

Aquatic Therapy in low back pain reduction evaluated through hydroxiproline levels

Original Article

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ABSTRACT: The objective of this study was to evaluate pain levels and hydroxiproline (HP) excretion in individuals with low back pain after aquatic therapy with mix stretching in a pool with water at 34°C. Eight male individuals, with ages between 25 and 45 years old, participated as volunteers with low back pain. This study was developed in the Police Phisiatry and Rehabilitation Center of Rio de Janeiro, and the pool dimensions were 12X6 m. The tests were done through Statistica 6.0, from Statsoft, 1981-2004. The results showed that the values of HP before and after the treatment were 53.3 ± 22.6 and 31.6 ± 11.3 mg/d, respectively. The t Student test showed $t = 3.93$ for $p = 0.008$ pain and HP levels. The indexes of low back pain before and after the treatment were 5 ± 2 e 2 ± 1 , respectively. The Wilconxon test showed $Z = 2.20$ for $p = 0.03$. We concluded that the aquatic therapy mist stretching promoted reduction on HP and pain levels, suggesting the occurrence of connective tissue damage through hidroxiproline levels.

Keywords: low back pain, hydroxiproline, stretching, over stretching, aquatic therapy.

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RESUMO

Hidrocinestoterapia na redução da lesão lombar avaliada através dos níveis de hidroxiprolina e dor

O objetivo deste estudo foi mensurar os níveis de dor e excreção de Hidroxiprolina (HP) em sujeitos com lombalgia através de um programa de hidrocinestoterapia enfatizando o alongamento misto em água aquecida a 34°C. Os sujeitos que participaram do estudo foram constituídos por um grupo de 8 policiais militares do estado do Rio de Janeiro, sexo masculino entre 25 a 45 anos. O método utilizado para mensuração da dor foi a escala CR10 de Borg e para análise da HP, o protocolo HPROLI 2h. No tratamento estatístico foi utilizado o teste t pareado para verificar a ocorrência de diferenças significativas na hidroxiprolina e teste de Wilcoxon para a dor. O nível de significância adotado foi de $p < 0,05$. Os resultados demonstraram os valores de HP antes e depois do tratamento ($53,3 \pm 22,6$ e $31,6 \pm 11,3$ mg/d). O teste t de Student apresentou valor t de 3,93 para p de 0,008. O teste de Wilcoxon apresentou Z igual a 2,20 para p igual a 0,03. Conclui-se que o método de alongamento misto utilizado na hidrocinestoterapia, em pacientes com lombalgia, promoveu redução dos níveis de HP e de dor lombar, sugerindo a presença de lesão de tecido conjuntivo através da análise dos níveis da HP na excreção urinária.

Palavras-chave: Lombalgia, hidroxiprolina, hidrocinestoterapia, alongamento, flexionamento.

INTRODUCTION

Spine problems influence on 25% of all of the incapacities for occupational lesion and cause a loss of 1.400 days of work for thousand employees in every year, in the United States (ACHOUR JÚNIOR, 2004). In Brazil, the muscle skeleton illnesses, with prevalence of the illnesses of the spine, are the first cause of sick-payment and the third retirement cause for disability (FERNANDES, 2000).

The causes of pain in the lumbar spine have been obtaining great prominence, in the last decades, for affecting an important portion of the economically active population. Between those illnesses, is the lumbar disc hernia. That pathology, can cause dysfunctions, disability and for possessing socioeconomic aspects, has been subject of countless epidemic studies in workers (GARCIA, 1996).

According to Thomson (2003), due to the complexity of the low back pains, we can etiologically classify as structural and traumatic, inflammatory, neoplasia, visceral reflexes, bone and metabolic illnesses.

We can, also, classify them in agreement with the age at the beginning, in the case of primary or secondary scolioses, osteochondritis dissecans of Scheurmann (in children), espondilosis arthrosis and discal prolapse (between 15-30 years), malignant neoplasias, arthrosis, prolapse discal (between 30-50 years) and in the case of espondilosis arthrosis, osteoporosis, illness of Paget (older of 50 years).

RESUMEN

Hidrocinestoterapia en la reducción del dolor lombar medido a través de los niveles de hidroxiprolina

El objetivo de este estudio fue el de medir los niveles de dolor lombar y excreción de HP en sujetos con lombalgia a través de un programa de hidrocinestoterapia enfatizando el elongación misto en agua aquecida a 34°C, teniendo como muestra 8 individuos de sexo masculino, con edad entre 25 y 45 años, voluntarios, con lombalgia. La pesquisa fue hecha en 10 Centro de fisioterapia y Rehabilitación de la Policía Militar del Rio de Janeiro y la piscina tenía las siguientes medidas e temperatura: 12x6 m, 1,20 de profundidad con a água a 34°C. El método utilizado para la medición de la dolor fue la escala CR10 de Borg y para análisis de la HP, el protocolo HPROLI 2h. Fue utilizado el teste t pareado para verificar la ocurrencia de diferencias significativas en HP y el teste de Wilcoxon para la dolor. El nivel de significancia adoptado fue $p < 0,05$. Los testes utilizados pertenecían al programa STATISTICA 6.0, StatSoft, 1981-2004. Los resultados demostraron la HP antes e depois do tratamento fueram iguales a $53,3 \pm 22,6$ e $31,6 \pm 11,3$ mg/d, respectivamente. El teste t de student muestra valores para t igual a 3,93, para p igual a 0,008 demostrando diferencia significativa ($p < 0,05$) entre HP antes e após a hidrocinestoterapia. La dolor antes e después de la intervención foram iguales a 5 ± 2 e 2 ± 1 , respectivamente. El teste Wilcoxon muestra valor para Z igual a 2,20, para p igual a 0,03 demostrando haber diferencia significativa ($p < 0,05$) entre la dolor antes y después de la intervención. Conclui-se que en la elongación mista utilizada fue verificado reducción de los niveles de HP y de dolor lombar, sugerindo la presencia de lesion de tejido conectivo a través de la análisis de los niveles de la HP en la excreción urinária.

Palabras clave: lombalgia, hidroxiprolina, hidrocinestoterapia, elongación, flexionamiento.

The mechanical and structural aspects are related to the muscle skeleton lesions of the functional units of the low back spine. Each functional unit is formed by two adjacent vertebrae, separate by a intervertebrae disk and soft tissues that surround them. The intervertebrae disk is disposed in four concentric layers. The most external are composed by a dense sheet of collagen, types I and II; in the middle there is a fibro cartilage layer; still exists a transition zone and the pulposus nucleus (HUMPHREYS, 1999). The pulposus nucleus is constituted by proteoglycan, that contains a net of fibers of collagen type II aligned randomly.

The muscular pain is already recognized as one of the factors of the lumbar pain. Its pain mechanism comes for the increase of the activity of the nociceptors of the muscular bellies. Those free nervous ends are located in the arterioles walls and in the muscle conjunctive tissue (CAILLIET, 2001).

Seen the abundance of collagen contained in the structures involved in the low back lesions and possible relationship with pain, the possibility correlation is questioned with the complaints of pain of patients with that diagnosis.

The same author declares that, lately, the pain becomes in a clinical entity and, in general, they recommend all kinds of mechanisms for control, with the objective of justify it. The pain started to be the main complaint in any pathology, being the main objective of the treatment.

In agreement with Borg (2000), the use of a scale can supply valuable additional information for their interpretations and to understand the studied topic. The need of a special scale that could be used for the noticed effort and also for other sensorial perceptions, besides the pain, was taken more and more evident.

Martin et al (2002) infers that happens a consensus in the literature, in what refers to the identification of the levels of collagen related to the biochemical components that are decisive in the regeneration of lesions for the increase of the molecular bioactivity.

The hidroxiprolina (HP) is a present aminoacid in a great part of collagen, constituent of the bone matrix and it not comes from dietetic sources, but of the hydroxylation of the proline during the initial stages of the biosynthesis of collagen and enters in the metabolism during decomposition (STRYER, 1992). Fox (1989) increases that the hidroxiprolina is a fundamental part of the collagen. In that decomposition are formed peptides containing hidroxiprolina, that don't largely suffer hydrolysis and are eliminated in the urine (VERLERG, 1982).

The cartilage is composed by collagen fibers of the types II, IX, X and XI, and it is deformed every time that there is mechanical compression on it. With the insistence of that mechanical force, it can happen the degeneration of the fiber of the collagen, turning irregular the matrix of the cartilage (CAILLIET, 2000).

According to Brown et al (1997), the generation of high force during the eccentric muscular contraction can affect the metabolism of the collagen and the muscular and tendinous structures of conjunctive tissue. The increased resynthesis of collagen can act as an adaptative answer to the muscle and an increased excretion of hidroxiprolina, hidroxilisina and piridinolina in the urine, could indicate the break of the collagen with result of an increased resynthesis.

The author in subject investigated the effect of a serie of 50 voluntary eccentric exercises in the quadriceps, in relation to the indirect indexes of muscle-skeleton lesions and biochemical marks of catabolism of the collagen in the urine, with the hypothesis that both, conjunctive tissue and muscle-skeleton, were used by eccentric exercises.

The hidroxiprolina and hidroxilisina excretions in the urine increased after the exercise, arriving at the apex in the second day, suggesting an increase of the lesion in the conjunctive tissue, possibly linked to a local inflammatory answer. Fox (1989) affirms in their studies that an increase in the urinary excretion of hidroxiprolina indicates damage in the conjunctive tissues, increasing that there is a significant correlation among the day that the levels are higher with the levels of more intense pain told by the individuals.

Inside of a program of physiotherapeutic treatment, besides the concern in reducing the pain picture and in rehabilitating the sequels originating from several pathologies, should not be forget about the need of recovering the flexibility of the tissues involved in the lesions (DANTAS, 2004).

The physiotherapy has several resources for treatment of lombalgia, the eligibility will depend on the patient's clinical picture and of the evaluation accomplished by the physiotherapist. Cailliet (2000) points the hydrotherapy as an effective treatment for the lumbar pain.

The aquatic treatment emphasizes the reduction of the pain and muscular spasm through the warm water, traction in deep water, prolongation and repeated movements until the maximum width that centralizes the lumbar pain and finally its elimination (MACKENZIE, 1990).

Close to the treatment of the pain is necessary to recover the flexibility of the tissues, because sensorial nerves that are inside the soft tissues are, a lot of times, deficient after a lesion or lingering tension (CAILLIET, 2000).

The flexibility is the physical quality responsible for the voluntary execution of a width movement to articulate maxim inside for a joint or group of joints of the morphologic limits, without the risk of provoking lesion (DANTAS, 2003).

The same author affirms that the training of flexibility improves the physical development and it makes possible the impairment of the risk of muscle skeleton lesion. However, the determination of the ideal level of flexibility and intensity of training of the same still a quite controverted theme.

Rosário (2004) affirms that the use of prolongation exercises to increase flexibility is based on the idea that is possible to reduce the incidence, the intensity or the duration of the muscletendinous and joint lesion. However, that statement should not be interpreted as if the flexibility articulates maxim will prevent the lesion.

Dantas (1999) defines with more clarity those two work types, naming the prolongation as sub-maximum work, executed inside the articulate movement limit, without causing discomfort, and denominates as "flexionamento", a maximum work, crossing the limit to articulate already with a subjective sensation of pain. Coming from that concept, it's necessary to differentiate the work forms in function of different intensity levels.

It is possible to verify the levels of HP in the urinary excretion through laboratorial examinations, like this, being considered as a biochemical marker of the formation and reabsorption of bones, the increase of levels of HP in the urine indicates catabolism of collagen on the movement system. Lower levels of HP post-exercises characterize a smaller microlesion degree in the mentioned system. Like this, it is possible to infer that the smallest catabolism of the collagen in the liquid middle can indicate the more insurance method of accomplishing the "flexionamento" (NASCIMENTO, 2004).

OBJECTIVE

The objective of this study was to measure the pain levels and excretion of HP in subject with submitted low back pain to a aquatic therapy program, with emphasis in the prolongation in warm water to 34°C.

METHODOLOGY

Selection of the Subjects

The group that participated in the study was constituted by 8 military policemen of the state of Rio de Janeiro, male, with age between 25 and 45 years, all volunteers, with diagnostic

indication of low back pain and medical direction to the aquatic therapy practice.

The study was accomplished in the Center of Physiatrics and Rehabilitation of the Military police of Rio de Janeiro, whose swimming pool presented the following measures and temperature: 12X6 m, 1.20 m of depth, and water at 34°C.

Hidrocinoterapia

The aquatic therapy program was constituted of ten sessions, divided in two weekly sessions. The following sequence of movements was selected: for the accomplishment of the heating, back marches and bicycle with float in the axillary area; for the exercises of mixed prolongation, escalade in the border, fetal position, prolongation of tibia ischia with feet in the border, prolongation of tibia ischia in position orthostatic and flexing of the body in flotation; and, finally, for relaxation, the patient in supine position.

HP and Pain

The verifications of the levels of HP in the urinary excretion had as base the values normal laboratoriais in adults, larger of 21 the tax of 15-43 mg / d, 114-330 mol / d (WYNGAARDEN; SMITH,

Figure 1 - Level of hp excretion before and after the hydrotherapy treatment

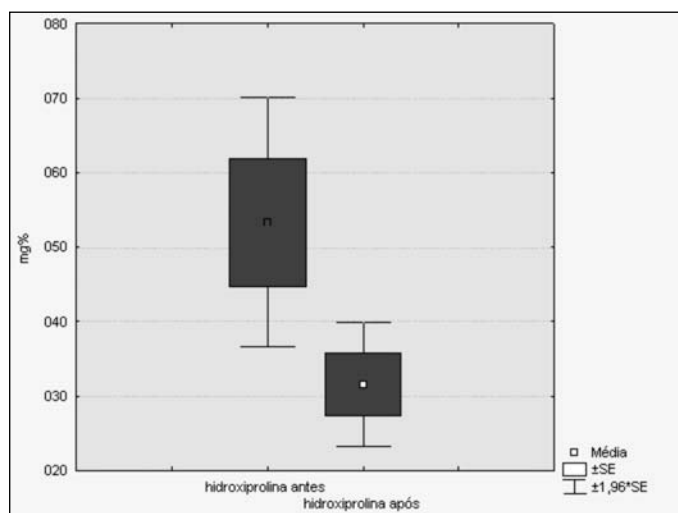
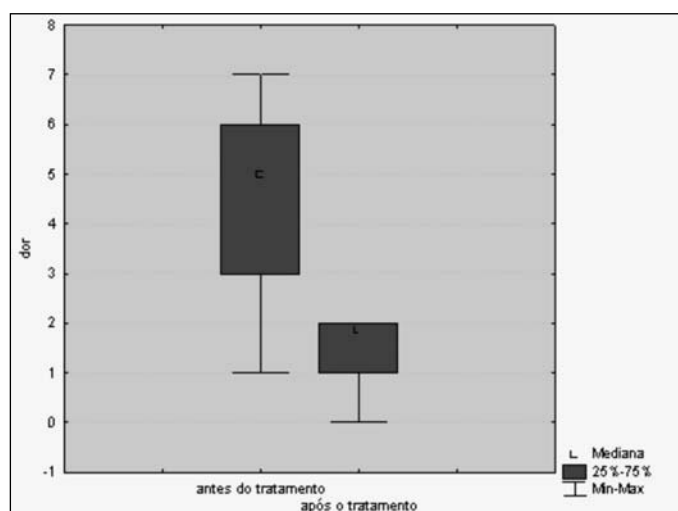


Figure 2 - Pain level before and after the hydrotherapy treatment



1984) and of 07-21 mg of creatinine HP / g through the method of HPROLI 2:00. A pre and a post test were accomplished for verification of the levels of HP. It was also used the verification of the pain levels with CR10 degree of Borg, before and after the aquatic therapy (BORG, 2000).

Statistical treatment

The pair t test was used to verify the occurrence of significant differences in the hidroxiprolina and the test of Wilcoxon to evaluate the pain levels. The level of adopted significancy was of 0.05. The used tests belong to the program STATISTICA 6.0, of StatSoft, 1981-2004.

RESULTS

The hidroxiprolina taxes before and after the treatment were same to 53.3 ± 22.6 and 31.6 ± 11.3 mg / d, respectively. The Student t test of presented value for t equal to 3.93, for p equal to 0.008 (Figure1), demonstrating ignificant difference ($p < 0.05$) among the levels of HP before and after the aquatic therapy.

The pain levels before and after the treatment were the same, 5 ± 2 and 2 ± 1 , respectively. The test of Wilcoxon presented Z equal to 2.20, for p equal to 0.03 (Figure 2), demonstrating significant difference ($p < 0.05$) among the levels of HP before and after the aquatic therapy.

Being observed figures 1 and 2, it's noticed the simultaneous impairment of HP and pain after the aquatic therapy treatment with emphasis in the mixed prolongation(covariancy).

DISCUSSION

This investigation verified the occurrence of significant impairment in the levels of urinary excretion of HP in the submitted subjects to the mixed prolongation in the aquatic way. It was also observed the occurrence of significant impairment of lumbar pain, as it was proven by the decrease of the index of pain of 5 for 2, in the CR-10 scale of Borg. Such data reaffirm studies as, for instance, the one of Blades (1990), that suggests that to unload the spine through immersion in the shallow or deep parts of the swimming pool, together with the sensitive stimulus for the flux along the body and the temperature of water are aspects that can contribute to the reduction of the pain. The muscular suffering is intimately related to the damage in the conjunctive tissues associated to the muscle, in other words, the fasciae of the conjunctive tissue (ALTER, 1999). In agreement with the same author, the investigations of his research reveal a significant positive correlation between the urinary excretion of hidroxiprolina (HP) and the subjective incidence of muscular suffering and the irritation or damage of the conjunctive tissue.

In the results of Nascimento (2004) study there was a significant increase ($p < 0.05$) of the basal levels of HP in the "flexionamento" in soil, could be affirmed that the activities of training in soil contribute to the elevation of risks of microlesions occurrence, once the levels of HP in the urinary excretion come higher, if compared to the "flexionamento" in water. Fits to emphasize that the effect

of the referred microlesions directly linked to the damages of the conjunctive tissue synthesized in the cells, resulting from the high hidroxiprolina concentration.

According to Bates and Hanson (1998), the hydrotherapy has an including therapeutics that uses the aquatic exercises in the rehabilitation of several pathologies. That therapeutics promotes the results of muscular relaxation, relief of pain, reduction of muscular spasm, reduction of gravitational force, increase of the width of movements, it gets better of periferic circulation, and among others, the improvement of moral and self-confidence.

In spite of the liquid ambient provides movements facilitation, mainly for the action of the buoyancy that favors the impairment of the pressure to intra-articulate and of the work of the antigravitational muscles (paravertebrals and isquiotibials), many authors defend the inclusion of aquatic activities as therapeutic measures for the backbone with the objective of invigorate or reinforce of oblique muscles of dorsolumbar and lumbar stabilities, mainly.

The prolongation in warm water can be used in rehabilitation phase of a lesion and in the presence of muscular rigidity, being recommended as a way of contributing in the withdrawal of the muscular reefing (ACHOUR JR., 2004). Koury (2001) affirms that, during the immersion, there is a reduction of the gravitational forces, what increases the mobility for many patients with lesion and lumbar pain.

CONCLUSION

Through the obtained results was possible to verify that the method of mixed prolongation used in the aquatic therapy, in patients with low back pain, promoted reduction of levels of HP and of lumbar pain, suggesting the presence of a lesion of the conjunctive tissue through the analysis of the levels of HP in the urinary excretion.

The development of studies is recommended that relate the concentration of HP and the subjective perception of lumbar pain of several etiologies, as well as the increase of the experimental group and use of other methods that develop the flexibility, such as dynamic "flexionamento", neuroselfperceptivy facilitation (FNP), seeking more relevant verifications in the population context.

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