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Surgical management of degenerative lumbar spine disorders using Spine semi-rigid (DYNESYS) stabilization system - A study on 25 cases

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Abstract

25 adult patients (Male 10: female 15) operated at spinal unit at District General Hospital using Dynesys System, between 2004 and 2005. All the cases were operated by one consultant surgeon. Mean age of the study group was 52 yrs. (range 24 – 70 yrs.).

Clinical evaluation was based on pre & post operative Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) at fixed interval at 6 weeks, 6 months, 1yr, 2yrs, 5 yrs. and 10yrs. The final ODI score reduced from preoperative 54 to 29 at end of 10 years of post operative follow up. The improvement pattern for ODI score was observed at different interval, which follows a descending (gradual improvement) pattern as 43.0, 38, 32.5 and 29 at 6 wks, 6 months, 1 yr, and 2 yrs, respectively that represents an improvement of 20%, 29%, 40% and 46% and there were no further change in ODI score after 2 to 10yrs of follow up. With regard to complications, we would like to report total 4 (16%) cases, 2 superficial infections, 1 seroma, and 1 case due to technical error (wrong position of S1 screw). Dynesys can be considered as an effective option to rigid stabilization systems, in terms of patient based clinical outcome, and avoidance of complications of rigid system like, screw loosening, fractures of vertebral body, back pain because of loss of lumbar lordosis, morbidity related to bone grafting.

Keywords: Dynesys-semirigid flexible transpedicular spine stabilization system; Rigid fixation- pedicle screw and rod system with fusion; VAS-Visual Analogue Score; ODI score- Oswestry Disability Index score

1. Introduction

DYNESYS is a dynamic non fusion transpedicular system, introduced in the market in 1994^[1]. Traditional decompression with fusion with the help of rigid pedicle screw system has disadvantage of progression of degenerative disease in the disc segments above and below fixation. Dynesys (fig: 1) is a flexible posterior stabilization system that provides an alternative to fusion. It is designed to preserve intersegmental kinematics and alleviate loading of facet joints and thereby preserving articular function Eur spine J, Bordes-Monmeneu M and *et al.* ^[2, 3]. Recent biomechanical evidence suggests that the over all range of motion with Dynesys is less than an intact spine Niosi CA *et al.* ^[4].

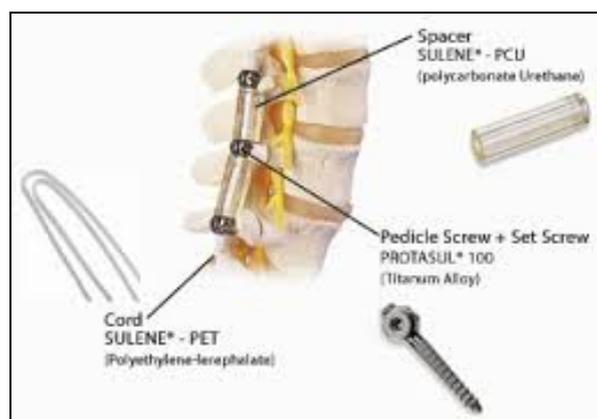


Fig 1: Dynesys fixation

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In the course of degenerative process, during which the segment undergoes various anatomic alterations, there are significant changes in both motion characteristics of and the load distribution across the affected segments Kirkaldy- Willis WH *et al.* [7].

This new system for treating Lumbar degenerative pathology is based on lumbar stabilization and preservation of articular function, as opposed to traditional arthrodesis restrictions. Bordes-Monmeneu M *et al.* [3].

The concept of spinal fusion originally arose from the notion that a degenerated motion segment is often “unstable” or shows “movement abnormalities,” and that accordingly, the elimination of motion in the affected segment would prevent it from undertaking the movements associated with the generation of pain. Recent thinking, however, suggests that the preservation of movement per say may not be the most important factor accounting for the success of fusion. By preserving flexibility of a motion segment (fig: 2) may allows greater physiological function Eur Spine J [6]. Suggestion is that preservation of all movement within fused segments may not only be detrimental to saggital balance and overall function, but also may elicit accelerated degenerative changes in adjacent segments. Although the system now has been in clinical use for almost a decade, there are few studies in literature that report on patient-oriented outcome after Dynesys implantation.



Fig 2: Dynesys fixation to explain flexion and extension (semi rigid)

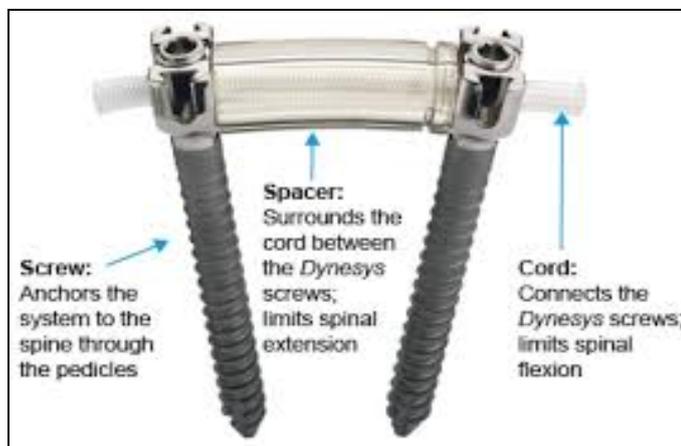


Fig: 3 Dynesys system

Objectives

- 1) To analyze the subjective evaluation and patient oriented outcome of dynamic (semi-rigid) instrumentation on lumbar spine pathology.
- 2) To evaluate complication rate with this system.
- 3) To investigate if a dynamic Spine system can replace the commonly used rigid systems in order to avoid the disadvantages of fusion.

Study design

Retrospective clinical study of consecutive series of 25 cases.

Materials and Methods

This study analyzes series of 25 adult patients (Male 10: female 15) operated at spinal unit at District General Hospital using Dynesys System, between 2004 and 2005. All the cases were operated by one consultant surgeon. Mean age of the study group was 52yrs (range 24 – 70 yrs).

Clinical evaluation was based on pre & post operative Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) at fixed interval at 6 weeks, 6 months, 1yr, 2yrs, 5 yrs and 10yrs. We analyzed the outcome of Dynesys System in different indications like Lumbar stenosis (8 cases), Disc prolapse (9 cases), Spondylolisthesis (5 cases) and with Degenerative Disc Disease (3 cases). 6 patients had pedicle screw fixation of more than two levels.

All patients were investigated with pre & postoperative standard X-ray and MRI of Lumbar spine.

Preoperative evaluation

Preoperative evaluation included patient history, imaging, clinical and neurological evaluation by the treating surgeon.

Surgery

The system consists of pedicle screws made of Ti-Al-Nb forge alloy protasul100. The screws are connected with a polyethylene terephthalate cord that runs in the center cylindrical spacer made of a polycarbonate urethane. By tethering the cord and selecting the appropriate length of the spacer between the screws, segmental distraction or compression may be applied.

The procedure was performed in prone position. A midline approach, with dissection of the erector spinae muscles, provided access to the bony anatomy of the lumbar spine. If indicated decompression of the spinal canal was performed first. Insertion of the pedicle screws was carried out under radiologic control using C-arm. The polycarbonate urethane spacer was cut according to the measured distance between the screws, with the length being chosen to compensate any existing lordosis or kyphosis. The central cord and the spacer were then locked within the screw heads. No postoperative brace was given, and patients were mobilized if safe to do so.

In 40% of cases one level, 36% two levels, 20% three levels and 4%, had four levels fixed.

The most frequent instrumentation was L4-L5, and L5-S1.

Radiological and Clinical follow –up

The first post operative x-rays were examined and any technical error or other complications were documented.

Results

All patients were evaluated up to 10 years after surgery. The results were analyzed based of the clinical scores of VAS& ODI system and also study of complications by analyzing the X ray and MRI as indicated.

Regarding VAS scoring system we considered VAS for Low Back Pain (LBP) and Leg Pain separately for surgical outcome analysis (fig: 4 &

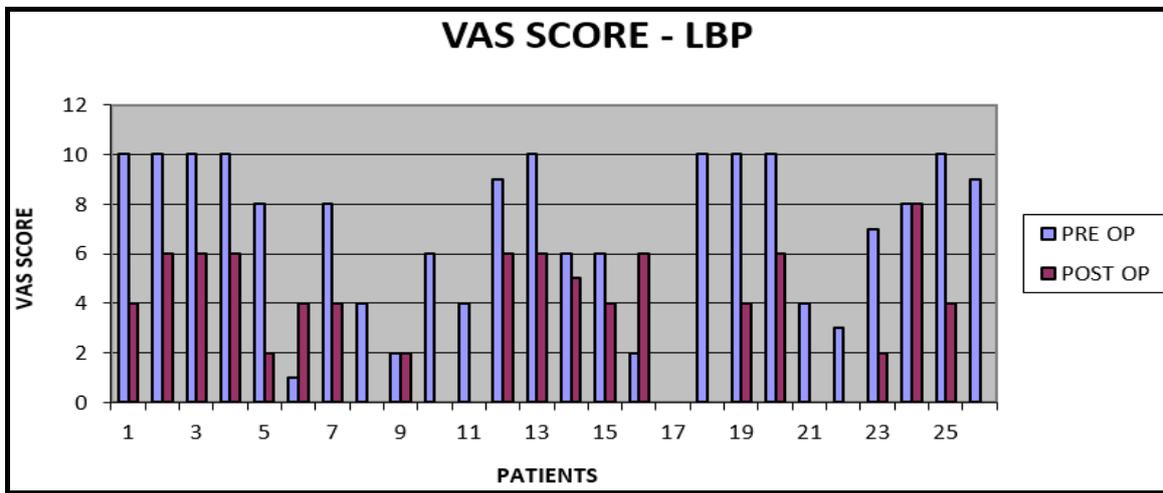


Fig 4: Comparison between VAS pre and post operative period

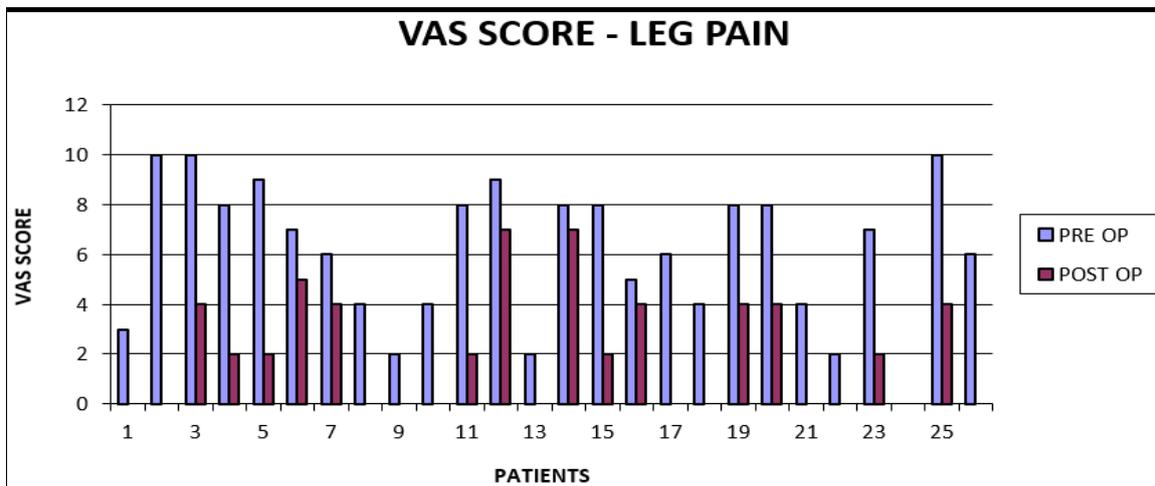


Fig 5: Comparison between VAS – leg pain pre and post operative period

The mean preoperative scores of Visual Analogue Scale for low back Pain was 6.9, and decreased to 3.4 after surgery at end of 24 months follow up and there were no further change in VAS after 2 to 10yrs of follow up.

Similarly mean scores of Visual Analogue Scale for leg pain was decreased from pre op 6.2 to 2.1 at end of 24 months follow up and there were no further change in VAS after 2 to 10yrs of follow up. In two patients out of 25 patients VAS increased compare to preoperative score because of

complication like persistent long-term infection.

The final ODI score reduced from preoperative 54 to 29 at end of 10 years of post operative follow up. The improvement pattern for ODI score was observed at different interval, which follows a descending (gradual improvement) pattern as 43.0, 38, 32.5 and 29 at 6 wks, 6 months, 1 yr, and 2 yrs, respectively that represents an improvement of 20%, 29%, 40% and 46% and there were no further change in ODI score after 2 to 10yrs of follow up (fig: 6).

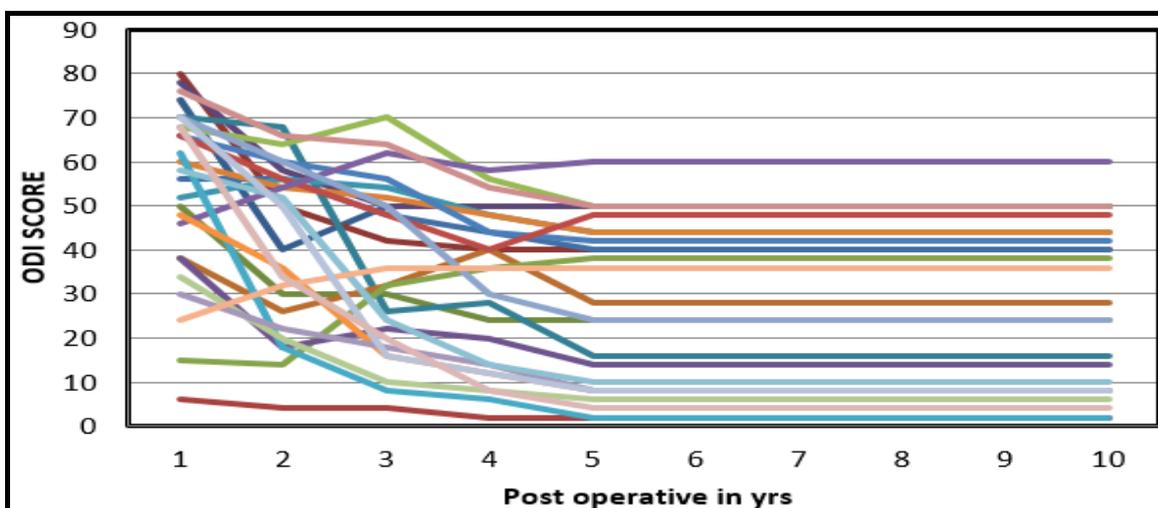


Fig 6: ODI score progress

There was remission of sciatica symptoms and improvement in the claudication pain during follow up. In patients operated for more than two segments of Dynesys fixation the mean ODI score was 52, and 35 preop and post op respectively, which suggests less improvement in clinical outcome when compared with entire study group.

In this study we compared clinical outcome in age group more than 50 yrs (Group A), with those in the age group less than 50 yrs (Group B).

In Group A mean ODI score was 50 and 25, pre and post operative respectively, that suggests >50 % improvement in

clinical outcome.

Similarly in Group B mean ODI Score was 62, and 34, pre and post operative respectively. This suggests there is no age related difference in final clinical outcome in relation to this fixation system.

When analyzing the final outcome in relation to different surgical indications, more than 50% improvement was observed in mean ODI score, from 49 to 21, pre and postop respectively in lumbar instability especially spondylolisthesis and Lumbar canal stenosis (fig: 7).

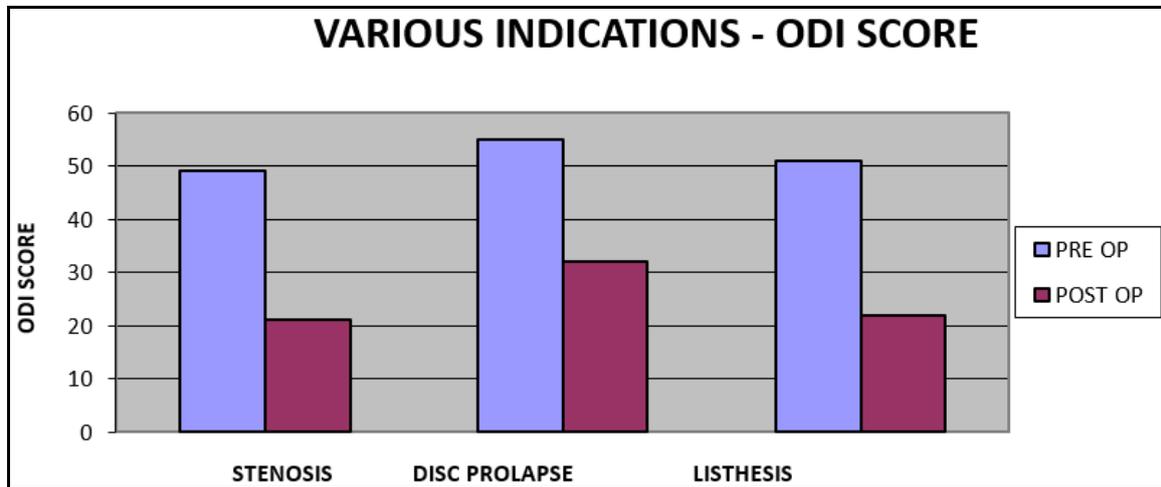


Fig 7: ODI progress with various pathology

Complications

With regard to complications, we would like to report total 4 (16%) cases, 2 superficial infections, 1 seroma, and 1 case due to technical error (wrong position of S1 screw).

Discussion

This study shows that Dynesys instrumentation applied over a short area for various indications including Disc pathology and instability of lumbar spine has significant clinical improvement of both self-assessment and pain score.

From this study we infer that VAS system for back pain and leg pain shows significant improvement in assessment score at 2 yrs follow up and there were no further change in the score after 2 to 10yrs of follow up (fig: 8), using Dynesys system, as a method of dynamic fixation except in some patients, in whom results are not up to expectation because of associated post operative complication like infection and screw malposition.

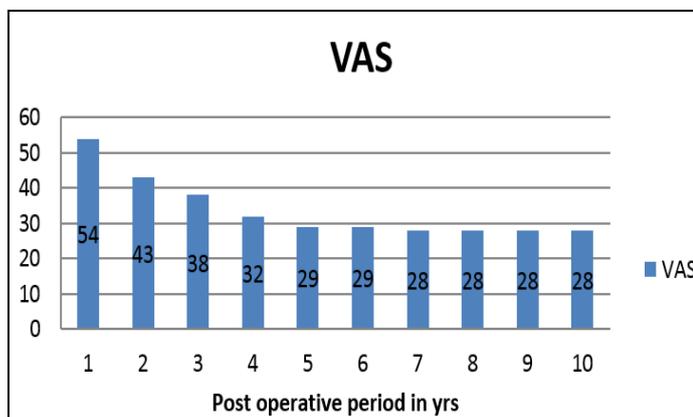


Fig 8: Progress of VAS for post operative period

AS Dynesys is not a rigid method of fixation and fusion, it has been observed that, there is gradual improvement of symptoms and score over a period of two years follow up as per the graph and it remains same for the rest of 10yrs.

The dynamic neutralization obtained using this system, should not be considered as an arthrodesis, but this device has been advocated to achieve more physiological bony fusion. With this system NO bone grafting is necessary therefore donor site morbidity can be avoided¹. Dynesys system maintains enough stability to prevent further progression of spondylolisthesis (instability). Dynesys system in Spondylolisthesis and stenosis, gives similar clinical results as seen in established protocols using decompression and fusion with pedicle screws¹. A dynamic stabilization device has to provide stability throughout its lifetime, unless it activates or allows reparative processes with a reversal of degenerative process.

Even some literature ^[5] supports that dynesys system has limitations in elderly age group with osteoporotic bone with severe segmental macro-instability, from our results we imply that, age group does not affect clinical outcome by using this system of spine stabilization.

Conclusion

Dynesys can be considered as an effective option to rigid stabilization systems, in terms of patient based clinical outcome, and avoidance of complications of rigid system like, screw loosening, fractures of vertebral body, back pain because of loss of lumbar lordosis, morbidity related to bone grafting.

It preserves articular and physiological function, and at same time acts as a load-sharing device, which may allow disc to repair itself. Technically although the system is applied externally, it can be considered as a successful alternative to disc implant.

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