

## Joint Degeneration Cycle: A Novel Educational Model with Degenerative Intervertebral Disc Disease as an Example

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### ABSTRACT

A four-stations educational model is presented for understanding degenerative joint disorders. Using this model in patient education is supposed to bring maximum benefit from all treatment modalities. It could also be used in medical education to alert physicians to the importance of interventions targeting all the stations of the cycle..

**Keywords:** Degenerative spine disorders; arthropathy; patient education; medical education.

### INTRODUCTION

Joint stability is an important part of its function.<sup>1</sup> It depends on the joint integrity, surrounding ligaments, and muscles. The imbalance between the forces involved in the joint function will accelerate its degeneration.<sup>2</sup> The degenerative process involves anatomical arthropathic changes that usually aim at restoring joint stability. These arthropathic changes induce pain and dysfunctions that lead to decreased joint activity leading in turn to weakness and progressive imbalance between the involved forces.<sup>3,4</sup> This cycle represents a "joint degeneration cycle" model that can be applied to all body joints. Understanding this cycle and the therapeutic targets for every station will provide a holistic approach to patient care. The degenerative spine disorder is the given example clarifying the "joint degeneration cycle".

### JOINT DEGENERATION CYCLE (JDC) STATIONS

Degenerative joint disorders share common cycle composed of four stations. (Figure 1)

#### The first station: imbalance:

There is excessive stress due to imbalance between the forces on the joint and the strength of the muscles and ligament surrounding it. (That imbalance can be a result of many modifiable lifestyles issues such as

obesity, inappropriate physical load, lack of physical activity, occupational activities)

#### The second station: anatomical changes:

This results in joint pathological changes. The anatomical changes usually include body reactions that aim at restoring the balance between the forces involved and the joint strength. E.g., osteophytes that represent attempted of joint fixation.

#### The third station: pain and dysfunction:

This naturally decreases the joint activity.

#### The fourth station: progressive joint weakness:

Reluctance to physical activity leads to more muscle weakness which increases the imbalance between the forces on the joint and the muscle power.

This four-station model can be applied to almost all joint degenerative disorders. Understanding this model is very important not only for the physicians who design the treatment plan, but also for patient cooperation during implementing their roles in it.

### EXAMPLE FOR CLARIFICATION: LUMBAR SPINE DEGENERATION

#### The first station:

There's imbalance between the paraspinal muscle strength and forces on the intervertebral joints. The

forces included: patient weight, ordinary activities like sitting and excessive efforts related to work and postural stress.

**The second station:**

This imbalance results in acceleration of joint degeneration leading to anatomical and functional changes.

**The third station:**

The degenerative process is associated with pain either due to neural compression, facet arthropathy, desiccation or instability.

**The fourth station:**

This often leads to the patient’s reluctance to exercise and the tendency to rest to relieve pain. Hence, more weakness which will increase the imbalance between the forces on the spine and the vertebral column structure.

**THERAPEUTIC TARGET FOR EVERY STATION OF THE “JOINT DEGENERATION CYCLE”:**

Importance of understanding the joint cycle being in attention to directing specific procedures to every station of that cycle.

**The first station: prevention:**

The strengthening of the Para articular muscles is an important part of decelerating joint degeneration. On the other hand, reducing the forces involved is also important e.g., weight reduction and in treatment: the diagnosis of the weak muscle is an important part in directing physiotherapy.

**The second station: correction of anatomical abnormalities if applicable:**

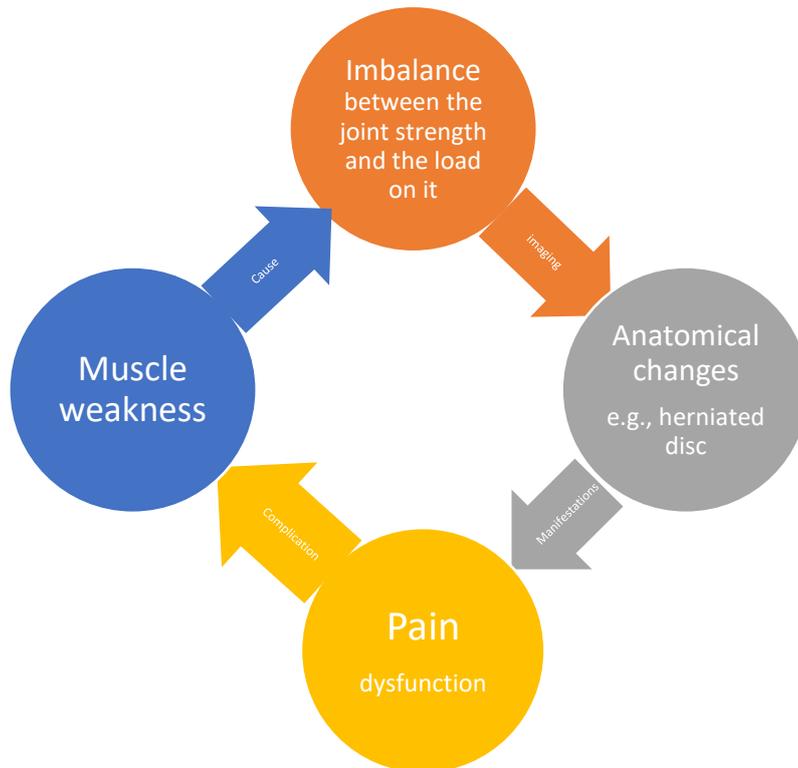
Anatomical and functional changes are usually treated with interventions. E.g. (using different surgical, or endoscopic, techniques of discectomy, fixation, Nucleotomy, etc.

**The third station: pain relief:**

Pain relief is a common practice in degenerative spine disorders and all joint degeneration. Pain therapy represents major part of the conservative treatment of all joint degenerative disorders.

**The fourth station: physiotherapy**

Patient education about the importance of physiotherapy along with the definitive treatment is important to prevent muscle wasting and progressive weakness.



**Fig. 1:** The joint degeneration cycle is composed of four stations. Imbalance, pathological anatomy, manifestations and weakness. Each station has its importance in diagnosis, treatment planning and patient education.

## DISCUSSION

The aim of this model is to provide a comprehensive yet simple method for educational purposes. Many factors are involved in spinal degenerative disorders. Familiarity with all aspects of spinal degenerative diseases requires a long time and practice. This creates a need to design an educational model for preoperative patient education to maximize understanding and assure patient satisfaction. This model seems applicable in all joint degenerative disorders because they share the same common stations.

Spinal degenerative disorders arise from a multifactorial process. The musculoskeletal system and the nervous system contribute to these processes. Patient education is crucial in sustaining success in any treatment modality for spinal degenerative disorders, especially in invasive modalities.<sup>5</sup> Preoperative patient education is essential in the achievement of postoperative patient satisfaction and improving patient reported outcome.<sup>5</sup> In a recent systematic review, the relation between health care providers and patients represented the top predictors of positive outcome.<sup>6</sup> A common language can be generated using the “joint degeneration cycle” model.

The educational model should simplify facts involved in spinal degenerative disorder without any defects in comprehensive information, which will lead to comprehensive treatment. This educational model must fill the gap between surgeon expectations and patient expectations.<sup>7,8</sup>

The “joint degeneration cycle” model is composed of four stations. *The first station* is the imbalance between the forces involved in the joint function and the joint strength and it is the key point in triggering the progression of joint degeneration.<sup>2</sup> The mere presence of manifestations of joint degeneration should be enough to diagnose imbalance.

To restore the balance, focusing on losing weight or changing occupations may be unpractical and usually challenged by socioeconomic factors. Besides, weight reduction is a difficult process with unsustainable results. On the other hand, strengthening the joint through physical exercise may be more applicable. Compared to how challenging it can be to begin a weight-loss program, beginning a physical activity can be challenging. However, physical activity promotes habits and over time, becomes addictive. Fortunately, maintaining a physical exercise routine makes it more durable than anxiety of food deprivation.

Physical exercise is usually applied under the supervision of a physiotherapist or trainer. On the other hand, weight reduction may involve surgical and non-surgical measures, which make it more costly, and time consuming. Occupational changes

and lifestyle modifications may require medical or non-medical interventions.

*The second station* comes when imbalance leads to certain anatomical changes. Some of these changes largely aim at stabilizing the joint against the involved forces e.g., osteophytes and osteoarthritic changes. Other anatomical changes do not e.g., disc prolapse and ligament strain. These anatomical changes are pathological and lead to joint dysfunction and pain. These changes are usually diagnosed by clinical manifestations and imaging. Definitive treatment of anatomical changes usually involves surgical procedures.

*The third station* is reflected by pain and dysfunction that diagnosed clinically. This station is targeted by all pain therapeutic modalities.

*The fourth station* is the progressive weakness which is expected due to patients’ reluctance to move against pain. Hence, pain treatment is essential to allow rehabilitation and maintaining muscle and joint function until the achievement of definitive treatment is intended. Or, to keep the muscle and joint viability for as long as possible in order to give the patient the best chance if the definitive is not possible due to any reason.

Diagnosis must define the four stations in order to provide a comprehensive treatment plan. For example, it is not enough to isolate a herniated disc with nerve root compression from the associated trunk muscle integrity and relation with the involved forces e.g., prolonged setting. Educating the patient about that will help in compliance with the comprehensive treatment plan. And it will increase satisfaction from the surgery for discectomy and nerve root decompression realizing that it is a part of the comprehensive treatment plan and not the only treatment. Accordingly, patient will accept that multiple treatment modalities may be applied for the same patient targeting different stations of the cycle as required.

## CONCLUSION

Understanding the joint degeneration cycle could provide a holistic approach to patient care in all degenerative spine disorders. It could help understanding the role of various interventions and their therapeutic targets within the cycle. This will, also, reduce the conflict between care givers’ advice and clarify the nomenclature.

Conflict of interest : none

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