



## Results of Lumbar Disk Prosthesis after a Follow-up Period of 48 months

Israel Caspi MD, Moshe Levinkopf MD and Jacobo Nerubay MD

Spine Deformity Unit, Department of Orthopedics, Sheba Medical Center, Tel Hashomer, Israel  
Affiliated to Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

**Key words:** lumbar disk, prosthesis, patient selection

### Abstract

**Background:** Damage to the intervertebral disk is usually corrected by means of a prosthesis.

**Objectives:** To report the outcome of the artificial lumbar disk replacement with the Charité SB III disk prosthesis in 20 patients after a 48 month follow-up.

**Methods:** The 20 patients were evaluated clinically and radiographically during this period. Preoperative diagnosis included degenerative diskopathy in 17 patients and failed posterior conventional discectomy in 3. The prosthesis was implanted at one level in 17 patients and bi-level implantation was performed in the other 3 patients.

**Results:** Eighty percent of patients reported satisfactory to very good results. Poor results were reported by four patients, one of whom underwent posterolateral fusion and another is waiting for the same operation. There were two dislocations of the prosthesis followed by immediate revision surgery.

**Conclusions:** Contraindications for surgery appear to be the principal cause of failure rather than the prosthesis itself.

*IMAJ 2003;5:9-11*

For Editorial see page 59

Degeneration of the intervertebral disk is one of the main causes of low back pain. The gold standard in the treatment of degenerative disk disease is spinal fusion. From a biomechanical perspective it appears logical that eliminating the motion in one segment will cause increased loads in the adjacent levels. The possibility of preserving motion in the diseased segment by disk replacement has gained increasing interest [1,2]. Fernström [1] is credited for the first clinical trials using an artificial disk, but his ball-bearing prosthesis proved to be unsuccessful due to subsidence into the vertebral bodies. The artificial disk that has been used most extensively is the SB Charité. In 1982, Büttner-Janzen and Schellnack initiated the development of a functional intervertebral disk spacer and in 1984 the first model was implanted. The prosthesis underwent several major revisions in design and the SB Charité III is currently marketed. In the present study the Charité disk was used in 20 patients with a follow-up of 48 months. In addition to presenting the encouraging results – 80% fair to excellent – we outline the problems associated with this type of procedure, the

technical base of the operation, and its limited application. Although promising, this is far from being a routine procedure.

### Materials and Methods

Twenty-three prostheses were implanted in 20 patients (11 men and 9 women) whose age ranged between 24 and 50 years. The total follow-up period was 48 months. In three patients two-level surgery (L4-5 and L5-S1) was performed. All patients had suffered low back pain with/without radicular pain for at least 5 years. Three of the 20 patients had undergone previous surgery by a posterior approach. The preoperative X-ray evaluation demonstrated narrow disk space [Figure 1]. Diskography as a pain provocative and memory test was performed in all patients. Magnetic resonance imaging was



**Figure 1.** Narrowing of disk space indicating degenerative diskopathy.



**Figure 2.** Black disk indicating degenerative diskopathy.

successfully used to analyze the diseased disk and the levels above and below [Figure 2]. The MRI also helped us to eliminate a residual posterior compression from scar tissue in the failed back that was operated on.

We used a third-generation prosthesis consisting of two endplates of cobalt-chromium-alloy and a polyethylene sliding core (ultra-high molecular weight), which allows segmental movements of up to 10 degrees in the different planes.

The surgical approach is anterior retroperitoneal. After mobilizing the great vessels and the sympathetic nerve chain the anterior part of the disk is exposed. Complete excision of the degenerated disk is carried out and the posterior longitudinal ligament is severed in order to allow reconstitution of the disk height. The largest possible disk prosthesis is chosen and inserted. After subtracting the disk space the polyethylene is introduced, and in most cases a prosthesis measuring 9.5 mm is used. X-rays monitor the position of the prosthesis. The patient's postoperative recovery starts with sitting and walking on the first day after surgery. Active physiotherapy is initiated 1 month post-surgery.

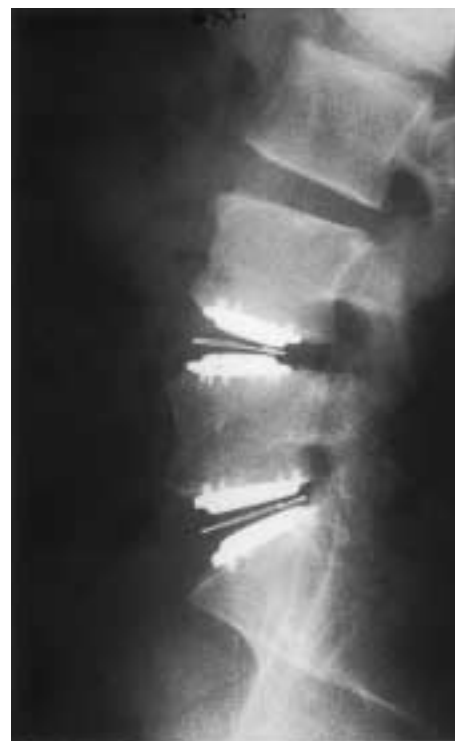
The main indication for lumbar disk prosthesis is chronic lower back pain due to disk degeneration in young patients (up to age 55). The lumbar disk prosthesis is indicated for patients under the age of 55 due to bone quality and status of posterior facet joints.

## Results

We analyzed 20 patients with a total of 23 prostheses. Follow-up was 48 months. The overall clinical results were rated as follows: fair = 3, good = 4, excellent = 11, and poor = 4 (one patient underwent secondary fusion and one is waiting for surgery). With regard to the patients' recovery in terms of occupation: four are completely disabled, one patient resumed physical labor, and the others returned to light and sedentary work.



**Figure 3.** L5-S1. Disk prosthesis.



**Figure 4.** Bi-level disk prosthesis.

The radiologic results were analyzed from X-rays taken during the follow-up [Figures 3 and 4]. There were two cases of migration of the prosthesis, occurring 2 days after surgery due to incomplete severing of the post-longitudinal ligament in one patient, and 2

weeks post-surgery due to small fracture of the lower endplate in the other. In both cases revision surgery was performed and a larger prosthesis was inserted. In one patient intraoperative laceration of the ureter and thrombosis of the iliac artery occurred and these complications were immediately treated. In two patients spontaneous ossification of the intervertebral anterior ligament was observed, but its progression was halted by intensive physiotherapy. The average range of segmental motion was 3–9°. In no patient was there infection or sexual complications. In four patients who rated their postoperative result as poor the postoperative X-rays showed good results, and after further investigation it became apparent that all four were in different stages of ligation.

## Discussion

In the era when Sir John Charnley revolutionized orthopedic surgery with the introduction of total hip prosthesis, Fernström [1] began exploring the possibility of disk prosthesis. The apparent gold standard for treating degenerative diskopathy was spine fusion, but this procedure presented several problems, including abnormal spinal kinematics, tearing of disks above and below the fused levels, donor bone graft site pains, pseudoarthrosis, and high cost.

In our study we suggest an alternative to spinal fusion – namely, functional disk replacement. The most common indication for artificial disk replacement is disk degeneration and post-discectomy syndrome. Instability and metabolic bone diseases are contraindications for the procedure. The clinical outcome of artificial disk replacement was assessed by comparing presurgical with follow-up data, using the Oswestry questionnaire and the visual pain analogue scale

Our results show that the ability of artificial disk replacement to relieve pain is superior to what might be expected from spinal fusion.

Complications such as dislocation of the prosthesis, laceration of the urethra and great vessels, and traction neuritis indicate the importance of the learning curve common to any new technology as

well as the proper training required. In our study the proportion of satisfactory results (80%) was higher than that achieved with arthrodesis [3]. Eighty percent of the patients in the present study resumed their preoperative employment. Patients with poor outcomes can be treated with spinal fusion without removing the artificial disk. In our study the Charité SB prosthesis provided a range of motion of 3–9° in flexion extension.

Since degenerated facet joints might become painful after disk replacement, young adults are the best candidates for the procedure. Osteoporosis in older patients may increase the risk of implant subsidence [4]. An incorrect surgical indication appeared to be the main cause of failure.

Prospective randomized studies with longer follow-up have been conducted [5] to assess whether the clinical results in patients with prosthesis are as good as those in arthrodesis patients and whether there are fewer adverse effects at the adjacent non-operated levels. There is no doubt that artificial disks – both lumbar and cervical – will be the modality of the future.

## References

1. Fernström U. Arthroplasty with intercorporeal endo prosthesis in herniated disc and in painful disc. *Acta Chir Scand [Suppl]* 1966;355: 154–9.
2. Büttner-Janzen, Schellnack K., Zippel H. Biomechanics of the SB Charité lumbar intervertebral disc endo prosthesis. *Int Orthop* 1989;13:173–6.
3. Stauffer RN, Coventry MB. Postero lateral lumbar spine fusion, *J Bone Joint Surg (Am)* 1972;1:1195–204.
4. David T. Lumbar disc prosthesis. *Eur Spine J* 1993;1:254–9.
5. David T. 10 years follow up to the SB Charité prosthesis. *Orthop Today* 1999;2:6.

**Correspondence:** Dr. I. Caspi, Dept. of Orthopedics B, Sheba Medical Center, Tel Hashomer 52621, Israel.

Phone: (972-9) 771-5815

Fax: (972-9) 774-4043

email: caspid@internet-zahav.net