APPENDIX – G

NOC FROM THE INSTITUTE
श्री भीरज साम्य,
लेखक—फिजिओलॉजिस्टी,
इंस्टीट्यूट ऑफ एलाइंड ईल्यो फार्मेजिकल,
राजकीय मेडिकल कॉलेज,
हल्द्वानी (कैरीफला)।

कृपया आपके प्रार्थना-पत्र दिनांक 13/06/2011 के ब्रां में, अवगत करा है कि
आपके NIMS, University, Jaipur से पी.डी. करने की अनुमति दिन शर्तों के
अर्थन ही जाती है:-

- शोध कार्य अर्थन ने, राजकीय मेडिकल कॉलेज, हल्द्वानी द्वारा सीपे गये दायित्वों
  के निर्धारण के कोई प्रतिकूल प्रभाव न पहुँचे।
- शोध कार्य हेतु सामान्य देय अवकाश का अतिरिक्त कोई अन्य अवकाश देय नहीं
  होगा।
- शोध हेतु, राजकीय मेडिकल कॉलेज, हल्द्वानी द्वारा कोई आर्थिक सहायता/भत्ता देय
  नहीं होगा।
- शोध कार्य की एक प्रति राजकीय मेडिकल कॉलेज, हल्द्वानी को नि:शुल्क उपलब्ध
  करानी होगी।

प्रार्थना:
राजकीय मेडिकल कॉलेज,
हल्द्वानी (कैरीफला)।

प्रार्थना:
राजकीय मेडिकल कॉलेज,
हल्द्वानी (कैरीफला)।
APPENDIX – H

ETHICAL CLEARANCE FROM THE UNIVERSITY
OFFICE OF THE REGISTRAR

Ref. NIMSUR/Reg./Ph.D./2009/024

Dated: 03.07.2012

To,
Mr. Dheeraj Lamba
S/o. Sh. Ramesh Lamba
Lakkar Bazar, Solan- 173212 (H.P.)
Mob. No. 09897390494

File No. 024/024

SUB: Approval of Synopsis.

Dear Ph.D. Student,

The Committee for Advanced Studies and Research NIMS University, Jaipur, has approved the synopsis submitted by you entitled "To Study the Characteristics and Efficacy of 820 nm GaAlAs Diode Laser for the Treatment of Plantar Fascitis among Porters/ Coolies in Kumaun Region, India: A Randomized Clinical Trial" in the subject of Physiotherapy. You are required to submit periodical progress reports (six monthly) in the month of Dec. and June every year.

Please note that:

1. According to guidelines, two soft copies are required to be submitted additionally to four hard copies for the UGC archives.
2. It may be pointed out that before submission of thesis one research paper is required to be published in an Indexed/National Society Journal which should bear the name of candidate and guide and the name of department/institute with the name of Nims University. The Journal should not be an online Journal.
3. Quote your File No. 024/024 in all future correspondence.
4. For any query or help, please contact Mob.No. 09784778000 between 2:00 PM to 5:00 PM.
5. Always keep updating your correspondence address and contact number in our record regularly.

Registrar

Copy to:

1. Student Guide
2. Co-Guide

Campus Address:
NIMS UNIVERSITY
Shobha Nagar, Delhi Highway
Jaipur-303121 (Rajasthan)

Phones: (01426) 5131-09/20/06/02
Fax: (0141) 2605050, (01426) 231635
Email: info@nimsuniversity.org
Website: www.nimsuniversity.org
APPENDIX – I

NOC FROM THE CO-SUPERVISOR
फर्मलिय, अधिश रोग विभाग
सरकारी मेडिकल कॉलेज, हाईबी, एवं सम्बन्धित अन्य युवराज्य विभाग स्वास्थ्य, हल्द्वानी (पूर्वी)
पूर्वी राष्ट्र-प्रमोद, एक्स 05946-234104, 234397  Ext 2306, 2346  पता- 05946-235077

पत्रकक्ष : 98/22/तीसरा, अधिश रोग विभाग

सा.सा.सा.
ि
श्री बौद्धि सिद्धी,  
श्रीमान श्रीमान विधिवत्ति विधिवत्ति  
राजस्थान राजस्थान, राजस्थान  
हल्द्वानी (पूर्वी)।

प्रेमक: को गाइड/ सूपरवाइजर के सम्बन्ध में।

उपरोक्त प्रेमक विषय में कम में आयात करना है वास्तव प्रमित दिनांक 13/07/12 के कम में आपके पीकरएडी  
७० हेतु को गाइड/ सूपरवाइजर की आयात करता है एवं विषय हेतु आपको एक्स और एक्स गुणधर्मित के जमा  
करने हेतु मेरे डाकपोस्ट की आवश्यकता है। इस सम्बन्ध में आपको गाइड बनने एवं दीर्घसमय की समस्याओं के लिए  
हेतु कोई अपहरण नहीं है।

संबन्ध: अधिश रोग की प्रमुखता।

(आपसी प्रतीक चिह्न)
एसोड प्रमोद एवं प्रमोद अधिश रोग विभाग,  
राजस्थान राजस्थान कॉलेज,  
हल्द्वानी (पूर्वी)।
Dr. Premnath Singh  
Assistant Prof. Orthopaedics  
Government Medical College  
हल्द्वानी (पूर्वी)।
APPENDIX – J

NOC FROM THE DEPARTMENT
विषय:- पीएम एवं डीएच रिपोर्ट के अनुसार से सम्बन्ध में ।

1. उपरोक्त विषय के बारे में आपको अवगत कराना है कि आपके पत्र दिनांक 16/07/12 के बारे में आपको पीएम एवं डीएच के सम्बन्ध में जोरदार नोटिफिकेशन में बहुतों को उपचार देने हेतु कोई आपत्ति नहीं है।

2. आपको द्वारा अवगत किया जा सकता कि बहुतों को उपचार देने हेतु लेखन अधीन के इलेवेंसल में कोई आपत्ति नहीं है।

(अपेक्षित शिक्षक)

पीएम एवं डीएच अर्थशास्त्र विभाग,
राजस्थान मेडिकल कॉलेज,
हल्दवानी (नवदीला)

Dr. Poonka Singh
Associate Prof. Orthopaedics
Government Medical College
HALDWANI (Nainital)
APPENDIX – K

RESEARCH PAPER PUBLISHED IN THE INDEXED JOURNAL
To Study the Characteristics and efficacy of 820 Nm GA-Al-As Diode Laser for the Treatment of Plantar Fasciitis among Porters/Coolies in Kumaun Region, India: A Randomized Clinical Trial

Dheeraj Lamba¹, Mukesh Tiwari², Pankaj Singh³
¹PhD Scholar, ²Research Supervisor, Professor, Dept of Orthopaedics, NIMS Medical College, NIMS University, Shobha Nagar, Jaipur, Rajasthan, ³Co-Supervisor, Professor Dept of Orthopaedics, Govt. Medical College & ST Hospital, Haldwani, Uttarakhand, India

ABSTRACT

Introduction: Plantar fasciitis (PF) is a common pathological condition affecting the hind foot and was first described by Wood in 1812, it was attributed to tuberculosis. By definition PF is an inflammation of the plantar fascia.

Objective: To investigate the effectiveness of 820 nm Ga-Al-As diode laser in the treatment of plantar fasciitis & to establish the status of diode laser as a popular modality for the treatment of plantar fasciitis where work exposure is a causative factor.

Method: Eighty (80) subjects were selected on the basis of the inclusion and exclusion criteria and were recruited randomly to either 820nm Ga-Al-As diode laser (experimental group) or dummy irradiation (placebo group).

Result: Overall results showed significant difference in VAS, FFI and DF from 0 week to 4th week in Group A indicating that the rate of improvement in Group A was more than Group B. Hence concluding the positive contribution of therapeutic modality for pain relief, increasing functional ability and increasing ROM (DF) whereas no difference was seen in (PF) ROM.

Conclusion: The present study finds that LLLT using Ga-Al-As diode laser at the parameters shown is a safe and effective treatment method for the patients having plantar fasciitis.

Keywords: (PF) Plantar fasciitis, LLLT (Low Level Laser Therapy), Ga-As-Al (Gallium Aluminum Arsenide), (FFI) Foot Function Index, (VAS) Visual Analogue Scale

INTRODUCTION

Plantar fasciitis (PF) is a common pathological condition affecting the hind foot and was first described by Wood in 1812 and he attributed it to tuberculosis.² By definition PF is an inflammation of the plantar fascia. PF is found at almost every age in both sexes and in many occupations.² The peak age of incidence in general population is between 40 and 60 years.¹

| Corresponding author: Dheeraj Lamba J-8, Type-IV, Govt Medical College Haldwani-263139 Mob - 09897390494 |

<table>
<thead>
<tr>
<th>Table No 1: Perpetuating factors.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrinsic Factors</strong></td>
</tr>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Psoriasis</td>
</tr>
<tr>
<td>Charcot foot</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Elevated Body Mass Index (BMI)</td>
</tr>
<tr>
<td>Reduced ankle dorsiflexion</td>
</tr>
</tbody>
</table>

There are a number of causes for the occurrence of plantar fasciitis, work exposure is one among them.² ³ ⁴ The practice of carrying heavy loads, weighing 50 to 100 kg is very common in India. Coolies carry loads,
transporting them from one place or vehicle to another. In India no research article or report investigating the status of health among the coolies at the workplace is available, and very few studies have been performed in occupational groups about the prevalence of musculoskeletal symptoms or complaints. The present study is designed and carried out to find out the prevalence of plantar fasciitis in a sample of coolies.

Geographically Kumaon Region of Uttarakhand in India has hilly areas and plain area, this difference in geography plays a vital role in the biological traits. Hiroyuki Tanaka et al in their study on the bone metabolism in high mountaineering found that low barometric pressure and low oxygen tension, is probably responsible for the bone atrophy at high altitude. At high altitude physical work capacity and performance are reduced. High altitude induction affects aerobic fitness directly by reducing in PO2 in the lungs that compromises oxygen tension and percent saturation of oxygen in arterial blood. The initial handicap of reduced oxygen availability is met by increased oxygen delivery through a greater amount of blood volume circulated by increased heart rate. With acclimatization arterial oxygen content is increased to sea level value while VO2 max remains reduced.11

Kumaon Region of Uttarakhand, India is similar in its geography and terrain like other high altitudes of the world so the present study becomes much more relevant to address the musculoskeletal problem (Plantar Fasciitis) among the Porters/ Coolies and evaluate the efficacy and features of low level laser therapy (LLLT) for its treatment.

LLLT has been defined as treatment with dose rate that cause no immediate detectable temperature rise in the treated tissue and no macroscopically visible change in tissue structure. LLLT was introduced in clinical randomized controlled trial on musculoskeletal pain as early as in 1980 but the equipment, experimentation design, and technique used in low-energy laser literature are highly variable, and close attention should be paid to therapy parameters when reviewing and comparing these studies. Still the efficacy of this therapy method is controversial.

The study was undertaken to check the efficacy of Low Level Laser Therapy on work exposure among Indian porters/coolies and to check the placebo effect of laser therapy on plantar fasciitis.

OBJECTIVE OF THE STUDY

- To investigate the effectiveness of 820 nm Ga-Al-As diode laser in the treatment of plantar fasciitis.
- Establishing the status of diode laser as a popular modality for the treatment of plantar fasciitis where work exposure is a causative factor.

HYPOTHESIS

820 nm Ga-Al-As diode laser would prove effective in treating plantar fasciitis among Indian porters/coolies.

METHOD

Forty (40) participants per group will provide 80% power to detect a minimal difference of 3 Points on the pain scale (SD 2, Δ=0.05, 5% loss to follow-up). Eighty (80) subjects were selected on the basis table no 2 and were recruited randomly to either 820nm Ga-Al-As diode laser (experimental group) or dummy irradiation (placebo group). After briefing their informed consent was taken, their demographic data was collected.

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: 25 years to 60 years</td>
<td>Presence of tight Achilles tendon</td>
</tr>
<tr>
<td>Sex: Male porters/coolies</td>
<td>Previous Surgery on foot</td>
</tr>
<tr>
<td>Duration of occupation: Minimum 1 year</td>
<td>Reiter's Syndrome</td>
</tr>
<tr>
<td>Subjects with Plantar fasciitis for 4 weeks or longer</td>
<td>Gout</td>
</tr>
<tr>
<td></td>
<td>Ankylosing spondylitis</td>
</tr>
<tr>
<td></td>
<td>Rheumatoid Arthritis</td>
</tr>
<tr>
<td></td>
<td>Neurological disorders</td>
</tr>
<tr>
<td></td>
<td>Paget's disease</td>
</tr>
<tr>
<td></td>
<td>Calcaneal Stress fracture</td>
</tr>
</tbody>
</table>
The design was a randomized, single-blinded, placebo-controlled clinical trial.

Table No. 3. Instrumentation

<table>
<thead>
<tr>
<th>Instrumentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallium Aluminum Arsenide laser</td>
</tr>
<tr>
<td>Visual Analogue Scale</td>
</tr>
<tr>
<td>Foot Function Index</td>
</tr>
<tr>
<td>Ankle ROM</td>
</tr>
</tbody>
</table>

**PROTOCOL**

Based on inclusion and exclusion criteria, subjects were included in the study; convenient sampling with random allocation to the two groups (A & B).

**Group A (Experimental Group)**

Patients in this group received Gallium Aluminum Arsenide laser therapy followed by stretching exercises of the plantar fascia. The patient is positioned prone lying to obscure viewing of laser with probe in contact with the skin at right angle. The foot was irradiated with a continuous wave 820 nm Ga-Al-As diode laser.

Treatment consisted of 1 minute 20 seconds of irradiation over the origin of the plantar fascia on the anterior inferior calcaneus and then twice one minute twenty seconds continuous sweeps of the laser along the prominent medial border of the plantar fascia. Treatment will be given three times a week for 4 weeks.

The approach to develop optimal parameters and dosage has been adopted by the World Association of Laser Therapy (WALT) in their recommendations for treating musculoskeletal disorders with LLLT (www.walt.ru) i.e. 100mW continuous wave 820nm Ga-Al-As IR diode device with energy density of 81 J/cm². Evaluation was performed before the first treatment (zero day), end of First, second, third and fourth week respectively.

To perform the plantar fascia stretch, the patient was instructed to first cross the affected leg over the contra lateral leg while seated. The patient then applied force distal to the metatarsophalangeal joint on the affected side, pulling the toes upward towards the shin until a stretch was felt in the sole of the foot. Tension in the plantar fascia was palpated with the contra lateral hand while performing the stretch. Both groups were instructed to hold the assigned stretch for ten (10) seconds and to repeat ten (10) times. The patient were instructed to follow the assigned protocol three times per day, with the first stretch done before the first step taken in the morning and prior to any weight bearing. Patient education regime included watching an educational chart on plantar fascia stretching exercises and giving subjects advice on footwear.

**Group B (Controlled Group)**

Patient in this group received sham laser radiation (no laser beam) was applied followed by plantar fascia stretching exercises and patient education regime as described above.

**DATA ANALYSIS**

Data analysis was done using SPSS software version 20.0.

**RESULTS**

Overall results showed significant difference in VAS, FFH and DF from 0 week to 4th week in Group A indicating that the rate of improvement in Group A was more than Group B.

![Graphical Representation of Visual Analogue Scale (VAS) in group A and B from 0 to 4th week](image1)

![Graphical Representation of Foot Function Index (FFH) in Group A and B from 0 to 4th week](image2)
In a developing country like India, very little attention is given to the health problems of the workers in different unrecognized sectors, as there is no comprehensive occupational health service in India. Coolies are mostly males, from a lower socioeconomic class. They perform hard physical labour. The aim of the present study was to address the problem of Plantar Fasciitis among Potters/coolie.

Implication of the present study is that significant difference was found in VAS, FFI and DF from 0 to 4th week between the two groups i.e. Group A (Ga-Al-As Laser + stretching) and Group B (Placbo + stretching) whereas for PF no difference was seen between Group A and Group B.

According to the present study laser therapy forms the basis of treatment of plantar fascia. The findings
substantiate the previous findings of Snyder-Mackler et al. 

\( ^{14} \) demonstrating a reduction in pain due to increase in latency of the superficial radial nerve in healthy subjects that correspond to a decrease in sensory nerve conduction velocity after application of He-Ne laser. Similarly significant improvement seen from 0 to 48th week could be due to decrease in pain, increase in ATP production and other possible mechanisms predicted are effects on endorphin \( ^{15} \) level gate control of pain given by Melzack and Wall. 

\( ^{16} \) Ernesto Cesar Pinto Leal Junior et al. \( ^{20} \) advocated that infrared LLLT can prevent ischemic muscle injuries by reducing the release of reactive oxygen species (ROS) and creatine phosphokinase activity, while increasing levels of antioxidants and heat shock protein.

\( ^{11} \) LLLT is safe, free from side effects and cost effective treatment, thus laser therapy adjacent to stretching exercises should form the primary treatment of plantar fascia.

**LIMITATION**

Lack of adequate literature on LLLT and lack of clinical studies performed with laser therapy on plantar fasciitis patients. Furthermore, no clinical studies have been done to check the efficacy of Laser Therapy on work exposure as a causative factor of plantar fasciitis; moreover no study has been done to check the placebo effect of laser therapy on plantar fasciitis among Indian population (porters/cookies).

No follow-up was undertaken in the present study due to vast area, poor accessibility, lower economic group and lack of awareness.

**CONCLUSION**

Present study reported significant difference in the effects of Ga-Al-As laser with stretching when compared to placebo with stretching alone on pain relief, functional ability and range of motion.

In conclusion, the present study finds that LLLT using Ga-Al-As diode laser at the parameters shown is a safe and effective treatment method for the patients having plantar fasciitis.

**ACKNOWLEDGEMENTS**

The author is grateful for the cooperation and support of all the subjects who participated in the study.

**Conflict of Interest and Ethical Clearance:** Nil and the ethical clearance was taken.

**Source of Funding:** Self finance and the authors has no financial interest.

**REFERENCES**


