INTRODUCTION

Rheumatic diseases are the major cause of morbidity and disability in the population, being pointed an increase in the prevalence of musculoskeletal disorders with the age. What takes the implications for the health cares, especially due to the population aging (BADLEY; TENNANT, 1992).

The osteoarthritis is a chronic disease, multifactorial that drives to the progressive functional inability (COIMBRA et al., 2002), with pain presence influencing the functional activities level (VASCONCELOS; DIAS; DIAS, 2006). According to Kafka (2002), the osteoarthritis is produced initially by fissures in the cartilage comes of applied loads in a very fast way.

Patients with osteoarthritis shows deficit of force comparing with healthy people of similar age, and even comparing to the non affected side; being possible that such fact happens due to the reflex inhibition, or to the exercise lack (BAYRAMOGLU; TOPRAK; SOZAY, 2007; SUETTA et al., 2007). Besides, individuals with severe knee osteoarthritis present proprioceptive deficit, when compared with individuals with less severe osteoarthritis (BAYRAMOGLU; TOPRAK; SOZAY, 2007; EMRANI et al., 2006), increase in the sensibility to the heat, pain to the pressure and the cold (KOSEK; ORDEBERG, 2000).

According to Coimbra et al. (2002), the osteoarthritis treatment should look for the functional improvement, mechanics and clinical, tends as base: educational programs, therapeutic exercises, orthesis, physical agents (as the physical therapy resources), drugs and surgical treatments.

A good number of animal models representing human arthritis have been developed in the last years, and the model of chronic arthritis created by into the joint injection of complete Freund adjuvante in rats, it is characterized by chronic inflammation and joint pain (HSIEH, 2006). According to Gomis et al. (2007), in knee arthritis model, the nociceptive answers increases when joint moving due to the inflammation induced locally. For Hsu et al. (2006), among the inflammatory mediators, the IL-20 play important part in the inflammation and angiogenesis generation, besides others like TNF-α, IL-1α, IL-6.

During the inflammatory process, it happens a sequence of events, it which some types of cells prevail and they exercise deep effects in the initial phase (platelets, endothelial cells and neutrophils), and in late phase (macrophages, lymphocytes, fibroblasts), these are involved with the pain production, chemotact, regulation of vascular tone, the repair and neovascularisation (SCOTT et al. 2004).

According to Scott et al. (2004) non-steroidal anti-inflammatory drugs (NSAIDS) have been used, in several forms, for more than 3500 years. To every year about 120 billion aspirin tablets are consumed in the world, and in older people, it contributes to 100.000 hospital admissions and 16.500 deaths each year, due to complications related to the gastrointestinal tract. Several physical modalities are used with the "anti-inflammatory" purpose, even so they are not still totally established.

Among the modalities, does it make an appointment to the low level laser therapy, which presents anti-inflammatory effects, how decrease with the liberation of TNF-α (AIMBIRE et al., 2006); COX-2 (ALBERTINI et al. 2007) and PGE2 (MIZUTANI et al., 2004), besides reduction of inflammatory edema for probable liberation of adrenal hormones (ALBERTINI et al., 2004). Bjordal et al. (2003) tell that the laser is a tool that significantly reduces the pain and it improves the joint chronic disorders; Enwemeka et al. (2004) confirms that the laser is effective in the pain reduction, even so different wavelengths can influence the therapeutic results.

For the reasons exposed above, the need of studies is observed that found the physical modalities use in joint inflammatory frames. Then, the aim of this study went evaluate the effect of the low level laser therapy, 660 nm, in the pain and edema evolution in rats Wistar submitted to the experimental osteoarthritis.

MATERIALS AND METHODS

Animals and Experimental Groups

Female rats Wistar (n=10), with 20 ± 2 weeks of age, obtained in Central vivarium of the State University of the Paraná West - UNIOESTE, Cascavel/PR. The rats were housed in a 12 h light-dark circle, four rats per cage, with free access to standard rat food and water. The experiment was carried according to the ethical precepts defined by the Brazilian School of Animal Experimentation (COBEA) (ANDERSEN et al., 2004). The animals were randomly divided in two groups:

- GS (group sham; n=5) - submitted to the right knee arthritis induction and to the sham treatment;
- GL (group laser; n=5) - submitted to the right knee arthritis induction and irradiated with laser 10 J/cm².

Induction of Arthritic Inflammation

The animals were sedate with inhalation of ethyl ether, later on the trichotomy of the right knee was accomplished. For the arthritis production, 0,1 ml of complete Freund adjuvant (CFA) was used, intra-articular tibio-femoral injections in the right knee.

Test of Functional Inability (Paw Elevation Time)

The test was characterized basically by a metallic cylinder in movement, and a computer software with connection to an adapted metallic boot to the rat paw, described originally by Tonussi and Ferreira (1992).

In this test, rats are placed on a revolving cylinder (30 cm diameter; 3 rpm) for 1-min periods and a computer-assisted device measures the total time that a specific hind paw was not in contact with the cylinder surface, i.e. the paw elevation time (PET). According to Bressan, Cunha and Tonussi (2002), animals that didn't suffer any intervention invasiva, and they don't present march alterations, the PET it is about of 10 s, considering than this value only increases in the affected limb.

The experiment began with the training of the animals on the cylinder, and the following day they were logged the values of PET. Soon after, there was the procedure of induction of the arthritis, happening reevaluations after 10 days of the injection, and finally after the 22nd day of lesion, what corresponded to the 10th day of treatment (interval of two days among 5th and 6th treatment session).

Edema evaluation

To quantify the edema in the experimental lesion area, previous the lesion, the diameter of the right knees was evaluated, with caliper positioned accomplishing the measures in lateral-medial sides (GOULD, et al. 2007; HSIEH, 2006), in the
moments similar to the PET.

**Laser Equipment**

In the 10th day after the arthritis induction, the treatment began using the laser of the DMC® mark, with wavelength of 660 nm, previously calibrated. The treatment happened in a punctual and continuous form, on the medial knee joint, being the animals maintained in thermoplastic-PVC container, originally described by Lirani (2004). The sham group suffered similar procedure, even so with the turned off equipment. The procedure was daily, for 10 days, with pause for two days among 5th and 6th sessions.

**Statistical Analysis**

The data were showed by the descriptive statistics (average, standard deviation) and analyzed within the groups with paired, two-tailed Student’s t-tests. Being accepted the significance level p <0,05.

**RESULTS**

The results obtained in the Paw Elevation Time (PET) evaluation and edema is presented in the table I and II, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Before Lesion</th>
<th>Before Treatment</th>
<th>After 5th treatment</th>
<th>Before 6th treatment</th>
<th>After 10th treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GS</strong></td>
<td>8.87 ± 2.08 s</td>
<td>15.93 ± 1.70 s</td>
<td>14.37 ± 5.41 s</td>
<td>14.35 ± 5.51 s</td>
<td>13.56 ± 2.93 s</td>
</tr>
<tr>
<td><strong>GL</strong></td>
<td>9.35 ± 2.32 s</td>
<td>14.87 ± 1.94 s</td>
<td>10.26 ± 1.09 s</td>
<td>10.59 ± 0.62 s</td>
<td>10.22 ± 0.65 s</td>
</tr>
</tbody>
</table>

For GS, when comparing with the before lesion value, the moment before treatment presented significant increase (p=0,0053) of PET in 79,51%, but for the following moments (after 5th treatment, before 6th treatment and after 10th treatment), there was just increase tendency, respectively of 61,93% (p=0,0658), 61,71% (p=0,0679), and 51,81% (p=0,0716). When comparing the values obtained after the lesion accomplishment, that is to say, in the moment before treatment, with the moment after to 5th therapy, non significant decrease of 9,79% was observed (p=0,4786), comparing with the moment previous to 6th therapy the decrease was not also significant of 9,92% (p=0,4945), and finally when comparing with the end of the treatment period, the decrease was not also significant of 14,88% (p=0,0895).

For GL, when comparing with the value before lesion, the moment before treatment presented significant increase (p=0,0023) of PET in 59,04%, for the following moments there was just light increase, not significant, when comparing with the moment after to 5th therapy (9,73%, p=0,4842), before to 6th therapy (13,26%, p=0,3089), and after the end of the therapies (9,30%, p=0,4245). However, when comparing the values obtained in the moment before treatment with the remaining moments, there was significant decrease in every moment, respectively, after 5th therapy -31,00% (p=0,0093), before 6th therapy -28,78% (p=0,0042), and at the end of the treatment -31,27% (p=0,0038).

**DISCUSSION**

The model of arthritis induction used in the present study, through the adjuvant injection has been used thoroughly to evaluate experimentally the pathophysiology of human rheumatoid arthritis, because of similarities among the two syndromes, being an useful instrument to investigate new analgesic and anti-inflammatory drugs. In this model, the articular hyperalgesia (p=0,0018), and at the end of the treatment -15,72% (p=0,0081).

Such fact agree with Laakso and Cabot (2005), that they evaluated the pain due to inflammatory process in rats paw, submitted the treatment with 780 nm laser, with doses of 1 and 2.5 J/cm². They observed dependent dose effect, and 1 J/cm² didn’t produce any effect, but, 2.5 J/cm² decreased the pressure pain threshold. For Castano et al. (2007), that they evaluated the
use of 810 nm laser different doses and irradiances, on rats with knee arthritis induced, they tell that the irradiation time is an important factor for the anti-inflammatory effects of the laser therapy, as edema reduction and levels of PGE, decrease.

The low level laser therapy is it shown useful in the mucopolysaccharide induction, in osteoarthritis experimental model, which are responsible for to maintain the fibers of collagen united and to assure the cartilage integrity. This form the laser increasing the articular cartilage biosynthesis, it results in improvement of the histopathologic alterations (LIN; HUANG; CHAI, 2006), the laser also increases the shock proteins amount and this form it protects the articular cartilage (LIN et al., 2004).

Campana et al. (2004) they evaluated the effects of the laser on plasma fibrinogen in the rats with arthritis induced by urato crystals. They treated with HeNe (6 mW), 8 J/cm², for 3 consecutive days. They tell that the laser presented effect anti-inflammatory in the arthritis induced, determined by the fibrinogen levels and for the histological evaluation.

Albertini et al. (2004) they evaluated the alteration in the acute inflammatory edema, after carragenina subplantar injection in rats paws, and they observed that irradiating the 650 nm laser, in the doses of 1 and 2.5 J/cm² reduced the edema, 27% (p<0.05) and 45.4% (p<0.01), respectively, and the dose of 2.5 Jcm² produced similar anti-inflammatory effects those produced by diclofenaco in the dose of 1 mg/kg. However, in adrenalecromed rats, the irradiation didn't inhibit the edema, suggesting that the laser is not a good anti-inflammatory agent for stimulating the release of adrenal corticosteroid hormones.

In the present study the edema evolution, it was altered by the laser therapy presence, because for the sham group the edema was produced, and it presented significant variation with relationship at the levels evaluated before lesion, for the moments before 6th therapy and after 10 therapy, and when comparing with the moment after lesion, in none of the following evaluations it happened significant decrease. In the treated group, the edema evolution showed that after the lesion accomplishment (before therapy) in any following moment there was significant increase when comparing with the values before lesion, and when it was compared the moment after lesion, the following evaluations showed significant decrease of the found values.

CONCLUSION
This form, it is pointed out that the low level laser therapy presented pain and edema effects, with significant decrease of the same ones in arthritic rats.

REFERENCES


ÉVALUATION DE LA DOULEUR ET OEDÈME DANS SOURIS SOUMIS À ARTHRITE EXPÉRIMENTALE QU'IL EST TRAITÉ AVEC LE LASER DE BASSE PUISSANCE

RÉSUMÉ
L'arthrite prend à l'incapacité progressive et douleur. Il a été eu l'intention à d'évaluer l'effet du laser de basse puissance, 660 nm, dans la douleur et évolution de l'oedème dans les souris Wistar a soumis à l'ostéoarthrite expérimentale. Il est séparé 10 souris viriles, avec 12±2 semaines d'âge, dans deux groupes: GP - arthrite provoquée et traitement du placebo; GL - arthrite provoquée et irradiée avec laser 10 J/cm². L'arthrite a été induite en injectant 0,1 ml d'Adjuvant Complet de Freund dans l'espace articulaire tibio - femoral du genou droit. La douleur a été évaluée par le Temps d'Élévation de la Patte (TEP), quand l'animal marche pour une minute dans un cylindre métallique, à des moments comparables à PET. Traitement au laser a été commencé dans la 10ème jour après l'induction de l'arthrite. La procédure était journalière, pour 10 jours, des intervalles de deux jours entre les 5ème et 6ème sessions. Les résultats ont montré que pour PET à GS a été significative augmentation après l'arthrite, avec un tendance à l'augmentation continue, sans diminution significative en comparaison post-injury avec les moments suivants, à GL il y avait une augmentation dans la post-injury, qui a diminué significativement dans les périodes suivantes. Pour l'arthrite, GS a présenté un effet significatif au cours de la récupération, mais pour GL l'arthrite était aussi présent, mais il n'y avait pas une réduction significative. Nous avons conclu que le laser produit des effets sur la douleur et l'oedème, avec une diminution progressive dans les moments suivants.

MOTS-CLEF: laser de basse puissance, oedème, douleur.
RESUMEN:
La osteoartritis es una enfermedad crónica, multifactorial que conduce a la incapacidad funcional progresiva, con presencia del dolor influyendo el nivel de las actividades funcionales. El objetivo de este estudio fue evaluar el efecto del laser, 660 nm, en el dolor y evolución del edema en ratones, sujetos al osteoartritis experimentales. Fueron usados 10 ratones hembras, divididas en dos grupos: GS - sujeto a la inducción del artritis en la rodilla derecha y al tratamiento placebo. GL - sujeto a la inducción del artritis en la rodilla derecha y irradiado con laser 10 J/cm². Para la inducción del artritis fue inyectado 0,1ml del Adjuvante Completo de Freund en el espacio articulartíbio-femoral derecha. La evaluación del dolor ocurrió por medio del Tiempo de Elevación de la Pata (TEP), cuando el animal caminaba por 1 minuto en un cilindro metálico en movimiento, en los momentos prelesión, después de 10 días de la inyección, después de la 5ª terapia, previo a la 6ª terapia y al final de la 10ª terapia. La evaluación del edema fue realizada con paquímetro metálico posicionado lateralmente a la articulación de la rodilla, en los momentos semejantes al TEP. El tratamiento con laser empezó en el 10º día después la inducción del artritis, por la interlinea articular medial. El procedimiento fue diario, por 10 días, alternado por dos días entre la 5ª y 6ª sesiones. Los resultados para TEP mostraron que para GS hubo aumento significativo del tiempo después de la lesión, con tendencia del aumento en los tiempos subiguientes, sin desminución significativa al confrontar los valores pós-lesión con los momentos subiguientes, para GL hubo el aumento en el período pos-lesión el cual disminuyó significativamente en los períodos subiguientes. Para el edema, GS presentó significativo aumento del mismo, el cual no disminuyó; en GL el edema también fue presente, pero hubo reducción significativa del mismo. Se concluye que el laser presentó efectos sobre el dolor y edema, con desminución significativa de los mismos.

PALABRAS CLAVE: laser de baja potencia, edema, dolor.

RESUMO:
A osteoartrite é uma doença crônica, multifatorial que conduz à incapacidade funcional progresiva, com presença de dor influenciando o nível das atividades funcionais. O objetivo deste estudo foi avaliar o efeito do laser, 660 nm, na dor e evolução do edema em ratos submetidos à osteoartrite experimental. Foram utilizados 10 ratas fêmeas, divididas em dois grupos: GS - indução de artrite em joelho direito e tratamento placebo; GL - indução de artrite em joelho direito e irradiado com laser 10 J/cm². Para a indução da artrite foi injetado 0,1 ml de Adjuvante Completo de Freund no espaço articular tibio-femoral direito. A avaliação da dor ocorreu através do Tempo de Elevação da Pata (TEP), quando o animal caminhava durante 1 minuto em um cilindro metálico em movimento, nos momentos pré-lesão, após 10 dias da injeção, após 5ª terapia, previo a 6ª terapia e ao final da 10ª terapia. A avaliação do edema foi realizada com paquímetro metálico médio-lateralmente à articulação do joelho, nos momentos semelhantes ao TEP. O tratamento com laser iniciou no 10º dia após a indução de artrite sobre a interlinha articular medial. O procedimento foi diário, por 10 dias, intervalado por dois dias entre a 5ª e 6ª sessões. Os resultados para TEP mostraram que para GS houve aumento significativo do tempo após a lesão, com tendência de aumento nos tempos subiguientes, sem diminuição significativa ao comparar os valores pós-lesão com os momentos subiguientes, para GL houve aumento no período pós-lesão, o qual diminuiu significativamente nos períodos subiguientes. Para o edema, GS apresentou aparecimento significativo do mesmo, o qual não diminuiu; em GL o edema também foi presente, mas houve redução significativa do mesmo. Conclui-se que o laser apresentou efeitos sobre a dor e edema, com diminuição significativa dos mesmos.

PALAVRAS-CHAVE: laser de baixa potência, edema, dor.