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Editorial

# Personal Experience on 250 Percutaneous Laser Disc Decompression (PLDD) Lumbar Procedures using a New 1470 Nm Diode Laser

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**Abstract**

**Introduction:** This scientific study aimed to analyze the results of 250 Percutaneous Laser Disc Decompression (PLDD) lumbar procedures using a new model of diode laser 1470 nm. The PLDD is a valid and serious alternative to microdiscectomy and endoscopic herniectomy in carefully selected patients affected by disc hernia or protrusion. Several scientific publications in the last 20 years have stated this one and PLDD si spreading worldwide. Only a few scientific publications have used criticisms toward PLDD but all the Authors of these last publications were never involved to practice PLDD directly.

**Material and Methods:** Two hundred and fifty patients affected by lumbar disc hernia or protrusion not responding to conservative therapies for 6 weeks were treated with PLDD using a new model of diode laser machine. The wealth of news is that this laser machine is a 1470 nm of wavelength. In the past, some spine surgeons used diode laser for PLDD but only 808 or 980 nm of wavelength. So this is the first study analyzing the result of lumbar PLDD using a 1470 nm diode laser. The inclusion and exclusion criteria for PLDD treatment are the large international accepted criteria (not extruded disc hernia, not calcified hernia, not large intradiscal vacuum phenomena, not infections or fractures or tumors of nearest vertebral bodies, not haemorrhagic phatologies of the patients, not spondylolisthesis more than I Frankel's degree). Age, gender, multiple level involved, associate pathologies and distribution were not statically different. The results were evaluated using the MacNab criteria, the Visual Analogic Scale (VAS) and the Oswestry Disability Scale (ODS). The follow-up period range from 6 months to 1,5 years (average 10 months). Results according to the MacNab criteria are: 87% of excellent/good results, 5% of recurrences and no complications.

**Conclusions:** The analysis of the results support that the new 1470 diode laser is a safe and an excellent laser for lumbar PLDD procedures. The 1470 nm diode laser has the advantages of compact size and lower costs of purchase and maintenance than Nd: YAG 1064 nm laser.

## INTRODUCTION

A first paper about PLDD was published in the New England Journal of Medicine under the title of "Percutaneous laser nucleolysis of lumbar disks" in 1987 thanks to the pioneer giant work on PLDD of Prof. Dr. Daniel S. J. Choy from Columbia University [1]. During these last 27 years many different lasers were used to perform PLDD. The most commonly used lasers for pure PLDD are the Nd: YAG 1064 nm laser, the diode 980 nm laser and the Ho:YAG laser. PLDD has spread worldwide and is being routinely performed in all of Western Europe, the United States, Central and South America, China, Japan, India, and Korea. Comparing the PLDD procedure using the Nd:YAG laser and the Ho:YAG laser with each other, Choy refers to the following points: because the transfer of energy to water is much greater in the Ho:YAG laser than in the 1064nm Nd:YAG laser, in the former, continuous saline irrigation is necessary to cool the fiber and needle tip. Thus, an additional channel must be provided in the "needle", therefore enlarging the minimum overall diameter (o.d.) of the needle to 2.5 mm. The o.d. of the 18G needle used in the Nd: YAG laser is 1.0 mm. Addition of viewing optics further enlarges the needle o.d. of the Ho: YAG laser to 6.5 mm. The use of the Ho: YAG system is therefore more invasive than the simpler Nd: YAG system [2]. The new Diode 1470 nm laser has almost the same chemical and physical effects of the Nd: YAG 1064 nm laser. This study analyzes the results of a new diode laser (1470 nm) on a large series of 250consecutive procedures in 204 patients treated with pure PLDD (46 patients were treated for 2 slipped disks at the same "surgical" time).

## MATERIALS AND METHODS

Patient's selection for PLDD followed the standard international criteria of back and/or leg pain due to disc hernia or protrusion [3]. Exclusion criteria were according to Choy's criteria [3]. The series consist of 250 consecutive PLDD procedures in 204 patients treated between January 2017 and June 2018. The levels treated were 200L4-L5 and L5-S1 (80%), 47 L3-L4 (19%) and 3 L2-L3 (1%). There were 125 male and 79 female. The age ranged from 19 years and 79 years with a mean age of 46 years. In 46 patients were treated 2 levels at the same time. In 11 cases of

L5-S1 disc herniation the extrathecal paramedian approach was used according to the Choy's approach to L5-S1 intervertebral disc space [3]. The operating time for each procedure ranged from 25 to 40 minutes. All patients were studied with Lumbar MRI (1,5 Tesla) and 95 (38%) also with EMG. The neurological deficits before the PLDD occurred in 49% of patients (reflex reduction in 39%, motor deficits in 20%, and radicular sensibility reduction in 32%) while in 61% of patients there were only irritative signs as straight leg raising (SLR) positive at less than 45 degree. All the patients received 1 gr. of vancomycin in 500 cc. of saline solution 2 hours before the procedure. All patients were mildly sedated with 10 mg of diazepam (1 hour before the procedure). The patient's position was always lateral with the right or left side depending by different parameters (affected side, how much large the disc space on antero-posterior x-Ray view was, if the patient had pain lying in a specific side of the lateral position) but preferring the affected side up in order to avoid anyway minimal irritation of the non – affected nerve. After the local anesthesia in the calculated entry-skin point according to the Choy's method [3] with 3-4 cc. of carbocain , the needle (18 Gauge , Becton-Dickinson) was inserted percutaneously and guided by C-arm fluoroscop (Siemens) into the intervertebral space of the herniated disc (only four or five spots of one second each for each procedure). Optical fiber 300 or 400 micron were always used. The tip of the optical fiber out of 5 - 7 mm. from the tip of the needle. The energy of each laser beam ranged from 6 to 7 Watt and the total laser energy delivered ranged from 400 to 600 Joules. These different single laser beams power and different total laser energies delivered depended how much tall the patient was, disc height, the presence of bubbles from the needle during the procedure, the heat sensation of the single patient [4]. The time pause between each laser beam was always 5 seconds. The optical fiber was retracted three to four times in each procedure allowing in this way two advantages: a) to allow the exit of the heat and b) to control the tip of the optical fiber. All the patients were discharged 8-18 hours after the procedure allowing them to stand-up from the bed only two times in the evening of the same day of the PLDD. The return to the daily normal activity was gradually day by day and step by step in 15-20 days. The return to their own jobs depended by the kind of job (it ranged from 15 days to 40 days). Follow-up visits were scheduled at 1 month, 3 months, 6 months, 1 year and until 4 years.

## RESULTS

The results, according to the MacNab criteria were as follow: 87% of excellent/good results, 5% of recurrences, 0,00% of complications [5]. The VAS score significantly improved from an average value of 8.3 +/- 1.4 before the PLDD to an average value6 - 12 months after the PLDD of 2.25 +/- 2.0 ($p < .01$). The ODS values start from a pre-PLDD average value of 56.1 +/- 10.0 to a post-PLDD average value of 20.9 +/- 5.5 ($p < .01$). The improvement was in a range of 1-7 days in 30% of patients while in 70% of patients it took more than 7 days (8-42 days). The pain killers after the PLDD were used by 37% of patients for a range time of 1-10 days. The neurological deficits showed an improvement in 45% of 49% while the irritative signs (SLR) disappeared in all patients with excellent/good results. In the post-operative period the patients dressed a lumbar brace for 10 days (not when lying bed) and the return at work ranged from 15 days to 40 days.

## CONCLUSIONS

The PLDD represents a first line of treatment as pure and safe minimally invasive interventional disc procedure. This statement is incontrovertible after more than 30 years of experience [2] and more than 100.000 PLDD's procedures around the world. The detractors of PLDD are always not involved in this kind of true minimally invasive disc procedure and have never had experience on PLDD directly. All health operators involved in PLDD experience have stated its usefulness and safety. The new 1470 nm Diode Laser represents a further step towards a new era of minimally invasive disc interventional disc techniques because, other than its validity stated by this scientific study, has the advantages of lower cost of purchasing and of annual maintenance.

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