

**Title**

**TREATMENT OF DEGENERATIVE DISC  
DISEASE, WITH LUMBAR DISC  
HERNIATION- COMPARATIVE ANALYSIS  
WITH AND WITHOUT  
“B-TWIN EXPANDABLE TITANIUM  
STAND ALONE INTERBODY FUSION.”**

by,

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## Introduction

*This paper is a comparative study of 3 treatment modalities for Degenerative Disc Disease (DDD) with disc prolapse. B twin expandable cages allow minimally invasive access for interbody fusion.*

**Degenerative disc disease** is defined as clinically symptomatic condition without new injury, in which a physiological load induces abnormally large deformations at the intervertebral joint <sup>1, 2</sup>. It is manifested as a progressive collapse of the disc space, hypertrophied ligamentum flavum and posterior longitudinal ligament. This consequently causes narrowing of the intervertebral space leading to subluxation and facet joint arthritis <sup>2, 3</sup>. This causes instability of the segment leading to discogenic and/or facet induced pain, and compressive radiculopathy.<sup>3</sup>

**Degenerative disc disease** refers to a syndrome in which a compromised disc causes back pain. It causes slow disc space prolapse, simultaneous discogenic/facet induced pain, and compressive radiculopathy. DDD usually starts with a torsional (twisting) injury to the lower back, such as when a person rotates to put something on a shelf or swing a golf club. However, the pain is also frequently caused by simple wear and tear on the spine.

Despite its rather dramatic label, degenerative disc disease is fairly common, and it is estimated that at least 30% of people aged 30-50 years, will have some degree of disc space degeneration, although not all will have pain or ever receive a formal diagnosis. In fact, beyond 60 years of age, some level of disc degeneration is deemed to be a normal finding, not the exception.

### **Causes of Degenerative Disc Disease:**

Degenerative disc disease can result from trauma (either acute or chronic/repetitive), infection, or the natural processes of aging. It can euphemistically be referred to as the- grey hairs of the spine!

It is one of the most common causes of low back pain.

DDD with or without disc prolapse, commonly presents with:

### **Symptoms:**

- Varying degree of low back pain
- Stiffness in the back
- Restricted activities
- Radiculopathy (if the disc is prolapsed) and there is a nerve root impingement
- Bladder or bowel involvement (rarely)
- Calf pain

### **Signs:**

- Positive SLR (Lasegue sign)
- Quadriceps, Hip adductors weakness (L3-4 disc herniation )
- Absent or diminished knee-jerk (L3-4 disc herniation )
- Extensor Hallucis Longus weakness( L4-5 disc Herniation)
- Extensor Digitorum Longus Weakness( L4-5 disc Herniation)
- Absent or diminished ankle jerk ( L5-S1 disc Herniation)
- Peroneus longus and brevis, gastrocnemius-soleus, gluteus maximus weakness ( L5-S1 disc herniation) <sup>1</sup>

### **Investigations:**

- X-Ray- look for intervertebral disc height, end plate sclerosis, subchondral cyst, listhesis if any and facet joint arthritis (at the affected level)
- Osteophytes
- MRI show black, dehydrated disc with or without prolapse

### **Diagnosis:**

Symptoms, signs, X-ray and the MRI are the chief diagnostic tools for this condition.

Many patients suffering with low back pain, and diagnosed with degenerative disc disease are left wondering exactly what this diagnosis means for them.

Common questions that are often on patient's minds' include:

- If I have low back pain from degenerative disc disease in my thirties, how much worse will it become with age?
- Would the degenerative disc disease become a crippling condition? Will I end up in a wheelchair?
- Am I required to restrict my activities?

### **Treatment of Degenerative Disc Disease:**

The primary line of treatment for DDD is conservative management by NSAID's, bed rest, and physiotherapy. Physiotherapy includes para-spinal, gluteal, and abdominal muscle strengthening exercises; short wave diathermy; and Transcutaneous Electrical Nerve Stimulation.<sup>1</sup>

If the patient does not find any symptomatic relief with conservative treatment, then the patient qualifies for one of the following surgical interventions:

### **A. Microlumbar Discectomy**

### **B. Posterior Lumbar Interbody Fusion (PLIF)**

### **C. PLIF with B twin ESS**

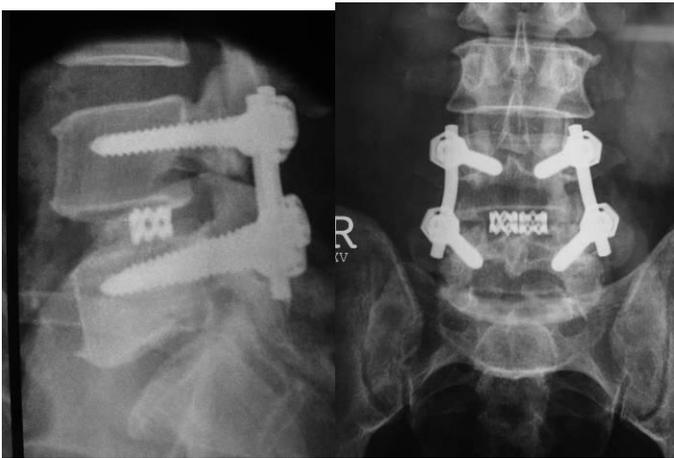
Surgical intervention allows re-expansion of the disc space and stabilization of the affected segment in balanced alignment thus establishing normal intervertebral height.

#### A. Micro Lumbar Discectomy<sup>6, 7, 18:</sup>

- Patient Position: Prone on a bolster
- Incision: Localize the level of affection with an image intensifier. Make an incision of 3 cm
- Sub periostially dissect the paraspinal muscles with the cautery, over the affected side
- Apply a specially made micro-lumbar retractor
- Expose the laminae, interlaminar space, and the medial edge of the facet joint without disturbing the normal anatomy of the interspinous ligament
- This is followed by flavectomy to visualize cauda-equina
- Identify the root from the cauda-equina
- Apply a special double-angled nerve root retractor to adduct the nerve root
- With a number 4 dura and patty, carry out a blunt dissection around the affected disc level
- The prolapsed disc is now visualized
- It could be of 2 types:
  - Disc Bulge

- Sequestered Disc Fragment <sup>16</sup>
- Extract the affected disc with a disc forcep
- Use an angled probe to check any migrated sequestered fragments
- Maintain haemostasis
- Close the incision in a usual manner

### B. Posterior Lumbar Interbody Fusion (PLIF) <sup>12, 15</sup>:



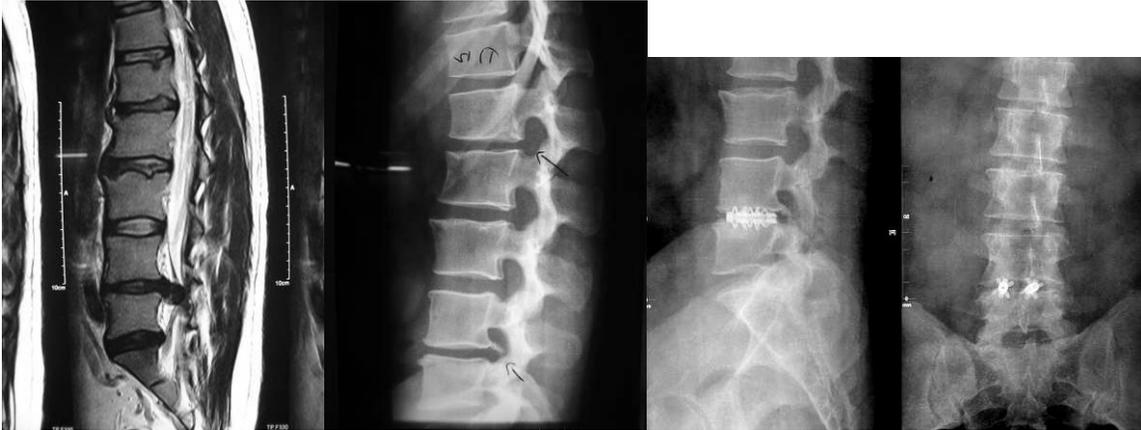
- Patient Position: Prone on a bolster
- Incision: Localize the level of affection with an image intensifier. Make an incision of 20 cm
- Sub periostially dissect the paraspinal muscles with the cautery, bilaterally
- Apply posterior spinal retractors
- Expose the laminae (one above and one below the affected level), interlaminar space, and the facet joints
- Perform lateral dissection till the transverse process is felt
- Perform wide laminectomy and decompress the nerve root canal on the symptomatic side.
- If possible preserve the facet joint
  - This prevents instability of the spinal column

- Locate the entry point of the upper pedicle with a candle stick and confirm with an image intensifier(IITV) ( AP and Lateral view)
- Prepare a screw holes in the pedicle with an appropriate size tap and insert the pedicular screws
- Repeat the same procedure on the opposite side
- Perform discectomy and end plate curettage <sup>16</sup>
- Fill the disc space with an autograft taken from the iliac crest or spinous process, keeping enough place for the mesh cages.
- Fill the pair of mesh cages with autograft
- Hammer the cages<sup>14</sup> into the disc space from either side under vision without damaging the surrounding structures
- Confirm the depth on IITV
- Connect the assembly with a connecting rod on either side
- At this stage connecting rods can be bent to maintain lumbar lordosis
- At this stage the disc space is distracted to achieve stability and maintain the disc space height
- Maintain haemostasis
- Close the incision in usual manner

### C. Interbody Fusion with B-Twin ESS <sup>19</sup>:

Interbody fusion with B Twin expandable cage is a recent advancement in the surgical treatment of DDD with or without disc prolapse.

The B-Twin ESS is made of titanium. When collapsed the fins are enclosed in a cylinder with a diameter of 5 mm. Following expansion the cage is 15 mm in diameter and 25mm in length. The final configuration is trapezoid. There are three available sizes 9.5 / 11, 11.5 / 13, & 13.5 / 15. The selection is made pre op and confirmed intra operatively. At the end of the procedure the device self locks. The delivery system can be used only once. It is introduced into the intervertebral space bilaterally and then expanded.



- Patient Position: Prone on a bolster
- Incision: Localize the level of affection with an image intensifier. Make an incision of 10 cm
- Sub periostially dissect the paraspinal muscles with the cautery, bilaterally
- Apply a specially made retractors
- Expose the laminae (one above and one below the affected level), interlaminar space, and the entire facet joint
- Perform bilateral laminectomy and decompress the nerve root canal on the symptomatic side.
- Preserve the facet joint
  - This is a crucial step in this surgery. Preserving the facet joint is a must because a pedicular screw will not be inserted in this case. Thus, the posterior stability of the spinal column is maintained.
- Perform discectomy
- End plate curettage<sup>16</sup> is performed with special curettes till it bleeds
- Fill the intervertebral disc space with minced iliac crest or spinous process bone autograft through a 5 mm diameter funnel.
- Insert the B twin ESS applicator from either side and expand the cage one by one.



Before expansion



after expansion

- Monitor both stages on IITV
- No hammering is involved
- Maintain haemostasis
- Close the incision in usual manner
- It can be supplemented with intertransverse autograft or pedicular screws for the surgical treatment of spondylolisthesis.

### **Materials and Methods**

We did a comparative analysis of 45 surgical interventions for DDD. The purpose of this study is to compare these conventional modalities with a minimally invasive stand alone instrumented fusion using “B-Twin Expandable Titanium Spacer” as an extension of the micro-lumbar discectomy.

### **Case Study**

- 45 patients (M= 25, F=20 )
- Age group of patients: 30-50 years
- Presented with radiculopathy and axial back pain
- Post- failure of conservative treatment
- MRI shows degenerative changes at symptomatic disc level with or without degeneration at adjacent levels

45 patients between the ages of 25-50 years who presented with significant leg symptoms and axial back pain, not responding to conservative treatment were

analyzed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) <sup>5</sup>

Patients who presented exclusively with compressive radiculopathy, and no or mild back pain, MLD was the choice of treatment. PLIF or B Twin ESS is the choice of treatment, in patients with significant back pain, and compressive radiculopathy. B Twin ESS is an expensive procedure. Non-affording patients essentially chose conventional PLIF over B Twin ESS.

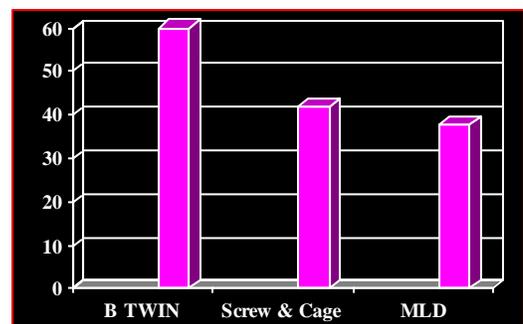
All patients had MRI evidence of Modic Type II degenerative changes at the symptomatic disc with or without degeneration at adjacent levels. All patients had clinico-radiological correlation as regards the side, site and level of disc herniation. Provocative discography was not done in any of these patients.

15 patients underwent unilateral micro-lumbar discectomy, 15 patients underwent in addition a biportal “B-Twin Expandable Titanium Spacer Fusion” with local corticocancellous non-structural autograft plus optional bone substitute, and 15 patients underwent conventional open posterior decompression with instrumented interbody fusion with pedicular screws and titanium mesh cages.

**Outcome:**

- Oswestry Disability Index (ODI) <sup>5</sup>

At 12 months more patients with B-Twin ESS had improvement in ODI Scores over other methods



- Visual Analogue Scale (VAS)

At 12 months

B-TWIN = 42% improvement

PLIF with screw & cages = 37% improvement

MLD = 32% improvement.



**Follow-Up:** Post surgically, follow-up was requested for 1 year. 43 patients completed this follow up. 2 patients, lost follow up after 6 months.

**Results:** The study was closed after 1 year.

	MLD	PLIF	B-TWIN
Incision	3 cm	20 cm	15 cm
Surgical Time	45 minutes	2 hours	1.5 hours
Blood Loss	10-20 cc	100-200 cc	50-100 cc
Superficial wound infection	1	0	0
Deep wound infection	nil	nil	nil
Length of Hospital Stay	1-2 days	5-7 days	2-3 days
Recovery	a. Complete relief from leg pain b. Back pain may persist	Complete relief from leg and back pain	Complete relief from leg and back pain
Lordosis	Remains undisturbed	Compromised	Maintained
Dural laceration	Nil	Nil	Nil
Epidural bleeding and fibrosis <sup>9</sup>	Nil	Significant	Nil
Implant failure	NA	Nil	Nil
Disc Space Height	Unchanged	Increased from 7 mm to 11 mm without maintaining normal lumbar lordosis	Increased from 7mm to 11mm with maintaining normal lumbar lordosis.
Subsidence	NA	1 to 1.5mm at the end of 1 year	0.7 to 1mm at the end of 1 year

## **Analysis and Discussion**

Micro-lumbar discectomy alone gives excellent resolution of leg symptoms (compressive radiculopathy) <sup>3</sup> the protruding disc fragment, which is irritating the cauda or the root, is decompressed during MLD. Therefore, removal of this fragment gives immediate relief to the patient.

However, some patients with DDD may present with, radiculopathy with significant back pain. In these patients, there exists not only the protruding disc but there are arthritic changes at the corresponding level leading to significant back pain. A micro-lumbar discectomy cannot relieve the back pain because the arthritic segment, which is the primary cause of the back pain, remains untouched.

In these individuals, who are further not willing for a major lifestyle or vocational change, while MLD can take care of the leg symptoms, it is not the right choice of treatment because they will continue to have back pain. To achieve the desired results, conventional PLIF or B TWIN ESS should be the choice of treatment.

Conventional PLIF<sup>15</sup> requires the use of a twin cage device<sup>14</sup> with pedicular screws, the size of which is determined pre-operatively. The introduction of this cage into the disc space involves wide exposure and complete or partial facetectomy. The procedure also results in significant handling of dural sac<sup>17</sup> and the cauda equina. This creates a potential for neurological damage <sup>8,9</sup>

With the advent of B Twin ESS, the benefits of B TWIN ESS over the conventional PLIF are comparable

In the last option i.e. interbody fusion with B Twin ESS<sup>4, 13</sup>, with a minimally invasive approach (5mm portal) interbody fusion is carried out after standard decompression with preservation of facet joint and annulus fibrosus.

B Twin ESS being a lordotic cage, which means, if the size of the chosen cage is 11.5/13, this indicates when fully expanded the height of cage anteriorly is 13mm

and posteriorly is 11.5mm **(Figure)** so it maintains the lordosis of the lumbar spine. In PLIF, the mesh cages are flat and do not maintain the lordosis of the spine in the long term.



Compare the anterior and posterior diameter.

Implant subsidence (penetration of the end plate by the implant), in case of B Twin ESS is 0.5 mm at the end of one year. In PLIF, this is as much as 1.2 mm. Thus B Twin ESS maintains better stability of the construct.

The fins of BTwin ESS<sup>4, 13</sup> get engaged in the end plates, which prevents migration of the cage. This further enhances the stability of the construct. This stability provided by the B Twin or PLIF is directly related to the condition of the bone. It is logical that the osteoporotic bone will have higher subsidence rates irrespective of the device. Moreover, meticulous curettage of the nucleus, rather than installation of the device within a reamed channel, was suggested to promote fusion<sup>10</sup>

Additional use of pedicular screws and rods is optional and may be used to correct spondylolisthesis.



Conventional open instrumented fusion with screws and mesh cages has good results but have the increased risk of complications associated with longer surgery and excessive nerve root retraction which is almost nil when we use stand alone B twin ESS.

We would emphasize that the cardinal merit of the B Twin ESS is the relative freedom from complications as recounted above. Although PLIF per se has established itself as the surgical approach of choice, its record of complications has been puzzling. A recent review reported major complications in 45% of the cases and repeated operations in 25–40%.<sup>10,11</sup> PLIF using the B-twin ESS has thus far achieved as good a clinical outcome as the preceding variants of the method; and, in sharp contrast to the latter, virtually no complications have occurred.

### **Conclusions and Recommendations**

The “B-Twin” ESS stand alone fusion for DDD with disc herniation is an excellent minimally invasive mid-path regime in the treatment of DDD with lumbar disc herniation. PLIF using B twin ESS achieves ultimate outcome comparable to other devices but does not share the handicaps and hazards.

It is the most user-friendly system.

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