

Long Term Follow Up Of Low-Level Laser Therapy (LLLT) For Bilateral Hip Avascular Necrosis In Patients With Systemic Lupus Erythematosus

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Abstract

Objective: The current study evaluates whether the addition of low-level laser therapy (LLLT) into standard conventional physical therapy in patients with

bilateral hip avascular necrosis can successfully postpone the need for hip joint replacement surgery in Systemic Lupus Erythematosus patients

Methods: A prospective cohort study of a patient cohort of 30 consecutive unselected patients with systemic lupus having bilateral hip avascular

necrosis caused by chronic steroid usage belonging to Ficat's stages 3 and 4. The bilateral symptomatic hips of the patients were treated with either one of two conservative treatment protocols. Protocol A consisted of conventional physical therapy, Protocol B consisted of Protocol A with the addition of LLLT. The mean follow up was five years. Failure of conservative treatment was defined as break-through pain which necessitated operative intervention, and degree of pain was monitored and measured by Visual Analogue Scale (VAS)

Results: Upon completion of the study, among the 60 painful hips that were treated with either Protocol A or Protocol B; 20 hips among the 30 painful hips treated by Protocol A required joint replacement, whereas 2 hips among the 30 treated with Protocol B needed joint replacement surgery, the difference reached statistical significance ($p < 0.05$) by Chi Square testing

Conclusion: We conclude that low-level laser therapy is effective in postponing the need for hip joint replacement in hip avascular necrosis caused by chronic steroid usage in this group of young female patients suffering from systemic lupus.

INTRODUCTION

Hip avascular necrosis is a common indication or reason for total hip replacement to be done in younger subjects even in their thirties or forties, clinicians and patients alike however frequently sought to find ways to postpone this major operation for as long as possible since the longevity of total hips is usually only in the range of ten to fifteen years, especially for younger age groups.

Despite the fact that in recent years, low-level laser therapy was reported to be useful in managing the pain in hip and knee arthritis, there is no literature on its use in hip avascular necrosis, not to mention its long-term clinical efficacy.

The rationale behind the current study lies not only in the fact that previous clinical studies confirmed anti-inflammatory and bio-modulation effects of low-level laser therapy (LLLT), but also LLLT has the potential to improve the vascularity of the treated body part, in this case the femoral head of the hip.

As far as conservative treatment for managing the hip pain arising from hip avascular necrosis is concerned, most clinicians employ the use of non-steroidal anti-inflammatory medications, and conventional physical therapy consisting of ultrasonic therapy, trans-cutaneous electrical therapy, and short wave therapy. These forms of conservative treatment modalities represent symptomatic treatment with short-term

clinical effects.

This represents the first study to investigate whether LLLT can be an effective conservative treatment modality in managing the hip pain from avascular necrosis to the extent that total hip replacements can be postponed to a more advanced age.

MATERIALS AND METHODS

The study population consisted of a series of consecutive unselected 30 patients with a mean age of 39 (range 35 to 43) with documented radiographic and magnetic resonance imaging studies confirming the existence of bilateral Ficat's grade 3 or 4 hip avascular necrosis. Exclusion criteria included previous history of hip joint surgery, history of sepsis in the affected joint, and patients having leg length discrepancy. Patients with significant (> 2 cm) leg length discrepancy were excluded as it may potentially lead to unequal joint loading with the long leg receiving more loading during gait. Patients having early Ficat stages 1 and 2 were excluded as it will take a very long follow up to assess the efficacy of any treatment modality in this case LLLT in postponing hip replacement surgery. The study lasted from 2008 to the end of 2014.

The study represented a prospective randomized cohort study where either one of the painful hips was being assigned at random to receive either Protocol A or Protocol B by the drawing of envelopes by the patient. Protocol A consisted of standard physical therapy machines including ultrasound, trans-cutaneous electrical stimulation, short-wave diathermy. Protocol B consisted of Protocol A with the addition of LLLT. In this study, the LLLT employed 810 nm wavelength lasers emitting from GaAIAs semi-conductor laser device, with 5.4 J per point, power density $50\text{mW}/\text{cm}^2$ given three times a week for 12 weeks; sham light source was not administered for hips receiving Protocol A as the idea was refused by patients. Each subject was clinically examined and followed up by the same clinician to minimize the inter-observer error. All the physical therapy treatments as well as the LLLT were also performed by the same clinician. During the initial visit, care was taken to document the affected hips range of motion, the sites of tenderness, and the presence of and extent of leg length discrepancy, as we excluded patients with leg length discrepancy from this study. We employed the well-known and validated Harris Hip Score⁴ to assess the level of hip function in the initial and all subsequent follow up in the ensuing years. In this study, the patient acted as her own control.

RESULTS

The mean age of the patient population was relatively young as many systemic lupus patients present at a relatively young age, all subjects in this study population were females. The study period lasted from 2007 to 2014. Upon entry to the study, if the subject had their last magnetic resonance imaging more than one year ago, a new set of imaging was repeated to ensure there was no newer undetected pathologies which may affect the result of treatment. Data distribution was tested with the Kolmogorov-Smirnov test which in the current study was normally distributed, the data described therefore included the mean rather than the median.

All 30 subjects in the study population completed the treatment regimen with good compliance, there was no defaults. In total 60 painful hip joints were being treated by either Protocol A or B, the number of painful hips receiving Protocol A as well as B were the same. No side effects nor any patient discomforts was documented during all treatments. Any pain flare-ups during the five year mean follow up was treated by LLLT and physical therapy mentioned for Protocol B; and physical therapy machines alone for hips treated by Protocol A. Failure is defined as break-through pain intolerable to the patient which necessitated joint replacement surgery. Harris hip score was used to monitor the hip function over the years with clinical follow up every 2 months. The mean Harris hip score on entry to the study for the 30 hips treated by Protocol A was 67 (range 65 to 69). The mean Harris hip score on entry to the study for the 30 hips treated by Protocol B was 65 (range 63 to 67). At the end of a mean follow up of 5 years (range 4.5 to 5.5 years), 20 painful hips among Protocol A had intolerable pain and underwent hip joint replacement, the mean Harris hip score for the remaining 10 hips not requiring hip replacement was 75 (range 73 to 77). In addition, the VAS (Visual Analogue Scale) was used to monitor the level of pain over the years of clinical follow up.

On the other hand, for the 30 painful hips treated by Protocol B, at the end of a mean follow up of 5 years, only 2 hips were so painful that joint replacement was required, the mean Harris hip score of the remaining 28 hips was 71 (range 69 to 73), and the difference in the proportion of hips in the two groups with respect to the need of total joint replacement reached statistical significance ($p > 0.05$) on analysis using the Chi Square test. The mean clinical follow up of this cohort was five years, a reasonably long follow-up

is required to reveal whether addition of LLLT to standard conservative treatment protocol can have a chance to affect the natural course of the disease with a view to postponing the need for joint replacement.

DISCUSSION

The importance of rehabilitation of the hip pain in patients with steroid induced avascular necrosis which are sadly mostly bilateral lies in the fact that the not infrequent bilateral hip involvement in these systemic lupus patients markedly affects the activities of daily living and can be very incapacitating. However, the surgical option of total hip replacement may not be the first choice as these patients are not uncommonly too young for total hip replacements. Traditional methods of physical therapy treatments only afford short-term transient pain relief and does not have bio-modulation effects and anti-inflammatory effects offered by low-level laser therapy (LLLT).

Although there exists abundant literature concerning the positive clinical effects of LLLT in various arthritic conditions; this represents the first study to assess whether LLLT may have any clinical efficacy in controlling hip pain related to steroid-induced hip avascular necrosis, to the extent that total hip replacement can be postponed to a later date and act as a buy time procedure

The results of the clinical study showed very clearly that much fewer painful hips affected by avascular necrosis treated by LLLT in Protocol B require total hip replacement as opposed to similar painful hips on the contralateral side of the same patient that only receive conventional physical therapy only in Protocol A treated hips. Analysis by Chi Square testing underlined the difference reached statistical significance and is expected to have clinical significance in our attempt to use LLLT as a buy time procedure to postpone total hip replacement in this group of young patients

The current study is not double blind as the majority of subjects declined the idea of sham injections and therefore no formal placebo group can be obtained. The use of

envelopes to assign interventions in randomised trials is not robust and is open to bias. This as well as clinic follow up and assessment by a single orthopaedic surgeon is subject to bias and we acknowledge are weaknesses on the current study, and is recognized as such.

CONCLUSION

The current prospective study of a patient cohort of 30 patients with documented bilateral Ficat's grade 3 or 4 hip avascular necrosis showed positive clinical result in terms of reduced likelihood of hip joint replacement at a mean follow up of 5 years, relative to conservative clinical regimes that involve solely the use of standard conventional physical therapy machinery.

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