Deep oscillation therapy as an adjunct to kinesiotherapy in the treatment of gonarthrosis

Therapy of deep oscillations as a complement to kinesiotherapy in the treatment of gonarthrosis

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SUMMARY

Objective: To determine whether the use of deep oscillation therapy as an adjunct to kinesiotherapy has better results than the use of kinesiotherapy alone in the treatment of gonarthrosis.
Method: a quantitative and experimental study was conducted in 100 patients with a diagnosis of gonarthrosis admitted to the Julio Díaz Rehabilitation Hospital from January 2014 to January 2017. The patients were divided into two groups, an experimental group (n=50) treated with kinesiotherapy and deep oscillations, and another control group (n=50) who only received treatment with kinesiotherapy. All patients were assessed before and after treatment by visual analogue scale and Womac questionnaire. Interval estimation and parametric hypothesis testing were performed.
Results: There was a predominance of patients aged 60 years and older (56 % in the experimental group and 64 % in the control group), female sex (72 % in the experimental group and 80 % in the control group) and grade 2 gonarthrosis (52 % in the control group and 40 % in the experimental group). The most frequent location was in both knees (46 % experimental group and 42 % control group). Before starting the treatment both groups behaved similarly, with moderate pain intensity, joint limitation and regular functional status, at the end of the treatment both groups evolved positively, with high percentages of satisfactory results (88 %) for those who received deep oscillation therapy.
Conclusions: Deep oscillation therapy as an adjunct to kinesiotherapy was effective in the treatment of gonarthrosis.

Keywords*: gonarthrosis; kinesiotherapy; deep oscillations.

ABSTRACT

Objective: To determine if the therapy of deep oscillations as a complement to kinesiotherapy has better results than kinesiotherapy only in the treatment of gonarthrosis.
Method: A quantitative and experimental study was performed in 100 patients with a diagnosis of gonarthrosis admitted to Hospital Julio Díaz, from January 2014 to January 2017. Patients were divided into two groups, one experimental (n = 50) treated with kinesiotherapy plus deep oscillations and another control (n = 50) who were treated with kinesiotherapy alone. All patients were evaluated before and after treatment using visual analogue scale and WOMAC questionnaire. An interval and contrast estimation of parametric hypothesis was performed.
Results: Prevalence of patients aged 60 years and over (56 % in the experimental group and 64 % in the control group), female gender (72 % experimental group and 80 % control group) and grade 2 gonarthrosis (52 % control and 40% the experimental group). The most frequent location was in both knees (46% in the experimental group and 42% in the control group). At the end of the treatment, both groups had a positive outcome, with a high percentage of satisfactory results (88%) for those who received therapy of deep oscillations.
Conclusions: Therapy of deep oscillations as a complement to kinesiotherapy was effective for the treatment of gonarthrosis.

Key words: gonarthrosis; kinesiotherapy; deeposcillations.

INTRODUCTION

Osteoarthritis, also called osteoarthrosis (OA) or osteoarthritis, is a chronic inflammatory arthropathy involving joint structures (hyaline cartilage, subchondral bone, synovial membrane, etc.) and is due to a disorder in the regulation between synthesis and degradation of the extracellular matrix of cartilage, in a biochemical process mediated by cytokines and growth factors that in turn participate in the process of bone remodelling and joint destruction.[1-3]

According to the *American College of Rheumatology* it is defined as a heterogeneous group of conditions leading to joint symptoms and signs which are associated with defects in the integrity of articular cartilage, as well as changes related to the subchondral bone and joint margins.[4-5]

The knee is one of the joints responsible for load transmission and movement of the lower limb and is the largest and perhaps the most complex joint in the body. From a mechanical point of view, a balance between the requirements of stability and mobility are achieved in this joint; at the same time, it is the most frequent site of osteoarthritis.[6-9]

The patient with gonarthrosis reports pain around the joint, with mechanical characteristics, which increases with load and improves at rest, and morning stiffness not exceeding 30 min. There may be limited mobility and crepitus when mobilised; deformities may also be observed in cases of *genusvalgus, varus and flexus*.[10-13]

Today, in developed countries, one in six people suffer from gonarthrosis, and its incidence is directly linked to age, so increasing life expectancy should lead to an increase in the incidence of this disease. [14-15]

In the USA, gonarthrosis is one of the main causes of disability; in Spain, meanwhile, 1,000 out of every 100,000 inhabitants aged between 60 and 69 years are diagnosed each year.[8,16-17] In Cuba, morbidity due to disorders of the osteomyoarticular system constitutes an important health problem. 17.3 % of the Cuban population is over 60 years of age. Life expectancy at birth is 78 years and it is expected that by the year 2025 the elderly population will represent 21 %.[14-17]

Therapeutic modalities in the treatment of OA are numerous and include both pharmacological and non-pharmacological treatments, pharmacological treatments include: analgesics, non-steroidal anti-inflammatory drugs, opioids and corticosteroids,[18-19] and non-pharmacological treatments include: joint sparing measures, physical agents, physical exercise and surgery.

Exercise therapy decreases pain, increases muscle strength, joint range of motion, and improves aerobic capacity.[20-23]

The therapy with deep oscillations works in a range of frequencies that allows to cover objectives of lymphatic and venous circulatory drainage, muscle relaxant, anti-inflammatory effects, analgesic, in muscular contractures. [24-26] Treatments for patients with gonarthrosis should be aimed at maintaining the patient's autonomy and improving their quality of life.

Scientific problem:

What is the effect of deep oscillation therapy as a complement to kinesiotherapy for patients with gonarthrosis admitted to the SOMA service of the Julio Díaz Rehabilitation Hospital?

Statistical hypothesis statement:

1. Pain intensity by VAS.

H_0 : patients treated with deep oscillations and kinesiotherapy have a mean VAS (pain intensity) score equal to or higher than patients treated with kinesiotherapy alone at the end of treatment.

H_1 : patients treated with deep oscillations and kinesiotherapy have lower mean VAS (pain intensity) scores than patients treated with kinesiotherapy alone at the end of treatment.

2. Functional status by Womac questionnaire.

H_0 : patients treated with deep oscillations and kinesiotherapy have a mean score on the Womac scale (functional status) equal to or higher than patients treated with kinesiotherapy alone at the end of treatment.

H_1 : patients treated with deep oscillations and kinesiotherapy have lower mean scores on the Womac scale (functional status) than patients treated with kinesiotherapy alone at the end of treatment.

3. Response to treatment.

H_0 : patients treated with deep oscillations and kinesiotherapy have an equal or lower satisfactory response rate (≤70%) than patients treated with kinesiotherapy alone at the end of treatment.

H_1 : patients treated with deep oscillations and kinesiotherapy have a higher satisfactory response rate (>70%) than patients treated with kinesiotherapy alone at the end of treatment.

METHODS

A quantitative, explanatory and experimental study was carried out on patients with a diagnosis of gonarthrosis admitted to the SOMA service of the Julio Díaz Rehabilitation Hospital. The sample was selected using the probabilistic technique of systematic sampling and consisted of 100 patients. It was randomly subdivided into two groups:

 1. Control group: 50 patients who received kinesiological treatment alone. The programme consisted of three phases with a duration of 40 min. The exercises were performed from Monday to Saturday with a total of 20 sessions.

 2. Experimental group: 50 patients who received deep oscillation treatment with *Deep Oscillation Evident* equipment plus kinesiological treatment. Intensity: between 10 % and 20 % at the perception threshold. The programme had a duration of 15 min in which an oscillation frequency flow of 160-180 Hz was established for 10 min and a successive oscillation flow of 70 Hz for 5 min, 20 sessions, one daily from Monday to Saturday.

Criteria for assessing response to treatment:

- Satisfactory: when VAS is between 0-3 points on the Womac scale with good functional status (0-24 points) or on the scale of fair functional status with a difference from baseline of 20 points or more.

- Unsatisfactory: when it does not meet the above criteria.

Data processing and statistical analysis was carried out using computerised techniques and the SPSS software version 20.0. A comparison of proportions test was carried out using Epidat version 4.1. Categorical variables were analysed using frequencies and percentages. For the variables

measures of central tendency, dispersion and position were calculated. Interval estimation was performed with a 95 % confidence interval (95 % CI).
%). A Kolmogorov-Smirnov normality study was performed to determine the distribution of the sample, which was normally distributed, and therefore parametric, one-sided hypothesis tests were used with the independent samples statistic Student's T to determine whether treatment with deep oscillations and kinesiotherapy had better results than kinesiotherapy alone in relation to the mean score obtained on the VAS and Womac scale at the start and end of treatment.

ANALYSIS AND DISCUSSION

I. Univariate descriptive summary.

In both groups, patients aged 60 years and older predominated, with 56 % for the experimental group and 64 % for the control group (Table 1). The mean age of the sample was 60 (±7.9) years. No significant differences were found between the groups in relation to mean age (59.0 *vs.* 60.7 years; p=0.608).

Tabla 1. Distribución de los pacientes con gonartrosis de acuerdo a la edad

| Edad (en años) | Grupos | | | | Total | |
| | Experimental | | Control | | | |
	No.	%	No.	%	No.	%
40-49	8	16,0	5	10,0	13	13,0
50-59	14	28,0	13	26,0	27	27,0
60 años y más	28	56,0	32	64,0	60	60,0
Total	50	100,0	50	100,0	100	100,0
Estadígrafos descriptivos y estimación por intervalo						
Media±DS	59,1±8,2		60,8±7,6		59,9±7,9	
IC 95%	56,74;61,38		58,61;62,95		58,35;61,49	
Moda	60		62		62	
Mínimo± Máximo	45±78		45±76		45±78	

$X^2=0,996$ p= 0,608.
Fuente: Base de datos de SPSS.

Female sex was more frequent with 72 % in the experimental group and 80 % in the experimental group.
% for the control group (Fig. 1). In terms of location (Fig. 2), both knees were more frequently affected (46 % in the experimental group and 42 % in the control group). There were no significant differences between the groups (p>0.05).

Figure 3 shows the distribution of patients with gonarthrosis according to radiological assessment. In both groups, grade 2 gonarthrosis was more frequent with 52 % in the control group and 40 % in the experimental group. Both groups behaved homogeneously (p=0.391).
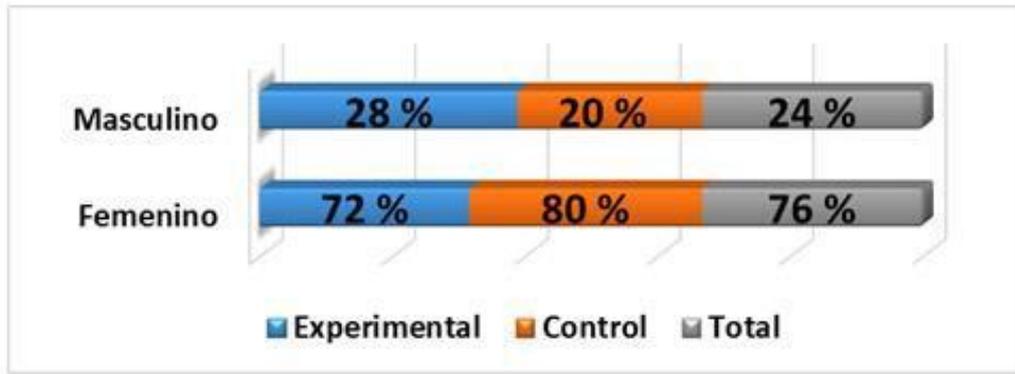
Fuente: Base de datos de SPSS.

Fig. 1. Distribución de los pacientes con gonartrosis de acuerdo al sexo. $X^2=0,877$ $p=0,349$.
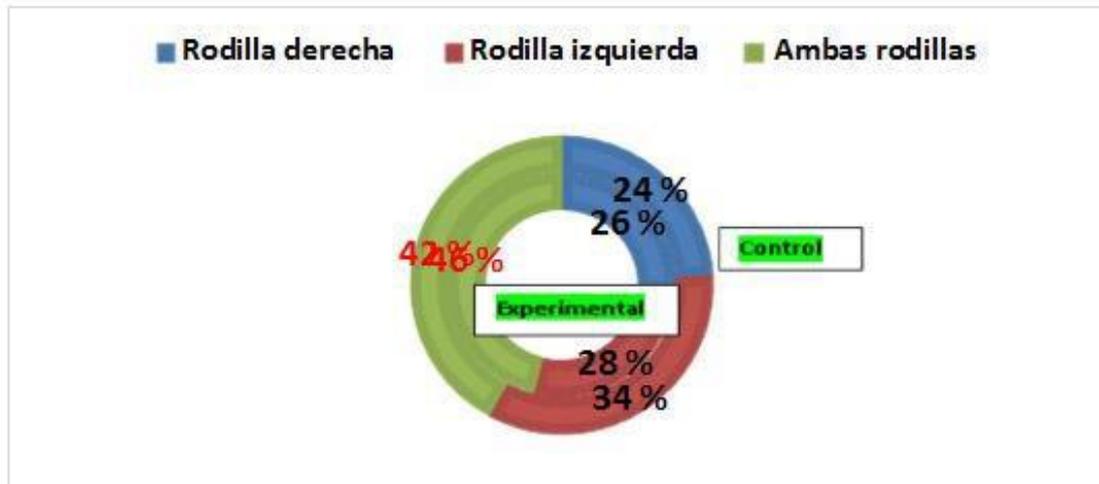
Fuente: Base de datos de SPSS.

Fig. 2. Distribución de los pacientes con gonartrosis de acuerdo a su localización. $X^2=0,421$ $p=0,810$
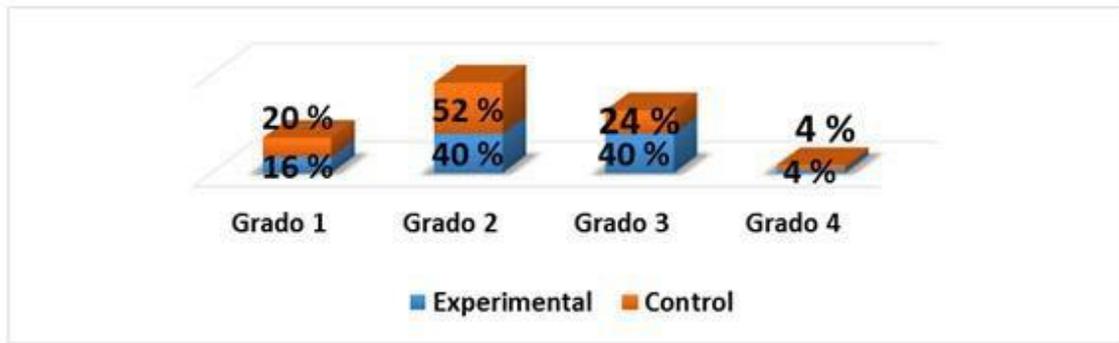
$X^2=3,005$ p=0,391.
Fuente: Base de datos de SPSS.

Fig. 3. Distribución de los pacientes con gonartrosis de acuerdo a evaluación radiológica.

II.   Hypothesis testing.

Table 2 tests hypotheses between the means of two populations for pain intensity according to VAS.

Tabla 2. Evaluación inicial con evaluación final de intensidad del dolor por EVA

Prueba T para medias de dos muestras independientes (EVA)		Inicial	Final	IC 95 %
Media ± DS	Experimental	5,1±1,4	1,3±1,2	0,97;1,93
	Control	4,8±1,2	2,8±1,2	2,47;3,21
Observaciones (n)	Experimental	50	50	
	Control	50	50	
Estadístico T		1,007	- 6,240	
Valor-p		0,316	0,000	

Fuente: Base de datos SPSS

Assumptions: one sample corresponds to the mean pain intensity (μ_1) for those who received treatment with kinesiotherapy plus deep oscillations and the other to the mean pain intensity (μ_2) for those who used only kinesiotherapy.

Hypothesis: left one-sided contrast. H_0 :

$\mu 1 \geq \mu 2$.

H_1 : $\mu 1 < \mu 2$.

Test statistic: Student's t-test (t-test for independent samples). Decision rule: Let $\alpha= 0.05$. Reject H_0 if the p-value $<\alpha$ or reject H_0 if the p-value $<\alpha$ or reject H if the p-value $<\alpha$.

value of the T-statistic found is less than $-t_{1-\alpha(n1+n2-2)}$ (called calculated t or critical value of t).

Statistical decision: H_0 is rejected because the value of p=0.00< α=0.05 or H_0 is rejected because the value of the T-statistic found is less than $-t_{1-\alpha(n1+n2-2)}$ = $-t_{0,05(98)}$. Then: T= - 6.240 <$-t_{0,05(98)}$) = -1.658.

Conclusion: In both groups there is a decrease in pain, but in the experimental group better averages are observed, with a mean at the beginning of 5.1±1.4 points corresponding to moderate pain and a mean at the end of treatment of 1.3±1.2 points (mild pain). Thus, patients treated with deep oscillations and kinesiotherapy have lower mean VAS (pain intensity) scores than patients treated with kinesiotherapy alone at the end of treatment.

p-value: For this test p=0.00<0.05. The contrast is significant.

Table 3 shows hypothesis testing between the means of two populations for the functional assessment according to the Womac scale.

Tabla 3. Evaluación inicial con evaluación final del estado funcional por escala de Womac

Prueba T para medias de dos muestras independientes (Womac)		Inicial	Final	IC 95 %
Media±	Experimental	40,3±13,5	17,8±15,1	13,58;22,18
	Control	42,1±14,9	26,9±13,6	23,10;30,82
Observaciones (n)	Experimental	50	50	
	Control	50	50	
Estadístico T		- 0,638	- 3,154	
Valor-p		0,525	0,002	

Fuente: Base de datos SPSS

Assumptions: one sample corresponds to the mean (μ_1) of the functional status for people with gonarthrosis who received treatment with kinesiotherapy plus deep oscillations and the other to the mean (μ_2) of the functional status for those who used only kinesiotherapy.

Hypothesis*: left one-sided contrast. H_0 :

$\mu_1 \geq \mu_2$.

H_1 : $\mu_1 < \mu_2$.

Test statistic: Student's t-test (t-test for independent samples). Decision rule: Let α= 0.05. Reject H_0 if the p-value ≤ α or reject H_0 if the value of the T-statistic found is less than the critical t-value.

Statistical decision: H_0 is rejected because the value of p=0.00< α=0.05 or H_0 is rejected because the value of the T-statistic found is less than $-t_{1-\alpha(n1+n2-2)}$ = $- t_{0,05(98)}$. Then: T= - 3,154< $- t_{0,05(98)}$ = -1,658.

Conclusion: it is concluded that, according to these data, there are indications that the means of the populations are different. In both groups there is improvement in functional status, but in the experimental group better averages are observed, with a mean at the beginning of 40.3±13.5 points corresponding to fair functional status and a mean at the end of treatment of 17.8±15.1 points (good functional status). Thus, patients treated with deep oscillations and kinesiotherapy have lower mean scores on the Womac scale (functional status) than patients treated with kinesiotherapy alone at the end of treatment.

p-value: for this test p=0.002 < 0.05. The contrast is significant.

Table 4 shows the hypothesis test between the proportions of two populations for the assessment of treatment response.

Tabla 4. Distribución de los pacientes con gonartrosis de acuerdo a la respuesta del tratamiento

| Respuesta al tratamiento | Grupos | | | | Total | |
| | Experimental | | Control | | | |
	No.	%- IC (95 %)	No.	%- IC (95 %)	No.	%- IC (95 %)
Satisfactoria	44	88,0 (61,3;90,7)	26	52,0 (17,6;25,6)	70	70,0 (26,3;53,6)
No Satisfactoria	6	12,0 (5,1;18,9)	24	48,0 (37,7;38,3)	30	30,0 (20,5;39,5)
Total	50	100,0	50	100,0	100	100,0

Fuente: Epidat. Prueba de comparación de proporciones.
Estadístico Z= 3,7097 p=0,000.

Assumptions: one sample corresponds to the percentage of satisfactory results (P_1) for patients who received treatment with kinesiotherapy plus deep oscillations and the other to the percentage of satisfactory results (P_2) for patients who received only treatment with kinesiotherapy.

Hypothesis: Right one-sided contrast. H_0:

$P1 \leq P2$....

H_1: $P1 > P2$...

Test statistic: Z-value (test for comparison of independent proportions).

Decision rule: Let α= 0.05. The critical value of z (one-tailed) is 1.64. H_0 is rejected if the value of Z found is greater than 1.64 or the value of p ≤ α.

Statistical decision: as the estimator Z=3.71 is greater than the critical value of z= 1.64 and p < 0.05, the alternative hypothesis is accepted and the null hypothesis is rejected.

Conclusion: It is observed that 70 % of the sample obtained satisfactory results. When analysed by groups, the highest percentage of positive results was in the experimental group (88 %) with a CI (95 %) (61.3; 90.7). Therefore, the patients treated with deep oscillations and kinesiotherapy have the highest percentage of positive results in the experimental group (88 %).

of satisfactory responses higher than patients treated with kinesiotherapy alone at the end of treatment.

p-value: for this test p= 0.000<0.05. The contrast is significant.

Figure 4 shows that since the estimator Z=3.71 is larger than the critical value of z (one-tailed) = 1.64, the alternative hypothesis is accepted and the null hypothesis is rejected. That is, the value of the Z estimator falls within the critical region or rejection zone.
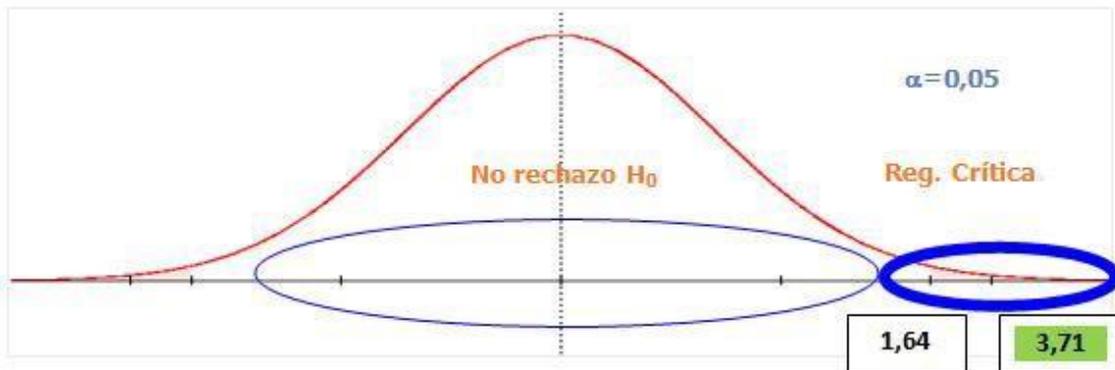
Fuente: Epidat.

Fig. 4. Prueba de hipótesis para la evaluación de la respuesta al tratamiento.

DISCUSSION

It is known that age is one of the most important risk factors for developing osteoarthritis in any joint, and the prevalence of the disease increases with age. [4,9-10] In other studies conducted in Cuba, in urban populations, higher incidences of OA are observed in the 55-59 age group.[6-8] However, most authors agree with the findings of the present study. Female gender is one of the risk factors described for osteoarthritis, so the result found in this study coincides with this risk factor and with numerous epidemiological studies and published reviews.[27-28]

Many investigations conclude that bilateral involvement is the most common occurrence, with women being more likely to have bilateral knee involvement.[7-9,11-12] This same conclusion appears in the work of Solís Carta.[6] Various studies show disparate results in relation to the degree of radiological involvement of patients with osteoarthritis. [25-26] Prada Hernández[16] found that the majority of patients participating in his study were in grade 2-3 in both hip and knee osteoarthritis.

In relation to pain and functional capacity, studies of quality of life in patients with gonarthrosis found that patients with osteoarthritis of the knee were affected by the pain and functional capacity dimensions of the Womac and that, after six months of applying lifestyle changes (exercise, analgesics, non-pharmacological measures, etc.), they experienced a significant improvement in these dimensions. [15-16]

In the literature consulted, only one study was found with deep oscillation therapy in gonarthrosis, where there is evidence of improvement of the articular arch and pain relief after treatment,[29] but many were found with non-pharmacological treatment, including the use of different physical means.[28,30-31]

CONCLUSIONS

Patients with gonarthrosis showed satisfactory evolution with kinesiotherapy, but those who also received deep oscillation therapy had better results. It is concluded that statistically H_1 is accepted and H_0 is rejected.

Conflict of interest

The authors of this work have received no financial support for its completion; we have not entered into any agreement whereby we receive benefits or fees from any commercial entity. Nor has any commercial entity paid or will pay any foundation, educational institution or other non-profit organisation with which we are affiliated.

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