1. Introduction:

Pain is the foregoing symptom of the patient whose disc degeneration deforms gradually. This patient is neurologically intact but the back ache or the pain radiating to the legs often disturbs him. In fact, pain is a symptom of a degenerative process. Pain in this process has more than one source. Rupture of the disc capsule, mechanical nosiception, stimulation of the nerve root at the epidural space by the intradicsal chemical substance (chemical nosiception), relaxation of the ligamentous connections of the vertebrae because of instability, erosion of the cartilage of the facet articulations or rupture of the joint capsule, rupture of the interspinous or supraspinous ligaments are all known as pain sources for these patients (1-4).

Dr. Henry Graff (5) from Belgium was the first to use the concept of ‘Dynamic Stabilization’ in 1980’s, he claimed that in chronic instability, fusion surgery is not necessary, but just simple stabilization of the vertebral column aiming to carry the load is sufficient. He explained that lumbar back pain can be relieved by supporting or correcting the tension band of the posterior column with the help of a posterior ligament system.

Biomechanical experiments prove that all the mentioned systems correct axial loading on the spinal column, normalize the neutral zone and supply a stabilization force close to those of the rigid systems (6). But concerning the Graff tension bands, because the posterior column is stabilized under compression, foraminal stenosis is inevitable. Nevertheless, they cause posterior annular bulging and as a result, spinal stenosis is expected. The Dynesis system (Zimmer Spine Inc. Warsaw, IN) was than invented as a result of these disadvantages (7,8). In this system, a spacer is located around the tension band to prevent the excessive compression. But a disadvantage of this system is that, there is no standardization for the tension force of the band.

It was Dr Strempel’s idea to place a joint between the screw’s head and stem (Cosmic, Ulrich AG, Germany) (9). This is the concept of the dynamic screw. Originally, this device was designed to facilitate fusion. But after a follow up period of the patients, it was realized that; although the pseudoarthrosis ratio is high with this system, the complaints of the patients improved. So, spine surgeons started using this system without fusion. Biomechanically, the dynamic and the rigid systems supply almost the same stabilization strength.

With the posterior transpedicular dynamic stabilisation systems (PTPDS), while the posterior tension band is functioning perfectly, the vertebral segmental motion is not eliminated. Ideally, it is best to use the rigid rod and dynamic screw system for stabilization of one motion segment. Using these systems for more than one motion segment may result to eliminate their dynamic property and thus, they gain the character of rigid systems. For this reason, it is ideal to use dynamic rod and dynamic screw combination for more than two motion segments. The follow up of our patients operated with this combination possess fair outcomes (10).

Intervertebral artificial disc prostheses, disc cushions, nucleus pulposus supporters are among the dynamic stabilisation devices for the anterior column. Interspinous supporters and PTPDS are the dynamic systems for the posterior column. PTPDS can be catagorized in three subgroups.

- Stabilization via rigid rod and dynamic pedicular screw;
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- Stabilization via dynamic rod and dynamic pedicular screw.

Lumbar dynamic stabilization is one of the promising spinal surgical techniques. With the aim of this system, the ratio of the spinal fusion surgery will lessen by time; while the morbidity and mortality due to fusion are going to decrease, the surgeon and patient satisfaction will increase considerably.

2. Indications:
The indications of this system are:
- Discogenic pain, recurrent disc hernias, degenerative antero and retro spondylolisthesis, lumbar spinal stenosis.

3. Contraindications:
There are no specific contraindications for this system except general medical vital problems.

4. Surgical Technique:
4.a. Surgical Equipment:
C-arm fluoroscopy, operating table suitable for spine surgery, operating microscope, high speed drill and transpedicular dynamic stabilization instruments are essential for surgical procedure (Figure 1a, 1b). It will be better to support the surgery with neuro monitoring recordings systems.

4.b. Operating Room Set-up:
The prone position of the patient is preferred and the C-arm and monitor are placed according to the localization of the surgeon. It will be better if the video and C-arm monitors are placed on the opposite side of the surgeon. The assistant is located opposite to the surgeon and the nurse is at the caudal of the patient (Figure 2).

4.c. Patient Positioning:
The patient was brought to the operation room, then, pre-operative evaluation was performed following the induction of general anesthesia. Prone position was given to the patient on the operating table. The level of the PTPDS is signed with the C-arm before medical clearance and sterile covering (Figure 3).

4.d. Surgical Technique:
After the determination of pathology level under C-arm, bilateral 3 cm length stab incision or 1.5 cm incision for each screw was made 3 cm off midline. First, under the AP and lateral fluoroscopic guidance, the pedicle is identified and the guide wire is inserted into the marked pedicle. With a special apparatus, the grooved screws are placed through the guide wire. The screw driver is slided on the guide wire and the screw is inserted into the vertebra corpus through the pedicle under AP and lateral fluoroscopy (Figure 4a, b,c,d). The same procedure is applied for the caudal and cranial pedicles under AP and lateral fluoroscopy (Figure 4e,f). After the insertion of unilateral screws, the opposite side located surgeon performs the same procedures to the opposite side pedicles under AP and lateral fluoroscopy (Figure 4g,h,i).

Than, the guide wire is taken out and the system is locked. The rod is placed by using the screw guide and the screws are connected to the rod (Figure 4j). Finally, the whole application system is discharged.

The hemostasis should be obtained with a bipolar cautery and a gentle tamponade with thrombin soaked gel-foam pledges. After the irrigation of area, use of epidural morphine paste or similar cocktails may help to reduce postoperative pain and allow for more rapid recovery and ambulation. A routine closure of the fascia and skin is performed after removing the PTPDS systems.
There is no need to use a drain if we ensure from the hemostasis. The fascia is closed with reabsorbable 0-Vicryl stitches and it is continued with 3-0 Vicryl stitches for subcutaneous layer after the injection of marcain (0.25%). Either Steri-Strips® or Dermabond® can be used to cover the skin. These materials may keep the skin edges closely with their waterproof barrier specialty for a 7- to 10-day period.

5. Postoperative Care:

The patient is returned to the supine position and taken to the post-anesthesia recovery unit after awakening from anesthesia. A muscle relaxant and non-steroidal anti-inflammatories are given systematically. The patients are allowed to mobilize and rehabilitation in the following hours after surgery to relax the paravertebral muscles. The patients may be discharged the day after surgery. Depending on their pre-operative medications, patients undergoing PTPDS may be discharged on a combination of muscle relaxant, and non-steroidal anti-inflammatories. The patient may return his job in 2 weeks after surgery.
Figure 4a,b,c,d: With a special apparatus, the grooved screws are placed through the guide wire. The screw driver is slided on the guide wire and the screw is inserted into the vertebra corpus through the pedicle under AP and lateral fluoroscopy.

Figure 4e,f: The same procedure is applied for the caudal and cranial pedicles under AP and lateral fluoroscopy.

Figure 4g,h,i: After the insertion of unilateral screws, the opposite side located surgeon performs the same procedures to the opposite side pedicles under AP and lateral fluoroscopy.

Figure 4j: The guide wire is taken out and the system is locked. The rod is placed by using the screw guide and the screws are connected to the rod. Finally, the whole application system is discharged.
6. Complications and Avoidance:

Neural injury may occur due to the removal of bone structures and disc fragments. Penetration of instruments may cause to contusion of neural structures. These kinds of spinal cord injuries may result with paraplegia, monoplegia or monoparasia. Iliac artery, ven and ureter injuries may occur due to the removal of disc fragments. More practice with cadavers, advance anatomy education and familiar to the instruments may decrease these complications before starting the PTPDS.

Caring on the sterilisation of the operation sets, instruments and operation area may prevent the deep paraspinous, epidural or superficial wound infection. The hemostasis before removing the PTPDS systems may prevent the postoperative hematoma. The occurrence of cerebrospinal fluid (CSF) leakage from a small dural tear may be treated with fibrin glue, fat or muscle grafts. Direct repair can be necessary for large dural tears and CSF leaks.

7. Case Illustrations:

63 years old male patient was admitted to our department complaining of severe pain during the last 30 days. He was hypertensive and diabetic. Neurologic examination was normal except severe back pain. The radiological images showed L4-5 grade I spondilolistezis and disc degeneration (Figure 5a, b, c, d). Discography was performed L4-5 disc degeneration was shown and pain provocation was positive (Figure 5e).

L4-5 percutaneous dynamic pedicular instrumentation (CosmicMia, Ulrich AG, Germany) was performed to the patient (Figure 5f, g, h). Postoperative course of the patient was uneventful and he was discharged 3 days after the operation.
8. References:


Figure 5:

e) Provocative discography under sagittal CT images, f) Postoperative axial view of the dynamic screws, g,h) Postoperative AP and lateral lumbosacral x-ray graphies of the patient.