

**INDICATIONS-SPECIFIC
ENDOSCOPIC
LASER-ASSISTED
INTERVERTEBRAL DISC OPERATION**

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Abstract

This study does not regard percutaneous manual endoscopic laser discectomy as an alternative method to open disc surgery.

Percutaneous laser disc decompression (PLDD) is presented here as a means of treating the conservatively therapy-resistant broad-based pyriform configuration of prolapsed intervertebral disc in cases where there are compelling indications. Percutaneous endoscopic laser discectomy (PELD) is the preferred operation method for narrow-based disc hernias held by the anulus fibrosus of the ligamentum longitudinale posterior.

Under a standardised indication scheme, a precondition for indication of the endoscopic mechanical manual laser-assisted disc operation is that the ligamentum longitudinale posterior must be intact. Where there is any suspicion of transligamentary sequester, pre-operative discography should be carried out to rule out any risk of contrast-medium leakage into the epidural cavity. The intra-operative image-amplification control with a flexible endoscope may be regarded as optimal.

This study presents the 5-year treatment results of 102 patients who underwent surgery on a total of 139 intervertebral discs.

Standardised Indication as a prerequisite for the Examination's Quality Safety

1. Intensive and conservative however, unsuccessful treatment of protruding intervertebral discs in the 1st, 2nd and 3rd stage with intradisc protrusion of the core of the intervertebral disc and/or subligamental slipped disc with a visible intact rear longitudinal ligament, as far as this may be assessed from the picture.
 2. Positive CT or MRI, which corresponds with the above described clinical diagnosis.
 3. Sensitivity disorders and/or paraesthesia with typical assignment to a dermatoma.
 4. Pain on one side spreading to the lower extremities.
 5. The extent of the sciatic pain is greater than that of the pain to the lower back.
 6. Positive Lasègue's sign and Bragad's sign.
 7. Deficit syndrome with typical paresis, sensitivity disorder and/or deviation of reflexes.
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- in the 1st stage of a protruding intervertebral disc, points 1+2 are obligatory
 - in the 2nd stage of a protruding intervertebral disc, points 1-4 are obligatory
 - in the 3rd stage of a protruding intervertebral disc, points 1-7 are obligatory

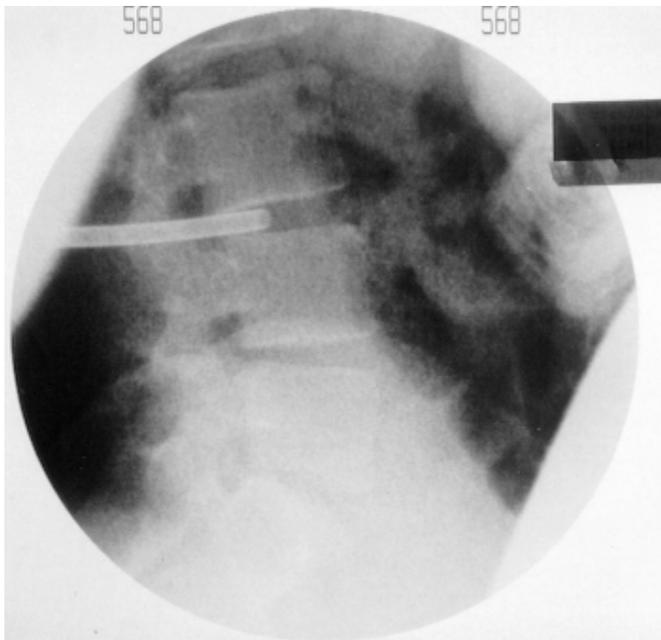
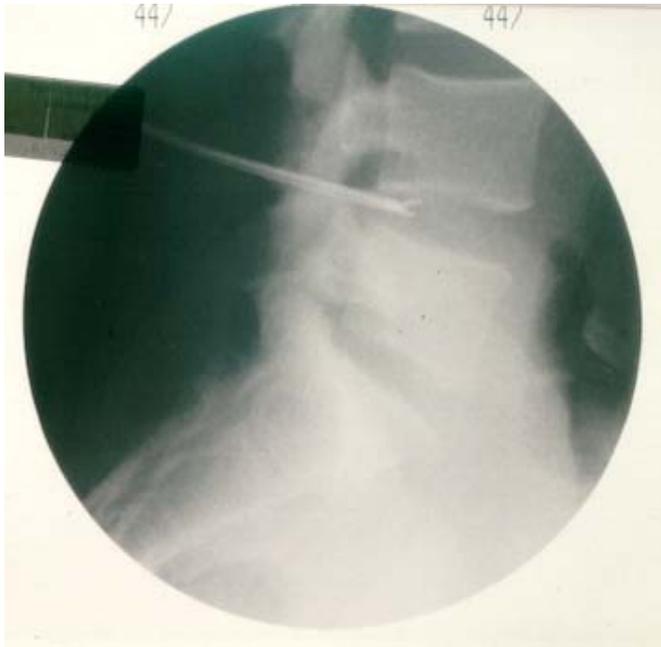
Contra - Indication

- Transligamental slipped discs, free intervertebral disc sequestra within the vertebral canal, which are eventually positioned toward cranial or caudal.
- Subligamental sequestra, which, in the discography indicate to the start of an epidural sequester, i.e. a perforation of the rear longitudinal ligament.
- Severe stenosis of the Rec. lateralis.
- Osseous root irritation, foramen stenoses.
- Calcified hard herniated discs.
- Severe, degenerative changes to the articulations of the vertebral column of non-discogenic causes.
- Patients with a clinical indication with severe neurological conditions like extensive paresis and/or cauda equina-syndrome with bladder and/or rectum dysfunction and saddle-block anaesthesia.
- Patients with additional complaints, e.g. fractures, tumours, infections or, in the case of an existing pregnancy, with a relatively higher risk to the patient.
- Haemorrhagic diathesis.
- Allergics to local anaesthetics.
- Severe coronary heart disease, unstable angina pectoris.

The Advantages of Endoscopic Intervertebral Disc Surgery

- The operation may be performed under local anaesthetic and therefore affords minimum risk of injury to the nerves.
- Low invasive method with great effectivity.
- Avoidance of epidural fibrosis through postero-lateral access.
- Low traumatisation without opening of the vertebral canal.
- Simple and short operation with little scarring and adhesion suffered by the patient.
- Decompression and pain release even during surgery.
- Minimal contamination through thermal laser-sterilisation effect.
- Minimal tissue damage without uncontrolled bio-mechanic long-time effects.
- Lumbar disc hernias, which do not break through the lig. longitudinale posterius, are effectively treated with a combination of percutaneous manual and endoscopic laser discectomy.
- Through this combination of mechanical, manual and laser-supported methods, hernia material, which lies out of reach of conventional instruments, may be additionally removed with the help of flexible laser probes.
- With the intra-disc laser method up to 15 % of the total weight of the intervertebral disc is reduced and with this, 4% to 5 % of nucleus material is removed.

- Shrinking effect of disc tissue with a reduction to the protrusion of the annulus and, at the same time, achieving additional release of the rear longitudinal ligament and of the root compression.
- Deactivating mediators of infections, like Phospholipase A2 and reduction of nervous controlled and precipitated reactions.
- Denaturation of sensitive and vegetative motoric ends of nerve fibres („The intervertebral disc may cause pain prior to any involvement of the actual root“ – E.Senn, Bellikon).
- The effect of the laser vaporises and denaturates innervated sequestered hernia material and blood vessels.
- Reduction of the extension of the rear longitudinal ligament and with this, a reduction of the irritation of the sensitive ramus recurrens of sinuvertebralis nerve.
- Normalisation of the state of pathological blood circulation, which causes irritation to the venous plexus that may lead to a Schultz-Charlton reaction.
- Reduction of the oedema surrounding the protrusion.
- Better preservation of the disc space than through chemonucleolysis.
- Less restriction of segment instability and height reduction to the intervertebral disc.
- Despite of age related degenerative changes to the intervertebral disc, prolapse, subligamental hernia material or scarred and nucleus material, which has been changed through collagen, may be removed by forceps.
- Brief convalescence and rehabilitation periods.



Instruments and their Mode of Application

Laser disc decompression nucleotomy is based on the effect to the disc tissue of the Neodymn-YAG-Laser with a frequency of 1064 nanometer and the Holmium-YAG-Laser.

The mode of action is based on heat coagulation, vaporisation and tissue compression of the intervertebral disc. For the Neodymn-Yag Laser as well as the Holmium Laser the deciding factor for the quantity of tissue removed is the total energy applied. The power of compression is only of secondary importance.

The duration of impulse of the Neodym-YAG-Laser with a frequency of 1064 nanometer amounts to between 0.5 and 0.8 seconds with an individual shooting power of 15 to 18 Watts. The maximum laser energy applied lies between 1400 and 1700 joule.

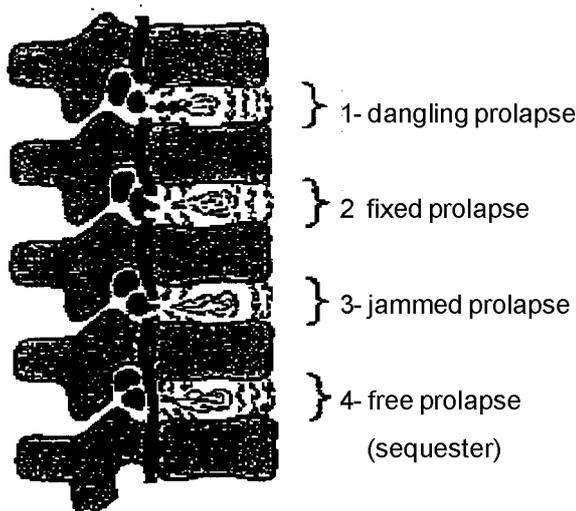
The instruments used are guiding wires and sleeves, shunts, hollow mills and dilation set. A CameLite – a combined camera and light source – with rigid 4.4mm, 0 degree endoscope optics with two instrumental canals, one rigid optics with a 3.15mm work canal and a flexible 1.5mm Phoenix Scope may be used alternatively. Hysteroscope pliers and a spoon and tumour gripper, which opens downwards, are used for mechanical decompression.

The operation may be carried out in a non-saddle-back position and in a lateral or prone position. The local anaesthetic must not cause any epidural or peridural anaesthetic. Puncture was effected at an angle of 30 to 45 degrees to horizontal. With the puncture of the intervertebral disc it is aspired to puncture the same not in the centre, but as closely to the upper cover plate as possible, because this involves less danger of incurring an injury to the root of the nerve. The position of the guiding wire and of the dilator should be inside the safe zone between the medial and lateral pedicle level. The endoscope and the fibre point must be in an equal distance from the base and the cover plate. Image intensified supervision of the guiding wire, the dilators and the endoscope is effected on two levels. During laser treatment it is

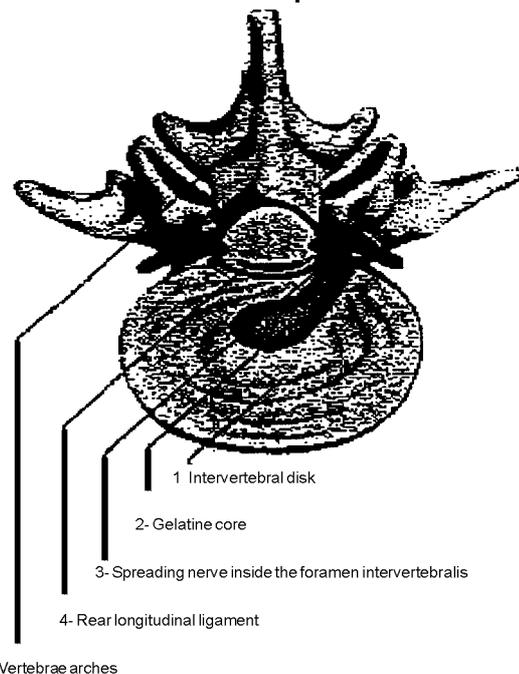
favourable to move the endoscope with its fixed fibre two to three centimetres forward and backward under C-arch supervision. Through intermittent laser treatment and rinsing in intervals of every 500 joule and suction with conscious patients, an increase of temperature may be minimised and the risk of damage may be kept at the lowest possible level.

With these pre-conditions and a correct position of the fibre inside the intervertebral disc there is only a very slight increase in temperature at the cover plates. The mechanical manual disc decompression method is carried out in turn with a gripper and a punch with the 1064 nanometer Neodym-YAG-Laser and an application of 500 joule in energy. A striking feature is the retraction of the nucleus pulposus tissue after an application of 500 joule, hence, with the gripper in the same position, it is possible to remove slightly protruded tissue. Through endoscopic visualisation the shrinking effect of the Neodym-YAG-Laser to the disc tissue is utilised for an easier mechanical removal of protruding intervertebral disc material.

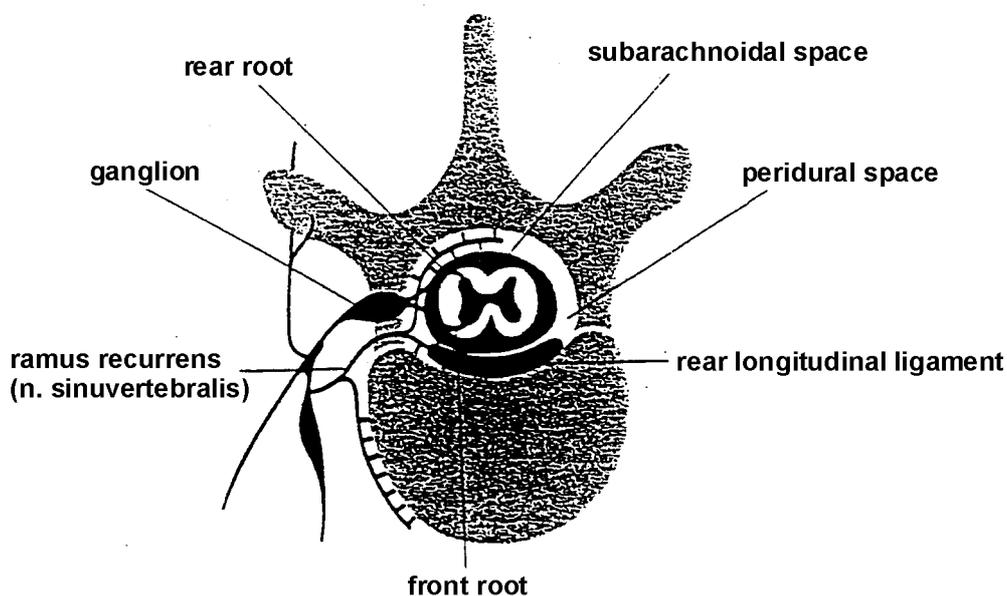
Various shapes of herniated vertebral discs (prolapse) to dorsal



Dorso-lateral herniated vertebral disc with nerve root compression

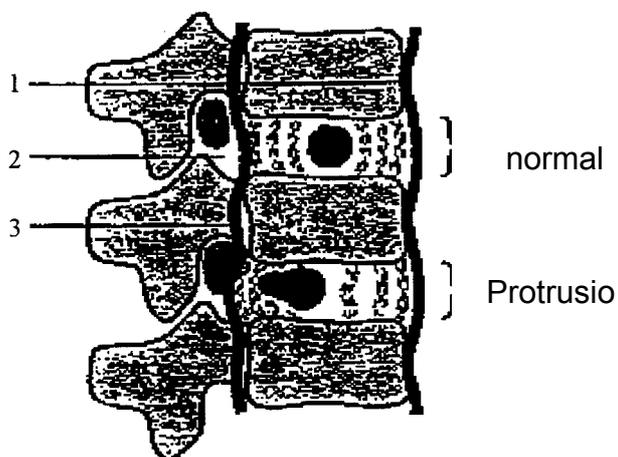


innervation of the longitudinal ligament



Normal condition and protrusio

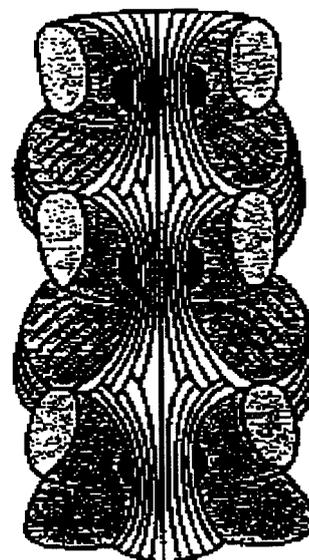
Course of the rear longitud. ligament



- 1 = Front longitudinal ligament
- 2 = Intermediate vertebral hole
- 3 = Rear longitudinal ligament

(The front longitudinal ligament rests at the bodies of the vertebrae.

The rear longitudinal ligament adjoins the intervertebral disc and overrides the bodies of the vertebrae.)

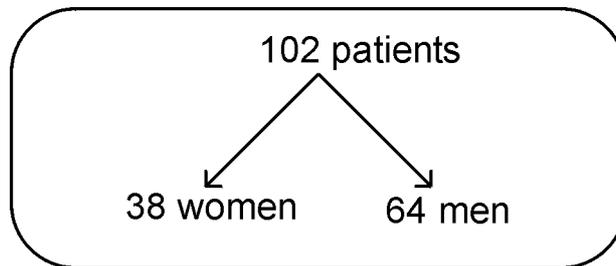


Rear longitudinal ligament of the vertebral column: The fan shaped extension into the rear wall of the intervertebral disc is clearly visible (according to Spalteholz).

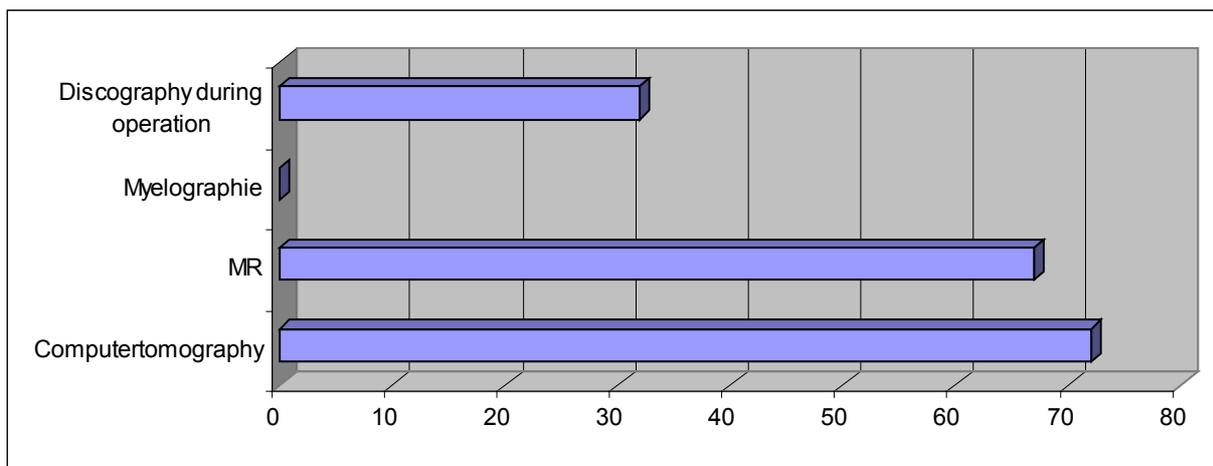
Post Operative Examination Periods: 4.6 to 6.6 years

Patient Data

pre-, peri- and postoperative



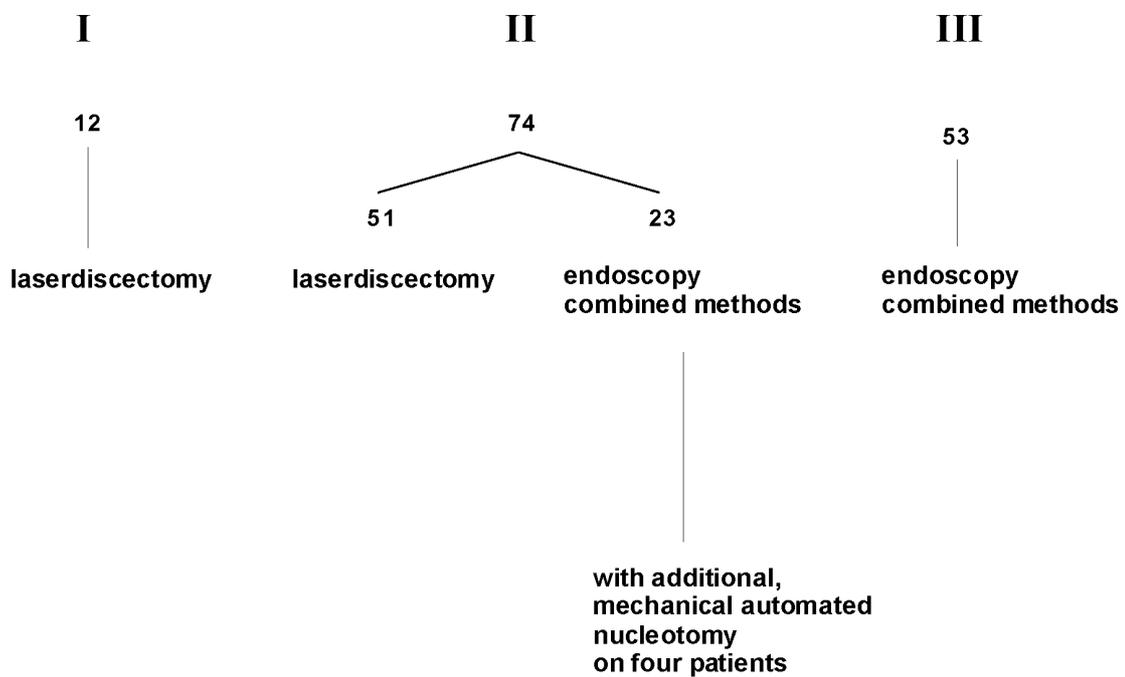
	Women	Men
Age:	27 - 73 years	24 - 68 years
	Ø 34 years	Ø 42 years



Pre-operative, Conservative Therapy

7 months to 18 years Ø 2.4 years

ID- Stage of Protrusion



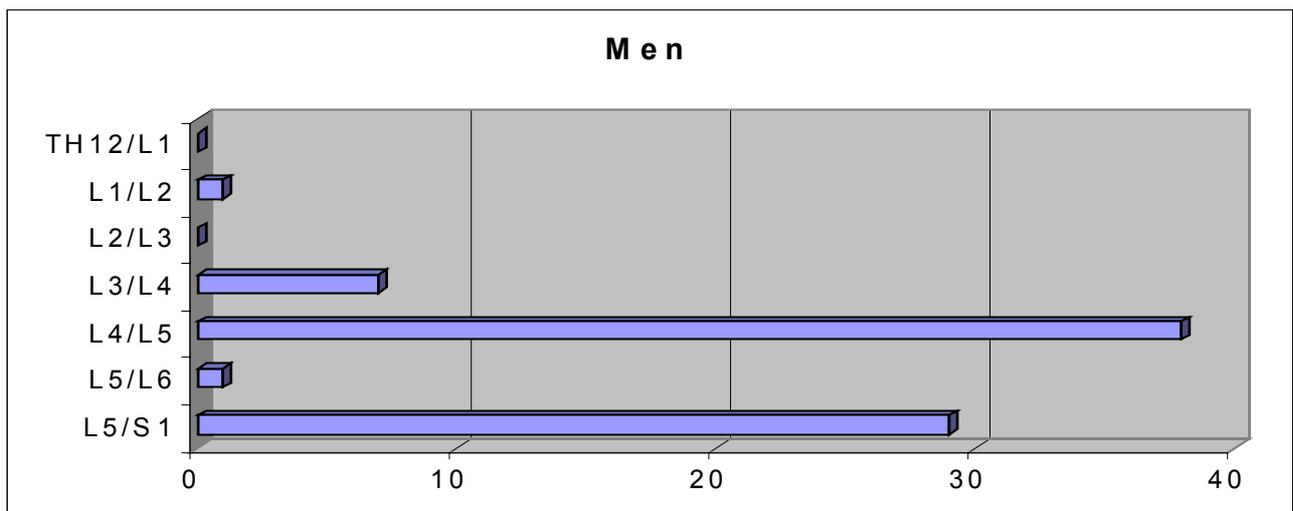
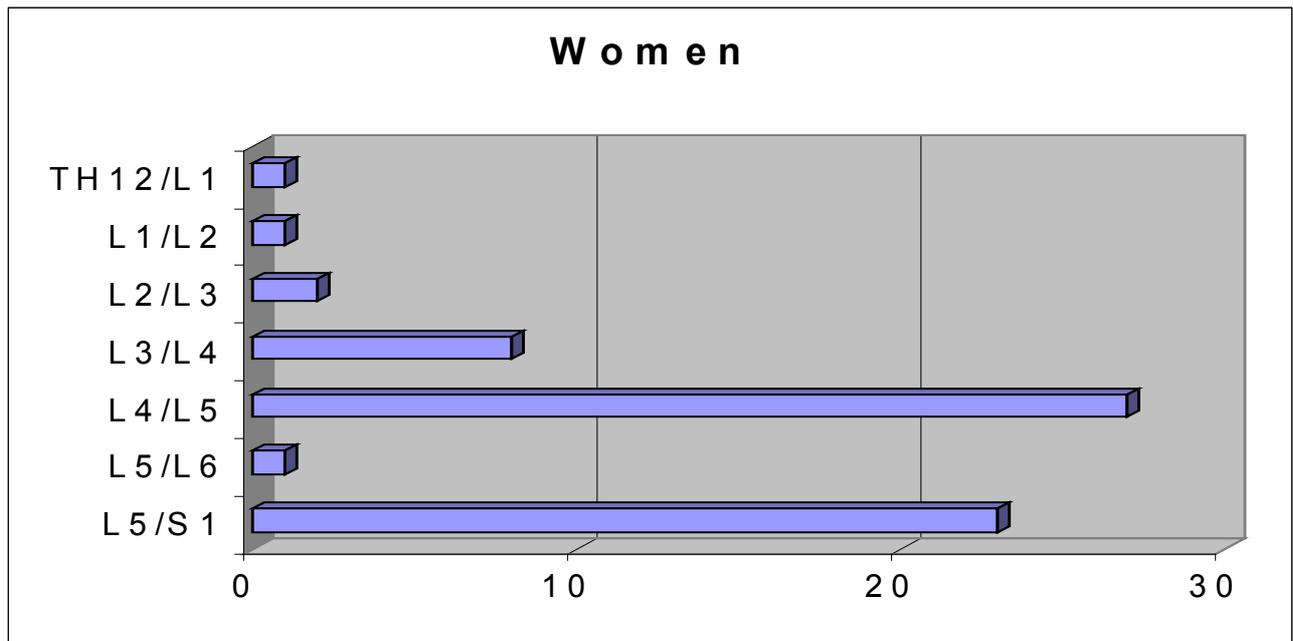
Removed ID-Material:

7-14 grams; Ø 8 grams

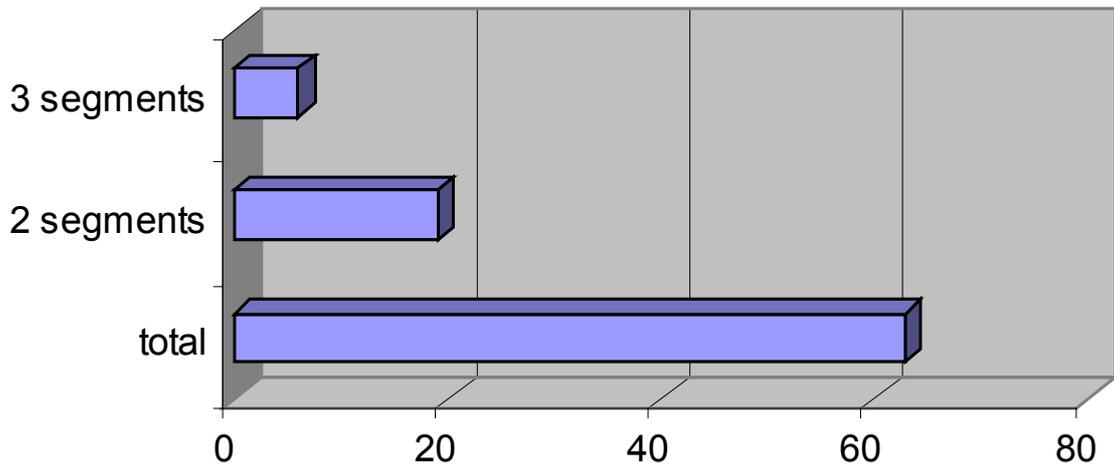
Medium time off sick of the patients who did not undergo repeated surgery:

5.7 weeks

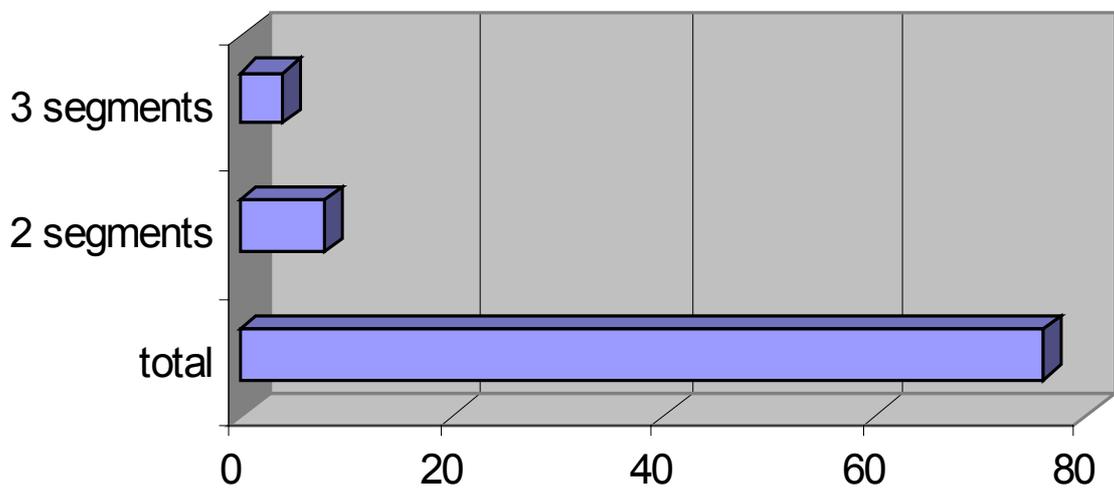
Order of intervertebral disc days according to the number of operations



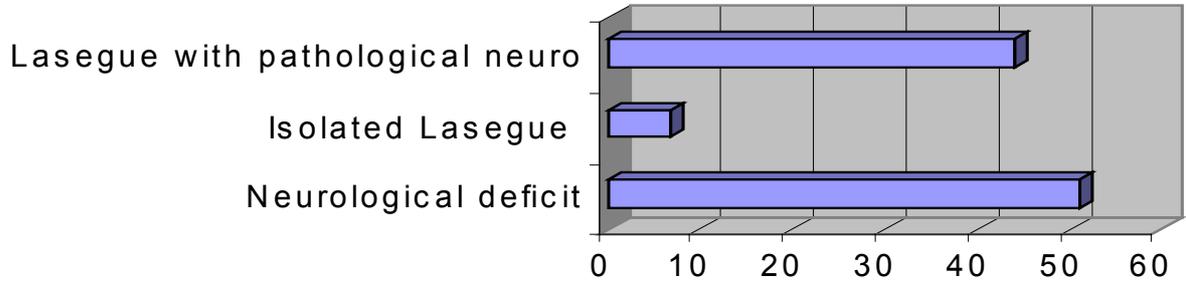
Number of Segments per Intervertebral Disc Operation – Women



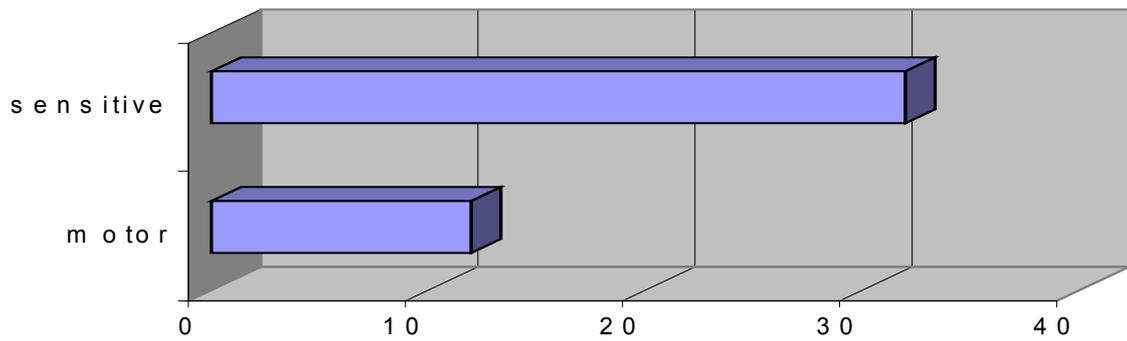
Number of Segments per Intervertebral Disc Operation - Men



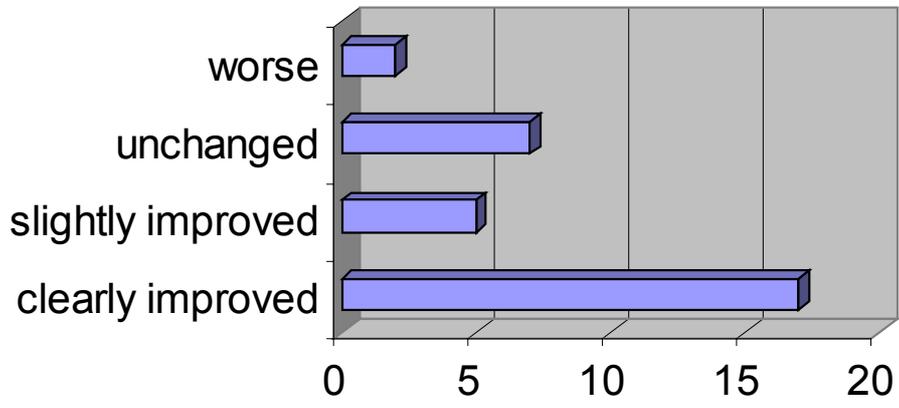
Pre-operative Neurological Status



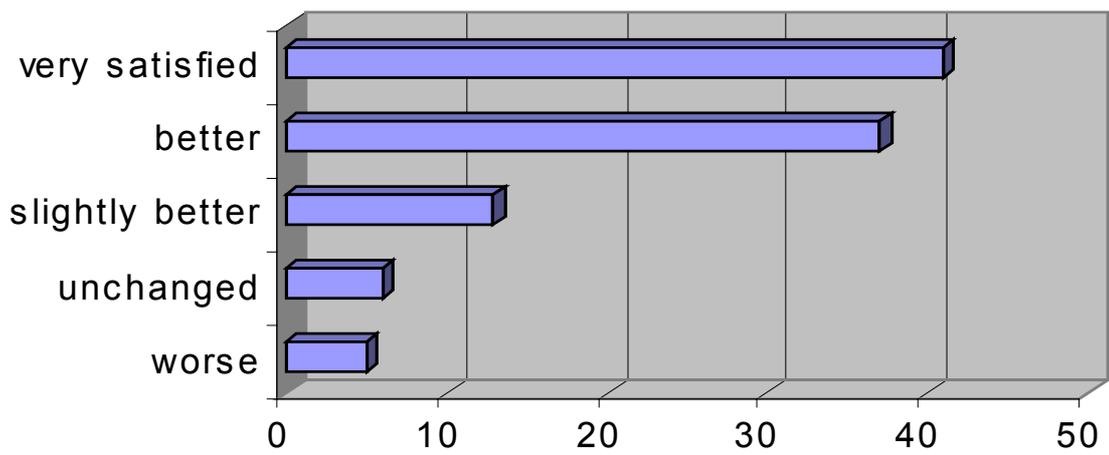
Lasegue with Pathological Neuro



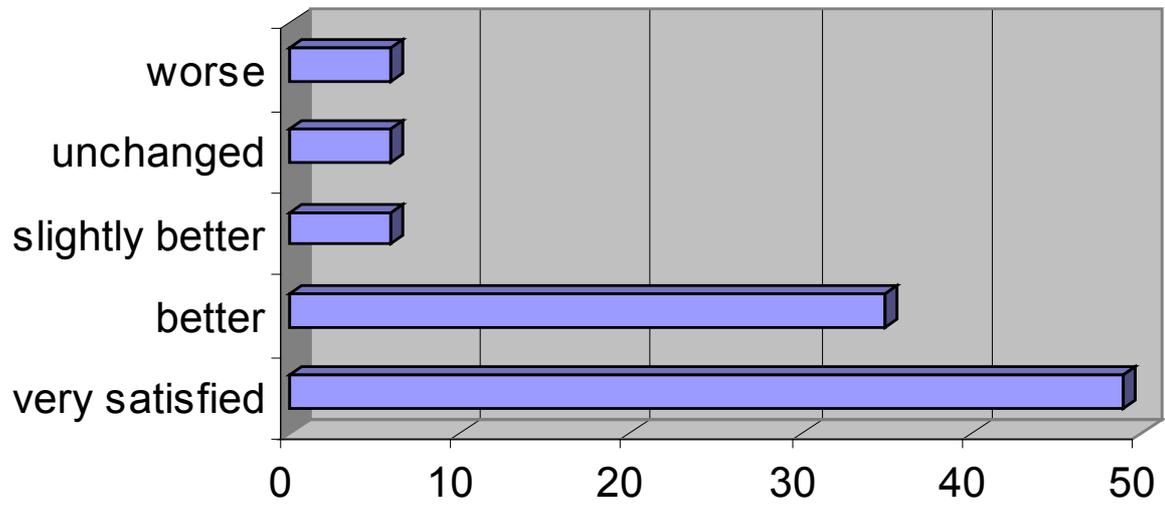
Sensitivity post op



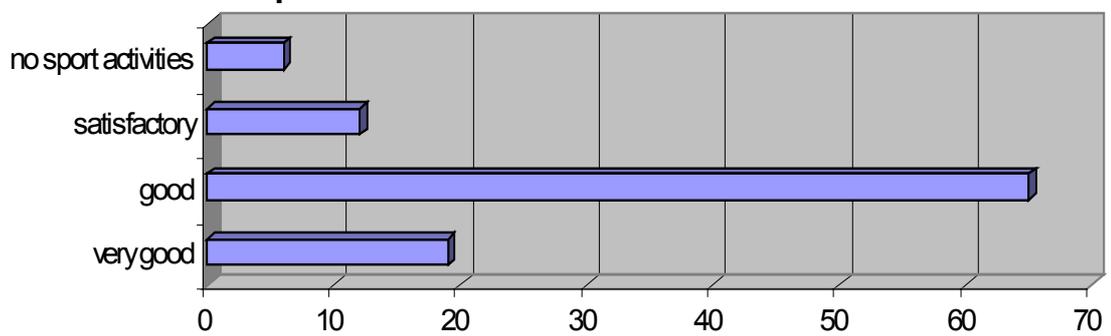
Reduction of back pain



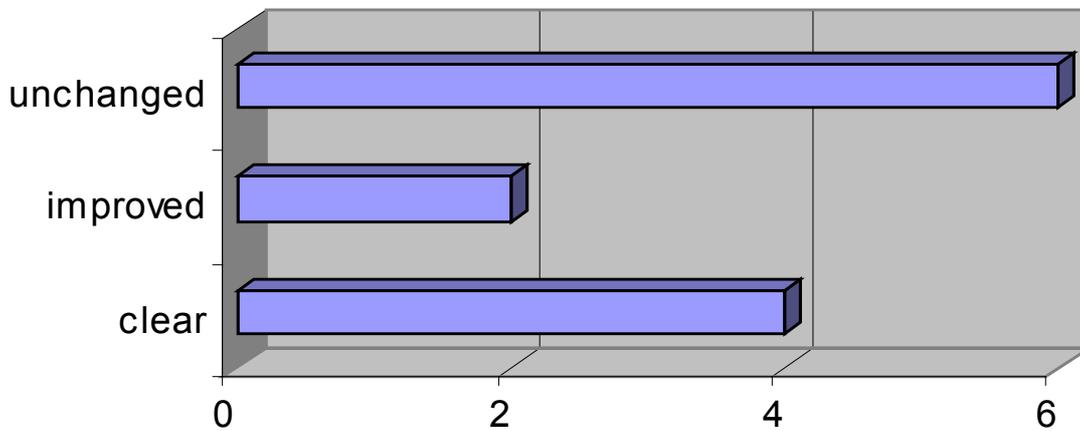
Reduction of pain in leg



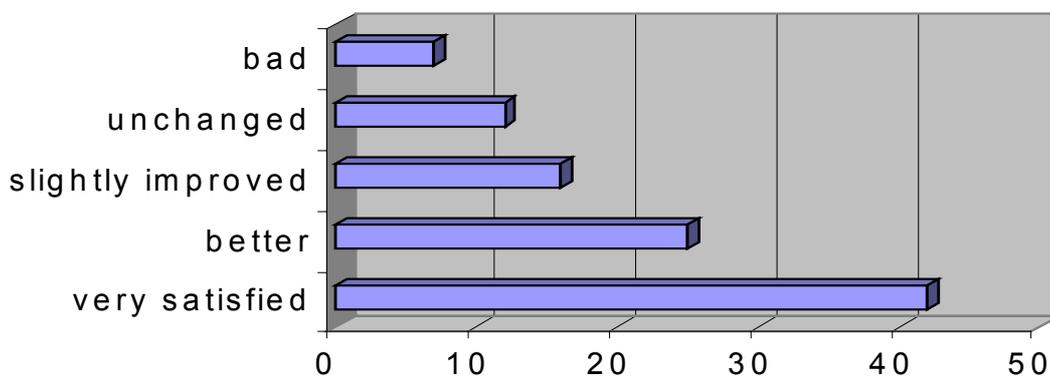
Performed sport activities in relation to the result of the treatment



Motoric movement – degree of increase in motoric strength



over all out come



Frequency of Repeat Operation

ID-Protrusion, 1st and 2nd stage	0
ID-Protrusion 3rd stage with subligamental sequester	6 (with 1 endoscopic follow-up operation)

We would like to express our warnings about continued long time conservative therapy. Chronification of pain and an adhesion of the nucleus pulposus with the annulus involving secondary intradisc vascular proliferation and innervation of sequestered hernia material will result in the patient not being suitable for these type of minimal invasive intervertebral disc surgery techniques. Therefore, the extremely long conservative treatment times recommended by Nachemson, which involve many weeks of being off sick and expensive conservative treatment and, on top of this, lead to frequent relapses, are no longer justifiable in the light of socio economic savings in costs within our National Health system.

In conclusion, it may be resumed that endoscopic manual and laser supported intervertebral surgery in consideration of the anatomic conditions and restricted indication may be continuously applied with success and will represent a new therapeutic window between conservative and open surgical treatment in the treatment of protruding intervertebral discs and slipped discs with a small subligamental sequester.