

# Disease Modifying Effect Of Low-Level Laser Therapy On Degenerative Lumbar Disc Disease Manifested As Intradiscal Gas (Vacuum Phenomenon)

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## Abstract

The present clinical case series of 7 patients all have so-called "Vacuum Sign" on the lumbar spine during initial presentation as chronic back pain. This vacuum phenomenon arises due to accumulation of gas usually nitrogen in the affected level with degenerative lumbar disc disease. This clinical case series reveal the success of LLLT in not only tackling the problem of discogenic back pain in these subjects, but also after prolonged administration of not less than 36 weeks lead to resolution of the gas or no more "Vacuum Sign" at the end of the study period on serial radiological follow up.

## INTRODUCTION

It has previously been reported by the author that low-level laser therapy (LLLT) can have disease modifying effect on degenerative knee joints [1]. It was further reported by the author previously that LLLT can have good clinical efficacy in control of back pain symptoms arising from discogenic back pain [2]. The present clinical case series of 7 patients all have so-called "Vacuum Sign" on the lumbar spine during initial presentation as chronic back pain. This vacuum phenomenon arises due to accumulation of gas usually nitrogen in the affected level with degenerative lumbar disc disease. This clinical case series reveal the success of LLLT in not only tackling the problem of discogenic back pain in these subjects, but also after prolonged administration of not less than 36 weeks lead to resolution of the gas or no more "Vacuum Sign" at the end of the study period on serial radiological follow up.

## MATERIALS AND METHODS

The prospective cohort study period spans from 2014 to 2020, consisting of patients attending 3 clinics namely wellness pain center, asia medical pain center, and digital therapy center. The male:female ratio was 2:5 and the mean age was 68 (range 59 to 72). All the patients also had MRI scan on admission to study to confirm the presence of gas inside the degenerative disc, and absence of other pathology such as tumors, infection, spondylolisthesis. Patients with

scoliosis or previous spinal operations or sciatica were excluded since the study mainly focused on any disease-modifying effect of intra-discal gas in degenerative lumbar disc disease. LLLT was provided by a GaAlAs semiconductor device emitting 810 nm wavelength, 5.4 J per point, and power density of 20 mW/cm<sup>2</sup> was used and the duration of application of LLLT over the relevant site was 360 seconds administered on twice weekly basis without the use of other oral medications. All patients consented to receive the treatment for at least 36 weeks and have serial x-ray assessments.

Serial radiographs were taken every month to assess any change in the radiological appearance of the "Vacuum Sign". No other physiotherapy treatments were administered other than FDA approved LLLT devices. The use of control by sham light source was objected by most subjects and thus sham light irradiation was not employed. All patients had minimum follow up of 1 year to assess the long-term clinical results in terms of pain level, as well as any changes in radiological "Vacuum Sign" on serial x-ray assessments.

## RESULTS

All subjects completed the LLLT treatment of 36 weeks without side effects. Treatment failure is defined by failure to obtain clinical remission of chronic back pain that necessitated medications, other physiotherapy, or even

surgery. In this study, there were no defaulters, and 7 out of 7 subjects demonstrated good clinical responses to LLLT with no more back pain after a mean follow up of 8 weeks (Range: 6-11 weeks). Fig 1 illustrates a typical patient with “Vacuum Sign” at L5/S1 at initial presentation. Fig 2 illustrates that at 36 weeks follow-up, the previous “Vacuum Sign” had disappeared.

At the last follow up, there was no pain in all patients, and all subjects were satisfied to know not only were there clinical response, but also positive radiological responses.

**Figure 1**

illustrates a typical patient with “Vacuum Sign” at L5/S1 at initial presentation



**Figure 2**

illustrates that at 36 weeks follow-up, the previous “Vacuum Sign” had disappeared



**DISCUSSION**

It was Fick who first described the Vacuum Phenomenon in 1910 during study on joints, Magnusson described this phenomenon in Inter-Vertebral Discs in 1937, followed by Knutson [3] who correlated the Vacuum Phenomenon to disc degeneration. Nowadays, it is believed that the gas is nitrogen, and there were previous case reports reported by Ricca of these gas pockets can sometimes produce compression on nerve roots [4]

Unlike traditional physiotherapy machines, LLLT confers biomodulation effects such as improvement in microcirculation, and upregulation of several genes involved in energy metabolism and oxidative phosphorylation which stimulates an increase in adenosine triphosphate production, which in turn regulates other cellular processes leading to normalization of biological functions at a cellular level [5]. This healing process takes time and thus underlying the need of continual treatment for not less than 36 weeks as in the current study.

**CONCLUSION**

The administration of low-level laser therapy for 36 weeks was shown to be effective in enhancing the healing of

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degenerative lumbar spinal disc diseases with intra-discal gas. LLLT was also demonstrated to be able to eradicate the “Vacuum Sign” in all subjects at the end of the follow up period of not less than one year.

### **References**

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