

## Multi-Level Disc Degeneration in Young Individuals - A Prospective MRI Study of 100 Computer Professionals

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### Abstract

**Introduction:** Intervertebral disc degeneration has a multifactorial etiology with ageing, mechanical, genetic, toxic and systemic factors. The degenerative trend doesn't correlate well with chronological ageing, as shown in studies that highlight genetic proclivity as the primary etiology.

**Objectives:** To assess the prevalence of multi-level disc degeneration in young individuals (20-40 years) with sedentary work pattern.

**Methods:** Prospective descriptive study (2013 - 2015) was carried out considering only computer professionals who presented with persistent back pain with or without sciatica. Inclusion criteria - 1. significant disc degeneration with Pfirrmann Grade > 3, 2. Multi-Level (> 3) disc degeneration. Patients with spinal instability, infection and previous spinal surgery history, were excluded. All the included patients were assessed for the number of levels, degeneration pattern (contiguous/non-contiguous) and end plate MODIC changes.

**Results:** 18% of professionals (18/100) had > 3 levels of significant disc degeneration. The mean age was 33 years (21 - 40 years). Out of 18 individuals, 7 (38%) were males and 11 (62%), females. 3-level disc degeneration was the most common - 67% (12/18), followed by 4-levels - 28% (5/18) and 5-levels - 5% (1/18). Type 1 Modic endplate changes were noted in 11% (2/18). Contiguous disc degeneration pattern was more common 61% (11/18) compared to non-contiguous - 39% (7/18). 22% (4/18) were smokers, all with a 3-level non-contiguous pattern.

**Conclusion:** Multi-level significant disc degeneration is common even in young individuals who have a sedentary work pattern. Genetic factors may play a major role than repetitive mechanical stress and ageing in determining the degree and level of degeneration.

**Keywords:** Multi-Level Disc Degeneration; Pfirrmann Grading; Computer Professionals

### Introduction

Degenerative disc disease is known to have multi-factorial aetiology which includes genetic, ageing, mechanical, toxic, traumatic and environmental factors [1,2]. Multiple level disc degeneration (MLDD) which is more common in elderly individuals gives a distinct dilemma for the treating surgeon in terms of identifying the symptomatic levels. Often adjuvant diagnostic modalities like discography, electro diagnostic studies, diagnostic neural blocks help in confirming the target levels. This confirmation is of paramount importance, for a surgery in asymptomatic level or failure to identify all symptomatic levels would result in failed back syndrome. Also unwarranted

surgical procedures addressing multiple levels would predispose to adjacent segment degeneration. Therefore it's essential to study the patterns of multi-level disc degeneration to plan treatment strategy.

Pfirschmann grading is a well-established MRI based classification of disc degeneration based on T2 weighted images [1]. Patterns of disc degeneration has not been studied in detail especially in multiple levels. Knowledge about this pattern would help to plan surgical interventions appropriately. Surgeries in symptomatic levels and asymptomatic adjacent levels can be planned or deferred predicting evolution of degeneration according to these patterns.

Computer professionals due to their work nature are prone for chronic neck and back pain [2]. The contribution of disc degeneration to these symptoms have not been studied in detail. The presence of changes in multiple disc levels in young which signifies a genetic contribution needs to be evaluated in detail, for the natural history of progression of degeneration is largely unknown. This study was planned to identify the prevalence of multi-level degeneration in young individual i.e. less than 40 years of age in a single profession – computer based jobs and classify them into distinct patterns.

**Materials and Methods**

This study was planned as a prospective descriptive study for 2 years duration 2013 - 2015. 200 patients who satisfied the following inclusion criteria were considered for this study.

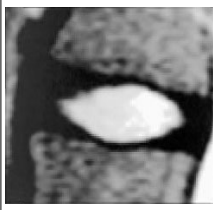
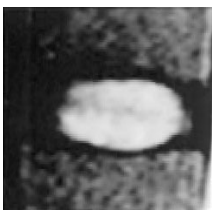



**Inclusion criteria:**

1. Age 21 - 40 years.
2. Low back ache with or without of radiculopathy for more than 6 weeks.
3. Computer professionals with sedentary work style (atleast 6 months duration).

**Exclusion criteria:**

1. Spinal instability.
2. Spinal infection.
3. History of previous spinal surgery.

All the patients who satisfied the inclusion criteria were considered for detailed assessment of degenerative pattern in disc and end plates. Patients with more than Grade 3 degeneration as per Pfirschmann's Grading [1] (Table 1) were considered to have significant degeneration in our study. More than 3 levels of significant degeneration was considered as Multi – level degenerative disc disease (MLDD).

Pfirschmann	Grade I	Grade II	Grade III	Grade IV	Grade V
MRI T2 Sequences					
Structure	Homogenous, white	Inhomogenous, with horizontal band	Inhomogenous, grey	Inhomogenous, gray or black	Inhomogenous, black
Signal Intensity	Hyperintense/ Isointense to CSF	Hyperintense/ Isointense to CSF	Intermediate	Intermediate to hypointense	Hypointense
Distinction of annulus and Nucleus	Clear	Clear	Unclear	Lost	Lost
Height of Disc	Normal	Normal	Normal to slightly decreased	Normal to moderately reduced	Collapsed

**Table 1: Pfirschmann Grading.**

In this sub-group of MLDD, 1) Number of levels of significant degeneration 2) Pattern of distribution as contiguous or non – contiguous involvement and 3) MODIC changes of the end plates were documented carefully by 2 independent surgeons of considerable experience in spine surgery.

Contiguous distribution was categorized into three groups as follows

- TYPE 3
  - TYPE 3A (IVD L1 to L3)
  - TYPE 3B (IVD L2 to L4)
  - TYPE 3C (IVD L3 to L5)
- TYPE 4
- TYPE 4A (IVD L1 to L4)
- TYPE 4B (IVD L2 to L5)
- TYPE 5 (IVD L1 to L5).

People with history of smoking were analysed for distribution pattern of degeneration.

### Results

18% of computer professionals (36/200) had > 3 levels of significant disc degeneration i.e. more than grade 3 pfirrmann degeneration (Figure 1). The mean age was 33 years (21 - 40 years). Out of 36 individuals, 14 (38%) were males and 22 (62%), females (Figure 2).

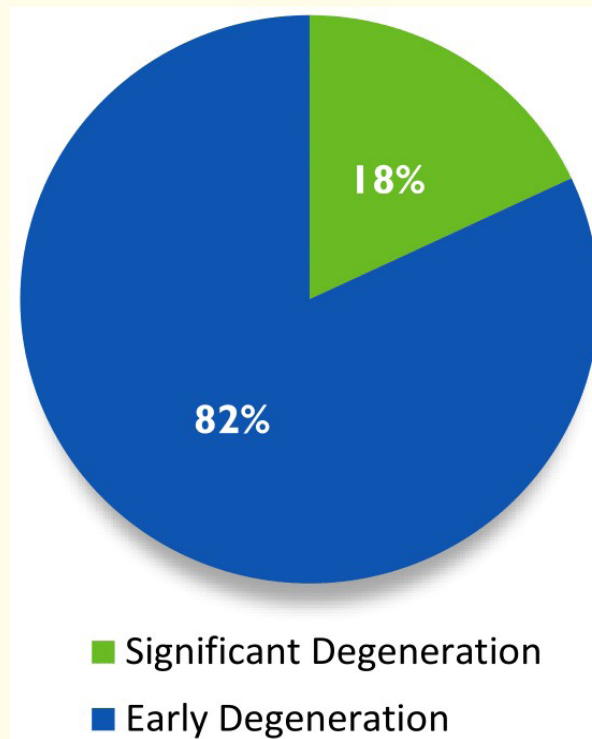
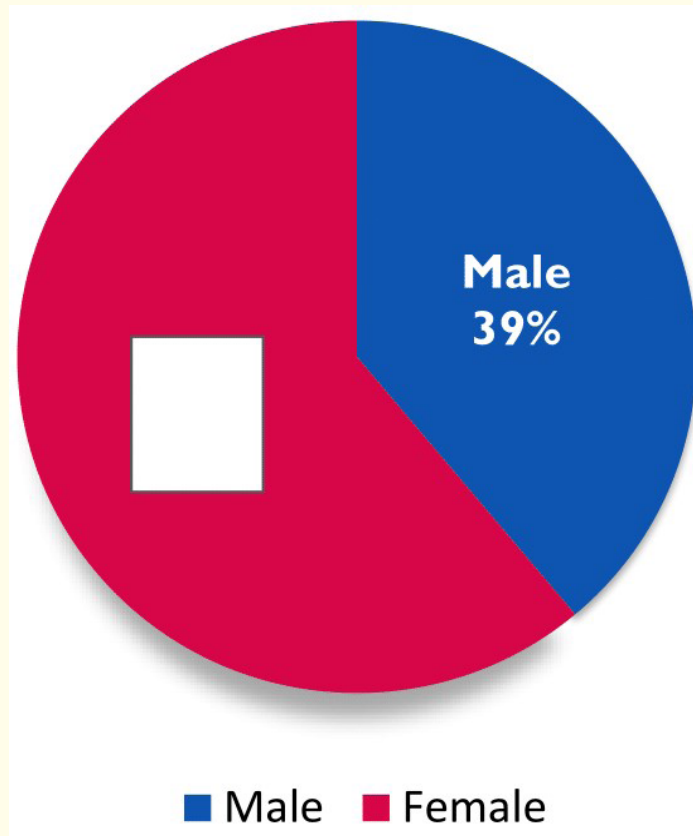


Figure 1: Degeneration.



**Figure 2:** Sex Distribution.

The morphological changes include diffuse bulge in 16/36, unilateral protrusion in 14/36 and annular tear in 6/36 (Table 2).

Morphological change	Frequency	Percentage
Diffuse Bulge	16	44%
Unilateral protrusion	14	39%
Annular tear	6	17%
Total	36	100%

**Table 2:** Morphological Changes.

In the multi-level affection 3-level disc degeneration was the most common - 67% (24/36), followed by 4-levels - 28% (10/36) and 5-levels - 5% (2/36) (Figure 3).

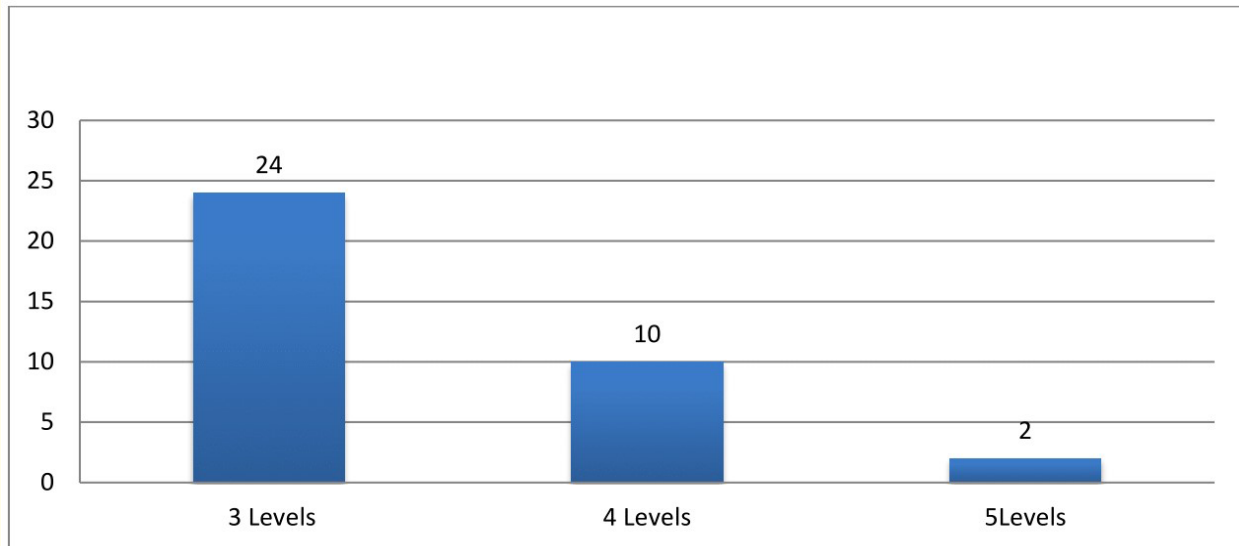


Figure 3: Number of Levels.

Only Type 1 Modic endplate changes were noted in 11% (4/36).

Contiguous disc degeneration pattern was more common 66% (24/36) compared to non-contiguous - 34% (12/36). The most common contiguous pattern was Type 3C -50% (12/24) (Figure 4).

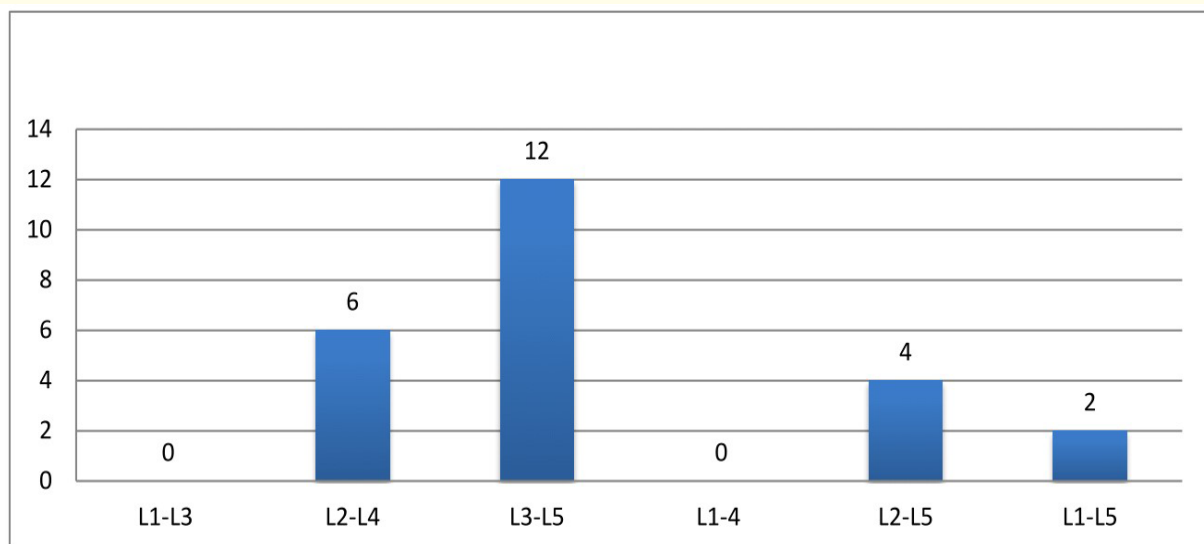


Figure 4: Contiguous levels of degeneration.

22% (8/36) were smokers, all with a 3-level non-contiguous pattern (Figure 5).

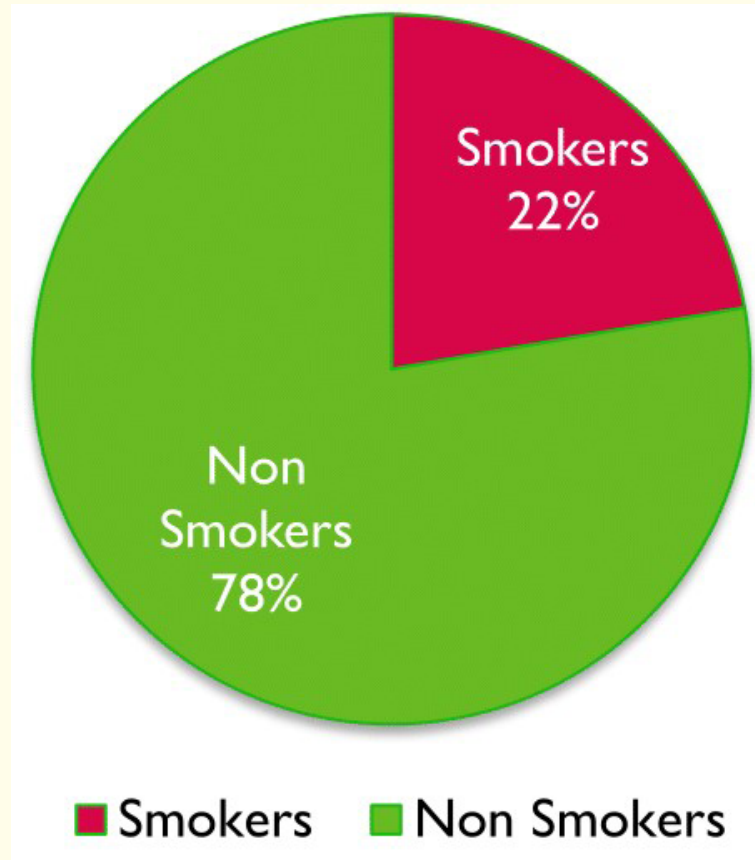


Figure 5: Smokers.

## Discussion

It is well established that intervertebral disc degeneration has a strong genetic basis with contribution from multiple factors like ageing, repetitive trauma and smoking that determines clinical presentation [1,2]. Though the typical age of manifestation of degeneration in the form of disc prolapse, spinal stenosis, degenerative spondylolisthesis varies from 30 years to 60 years of age early presentation is also noted in clinical practice.

Degenerative disc disease (DDD) when present in young individuals (20- 40 years based on WHO criteria) often creates a dilemma for the treating surgeon. Confusion regarding surgical options, tendency to opt for non-fusion techniques, concerns about adjacent segment degeneration, failed back syndromes which may result in permanent altered quality of life are the problems of disc degeneration in young patients [3]. Though MRI is the gold standard investigation tool for chronic low back pain its role in truly identifying symptomatic levels is questioned [4-6]. In spite of disc degeneration being the most common of back pain, other sources like facet joints, ligaments also contribute to variable extent [4,7,8].

Pfirschmann grading of degenerative changes in spine based on T2 weighted sagittal images has a good inter and intra observer reliability [1]. In this study two trained spine surgeons were involved to assess the degenerative pattern to avoid bias.

Work related musculoskeletal disorders occur due to repetitive and prolonged stress to different anatomical sites [9]. It is commonly reported in neck, back and upper extremities [10]. Certain professionals are prone for back pain like computer professionals [2], manual labourers, and health care workers [11]. More than 80% of people who use computers for more than 4 hours report low back pain [2]. Mitchell, *et al.* has shown that modifiable life styles, smoking, high stress, less muscular endurance, greater posterior pelvic rotation in slump sitting and more accurate spinal repositioning in sitting were associated with low back pain [12].

Computer professionals need to work for long duration in sitting posture which usually is stressful. sedentary nature of the job and habits like smoking may predispose these individuals to low back pain. In our study young individuals in the age group 20 - 40 years was chosen to avoid the bias of age related disc changes that may confound the assessment. Even though MRI may not always identify the symptomatic disc degeneration it is the standard investigation to quantify the degenerative changes [5]. Hence MRI was utilised in our study to quantify multilevel disc degeneration.

Among the degenerative pattern 3 level disc degeneration was the most common pattern followed by 4 and 5 level affection. Most common degenerative curve pattern for 3 level disc disease was Type 3C (50%) which involves lower lumbar segments (IVD L3-5). Least common degenerative pattern was Type 5 (IVD L1-5) (8%). The least affected inter vertebral disc was L1/2 (8%) which appeared to be resistant to degeneration.

Among the individuals with multiple level degeneration contiguous pattern was present in 66%. Von Forell, *et al.* have shown that biomechanically contiguous compared to skipped pattern of degeneration tolerated less stress dissipating it to the ligaments, pedicles and facet joints [13]. Low back pain and its severity is more pronounced in contiguous levels of degeneration [14].

Smoking predisposes to intervertebral degeneration by disrupting the extra cellular matrix, down regulating the replication of cells thereby reducing their biosynthesis potential and by constricting vascular network around the disc [15,16]. Cessation of smoking is associated with low back pain confirming its direct association [17]. In our study 8 out of 36 had smoking history and all of them had non-contiguous pattern of disc degeneration.

### Limitations

This study describes the point prevalence of multilevel disc degeneration in young individuals of a particular profession. Professional factors like duration of work, sitting postures, and weight of individuals which can also contribute to low back pain were not included in the assessment which is a limitation of this study along with the limited sample size. Also severity of degeneration and back pain was not correlated in this study.

### Conclusion

18% of young computer professionals present with low back pain due to multilevel disc degeneration (MLDD) which commonly affects three contiguous spinal segments. 50% of disc degeneration as MLDD involves L3 to S1 segments. L1/2 disc appears to be resistant to degenerative changes.

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