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Case Report

# Ultrasound conjugated with Laser Therapy in treatment of osteoarthritis: A case study

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## Abstract

Osteoarthritis of the hand is a chronic condition that involves hand joints, but receives less attention. Few studies have investigated the use of ultrasound therapy and laser therapy for the treatment of hand osteoarthritis. The objective was to evaluate the effect of the conjugated treatment of therapeutic ultrasound and laser therapy on the pain and joint function of a patient with hand osteoarthritis. The is case of a woman, 57 years old, with a diagnosis of osteoarthritis on hand for 3 years, presenting constant pain and worsening after manual activities. The pain and function were evaluated, respectively, by Visual Analog Scale (VAS) and Australian Canadian Osteoarthritis Hand Index questionnaire (AUSCAN). After 12 sessions using ultrasound and laser therapy application, there was an expressive improvement in the pain and functional indexes of the patient. The combined application of therapeutic ultrasound and laser therapy, through the unified field action of the therapies used, proved to be efficient in reducing pain and improving the functionality.

## Introduction

Osteoarthritis (OA) of the hand is a chronic condition that involves one or more joints of the hand associated with pain, joint limitation, loss of strength, swelling and functional disability in daily activities. There is an estimate that reaches about 26% of people, mostly women [1,2].

According to the European League Against Rheumatism (EULAR), the treatment for osteoarthritis of the hand include medicines, exercise, use of orthoses, electrotherapy, thermotherapy, massage and acupuncture for improvement of symptoms. However, laser therapy and ultrasound therapy are poorly used, although they have great therapeutic potential [1-3]. Laser therapy is known as a photobiomodulator which has been used as a non-invasive treatment in osteoarthritis for pain relief. The studies are based on the anti-inflammatory effect of light as an explanation for the improvement of pain [1,2,4].

In addition to laser therapy, other studies show the benefits of ultrasound (US) in improving pain and function of pathologies such as carpal tunnel syndrome. However, there are few studies in patients with hand osteoarthrosis [5,6]. In this context, the use of technology as therapy proves to be an excellent treatment option, due to the need to decrease medication intake.



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The aim of this brief report is to illustrate the effect of a combined therapeutic ultrasound and laser therapy treatment for symptomatic hand osteoarthritis (OA). Besides, the prototype of equipment was specially developed to promote the conjugated application (US and Laser), which can become a differential in treatment.

## Case Report

A woman at 57 years old, Caucasian, was admitted to our Unit of Photodynamic Therapy of Santa Casa de São Carlos, São Paulo, Brazil, complaining of constant pain in the right hand with diagnosis of hand osteoarthritis for 3 years. In the initial evaluation she presented constant pain in the hand with worsening in the manual activities, like piano, in addition to local heat and morning stiffness.

We collected information about her health status, including age, time frame of osteoarthritis diagnosis, comorbidities, and log of medication. We analyzed some important outcome variables, e.g. pain and physical function, which were assessed by a visual analogue scale (VAS) and Australian Canadian Osteoarthritis Hand Index (AUSCAN), performed before and after the treatment. The function was evaluated through the block test performed in 1 minute.

### Equipment and Intervention

It was used a prototype developed by Laboratory of Technological Support of the Institute of Physics of São Carlos, University of São Paulo (USP). This specific equipment promotes the conjugated therapy between ultrasound and laser therapy, allowing the action of therapeutic field overlap with laser and ultrasound (Figure 1). The combined therapy was applied to both hands, 2 times per week, during 12 sessions. The application protocol was performed in the palmar region of the patient's hand. The probe was kept in circular constant movements (angle of 90° with the skin surface). It was used gel and total contact in order to ensure an optimal energy delivery. The time of application was 12 minutes for each hand [7,8].

## Results and Discussion

Considering the evidences presented in relation to ultrasound and laser therapy as non-pharmacological forms of treatment, this case study points to an expressive improvement in pain and function indexes in a patient with osteoarthritis in hand after treatment with innovative equipment that conjugates the application of therapeutic ultrasound with laser therapy, generating field overlap. Table 1 shows the data computed in the initial and final phases of the treatment. It is possible to observe an expressive improvement in the pain index evaluated by both the VAS and the AUSCAN questionnaire.

| Ultrasound Parameters | | Laser therapy Parameters | |
|---|---|---|---|
| potency | 100 Hz | wavelength | 808 nm |
| mode | pulsed | power | 100mW |
| frequency | 1 MHz | time | 12 min each hand |
| duty cycle | 50% | | |
| SATA | 0.5 w/cm$^2$ | | |

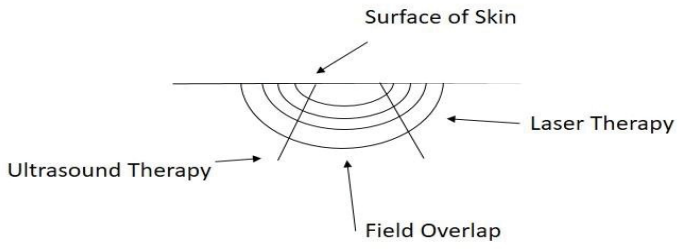



**Figure 1:** Design of field overlap with Ultrasound Therapy an Laser Therapy in conjugated treatment.

**Table 1:** Initial and Final data of variables of Visual Analogue Scale (VAS), Australian Canadian Osteoarthritis Hand Index (AUSCAN).

| Outcomes | Initial | Final | Δ |
|---|---|---|---|
| VAS | | | |
| Pain | 9.8 | 1.2 | -716.6 |
| AUSCAN | | | |
| Pain | 10 | 3 | -233 |
| Joint Stiffness | 1 | 0 | 0 |
| Daily Living Activity | 3 | 3 | 0 |
| Total | 14 | 6 | -133.3 |

**AUSCAN-**Australian Canadian Osteoarthritis Hand Index; VAS-Visual Analogue Scale.

There are few evidences found in the literature using these therapeutic modalities in hand osteoarthritis. Studies have shown the efficacy of therapeutic ultrasound in individuals with knee osteoarthritis by up to 21% in pain improvement using the device in pulsed mode and low intensity [9,10]. Another non-invasive therapeutical modality that has been used for several years in the control of pain is laser therapy. Its anti-inflammatory effect is pointed out in several studies [1,11,12]. However, in this case study where the therapy used was conjugated, VAS presented a percentage decrease of -716.66% in relation to pain perception. The Auscan questionnaire presented a significant decrease for pain quantification of -233.33% (Table 1). These results are corroborated by recent studies published by our group, which points out a great improvement in pain questionnaires for knee and hand osteoarthritis [7,8]. In addition to such significance, there was a return to the activity of playing the piano, without any sign of pain or limitation. In this way, our results corroborate the results of singular treatments found in the literature [7,8]. However, the results obtained make this model of equipment and therapy potentially used more beneficial for the treatment of osteoarthritis.

## Conclusion

This case shows the effectiveness of the conjugated therapy with ultrasound and laser therapy. The results shown apoint that the technological treatment of hand osteoarthritis is efficient, being able to discard options of pharmacological and invasive treatment. In this way, the use of new technologies through the efficiency of field overlap in this equipment, as well as a new methodology in the treatment of osteoarthritis, are more viable to better the life quality.

### Ethical Approval

The study was approved by the Hospital Ethical Committe (resolução 466/2012).

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