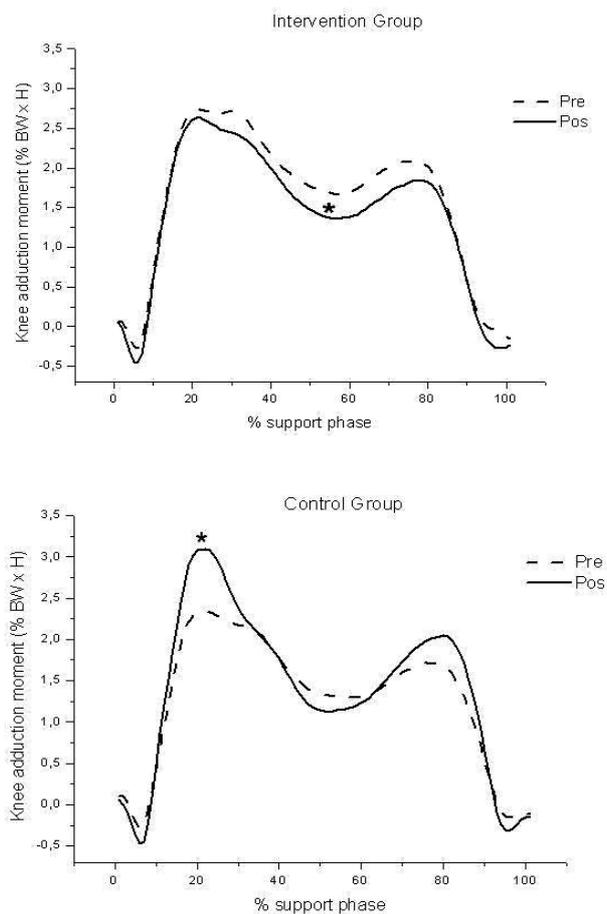


Figure 2: Knee adduction moment pre and post six-month period in both groups.

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REFERENCES

1. Trombini-Souza F., et al. *Gait Posture*; **34**(1):126-30, 2011.
2. Sacco I.C., et al. *Arthritis Care Res.*; **64**(3):368-74, 2012.
3. Trombini-Souza F., et al. *BMC Musculoskelet Disord.* **12**;13:121, 2012.
4. Hochberg et al. *J Rheumatol.* **24**(4):792-794, 1997
5. Henriksen et al. *Knee*; **13**(6):445-50, 2006.