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# THE RELATION BETWEEN MODIC CHANGES AND OCCUPATION TYPES IN SYMPTOMATIC YOUNG ADULTS

## *SEMPTOMATİK GENÇ ERİŞKİNLERDE MODIC DEĞİŞİKLİKLER VE MESLEK TÜRLERİ İLE İLİŞKİSİ*

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**SUMMARY:**

**Purpose:** We aimed to study relation between Modic changes and occupational status in symptomatic young adults.

**Materials and Method:** T1 and T2 weighted lumbar MR images of 32 female and 76 male between the ages 20-40 were evaluated for disk degeneration and Modic changes. Average age was 30,99. Patients were divided into three groups according to physical workload; sedentary workers, standing workers and ones with a heavy workload.

**Results:** The prevalence of the Modic changes was 29.62%, while disk degeneration was 45.37%. Type 2 predominance was observed. 94.59% of the Modic changes were observed in the lower lumbar segments. Comparison between occupational groups showed no statistically significant difference.

**Conclusions:** Contribution of this study to literature was the relation between occupational groups and Modic changes, and no significant difference was determined. We concluded that occupation type has no effect on the emergence of Modic changes.

**Key words:** Modic changes, occupation type, young adults, degenerative disk disease.

**Level of evidence:** Cross-sectional clinical study, Level III.

**ÖZET:**

**Amaç:** Semptomatik genç erişkinlerde Modic değişikliklerin meslek tipi ile ilişkisi araştırıldı.

**Materyal ve Metod:** 20-40 yaş arası, 32 kadın ve 76 erkek hastanın T1 ve T2 ağırlıklı lomber MR görüntüleri disk dejenerasyonu ve Modic değişiklikleri açısından değerlendirildi. Ortalama yaş 30.99'du. Hastalar iş yüklerine göre 3 gruba ayrıldı; sedanter çalışan, ayakta çalışan ve ağır işlerde çalışanlar.

**Sonuçlar:** Disk dejenerasyonu %45.37 iken, Modic değişikliklerin prevelansı %29.62 bulundu. Tip 2 hakimiyeti gözlendi. Modic değişikliklerinin %94.59'u alt lomber segmentlerde gözlendi. Meslek grupları kendi aralarında karşılaştırıldığında istatistiksel olarak anlamlı fark saptanmadı.

**Çıkarım:** Bu çalışmanın literatüre katkısı,Modic değişiklikleri ile meslek tipleri arasındaki ilişkinin incelenmesidir ve anlamlı fark saptanmamıştır. Bu çalışma ile bizim çıkarımımız Modic değişikliklerinin gelişiminde meslek türlerinin herhangi bir etkisi olmadığıdır.

**Anahtar kelimeler:** Modic değişiklikleri, meslek tipi, genç erişkin, dejeneratif disk hastalığı.

**Kanıt düzeyi:** Kesitsel klinik çalışma, Düzey III

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## INTRODUCTION:

Non-specific low back pain is the most common cause of pain in young adult population and it's closely related to vertebral endplate changes[7,22,25].

Degenerative disk disease (DDD) related vertebral endplate and subchondral bone changes were defined by De Roos and Modic and Modic classification was made based on MR imaging[4,17,18]. According to that, hypointensity in T1 weighted sequences and hyperintensity in T2 weighted sequences are described as Modic Type 1 lesion and considered as an indicator of active inflammatory process. In Modic Type 2 lesion,hyperintensity in T1 and T2 weighted sequences signify fatty degeneration of bone marrow with a more chronical process. Type 3 lesion described later is characterized by hypointensity in both sequences that are due to subchondral bone sclerosis[18].

Degenerative disk disease and Modic changes might increase with age but it has also been reported in various rates for young adult patients[16,23,24].

In this study, degenerated disk disease and distribution of Modic changes has been investigated by MR imaging for young adult symptomatic patients between the ages 20-40.

## MATERIALS AND METHOD:

In this cross-sectional study, Modic changes and disk degeneration presence (and their localization) for patients between the ages 20-40 with complaints of low back pain and sciatalgia was examined with the MRI and they were distributed in terms of age, gender and occupational groups (Table-1).

108 patients (76 male and 32 female between the ages 20-40; average 30,99) with back pain for more than three weeks, who has never had a surgical operation were included to the study. Patients who has a lumbar trauma story, scoliosis or spondylodiscitis were excluded.

In the study, 540 disk levels and adjacent endplates located in L1-S1 area were scanned by 1.5 T MRI with 4mm thick sections. T1 and T2 sagittal sequences and T2 axial sequences were examined. Radiological evaluation was made by an experienced orthopedist without the knowledge of clinical story. Disk degeneration was classified and recorded as; without signal change (grade-0), slight signal lose in nucleus in T2 sections (grade-1), hypointense nucleus with normal disk height (grade-2) and hypointense nucleus pulposus with decreased disk height (garde-3)[3]. Disk levels determined as grade 2 and 3 were added to calculation as degenerative disk. Same sections were also evaluated according to Modic classification and recorded as Type-1, Type-2 and Type-3 [17,18].

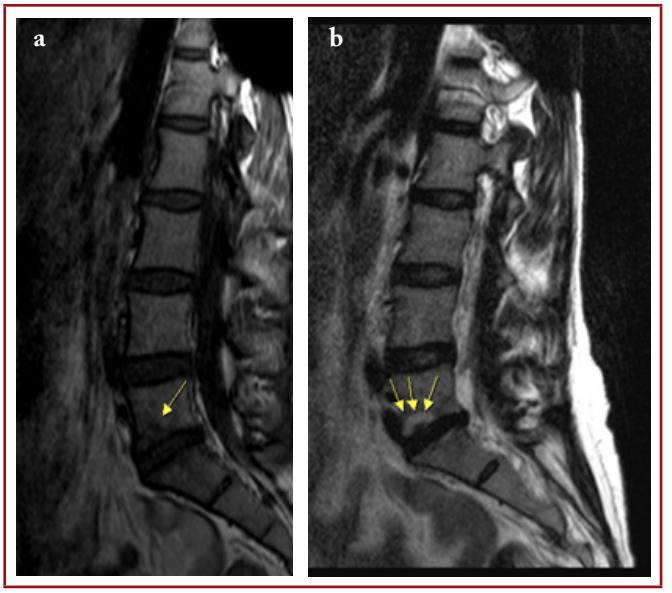


**Figure-1.** 33 years old female, **a)** T1WI shows hypointensity and **b)** T2WI shows hyperintensity in L5 vertebra


**Figure-2. 32** years old male, **a)** T1 and **b)** T2 weighted images show hyperintensity adjacent to degenerated disc at L4-L5 segment.

Patients were divided into three groups according to physical workload, as sedentary workers, standing workers and ones with a heavy workload. First group included patients who work in desk jobs for more than 4 hours a day. Second group included patients who work standing for more than 4 hours a day and the last group included patients who work in jobs with a heavy workload. These groups were divided into subgroups

as female and male and degenerative disk disease and Modic changes were investigated for each groups (Table-1).

Chi-square test and Student t test were performed using SPSS II Version 17.0 (SPSS, Inc, Chicago, IL, USA). $p<0.05$ was considered statistically significant.

## RESULTS:

In this study 540 lumbar disk levels and adjacent endplate changes of 108 symptomatic patients were examined and age, gender, lumbar disk degeneration and Mobic changes were recorded (Table-1).

In 49 of 108 patients (45.37%) and in 78 of 540 disk levels (14.44%) disk degeneration (grade 2 and 3) was observed at least one level. Multi level disk degeneration was found as 3 levels in 7 patients, 2 levels in 15 patients, and 1 level in 27 patients (Table-2).

Examination of all patients showed that 32 of 108 (29,62%) have at least one level Modic changes. All of the Modic changes determined adjacent to the degenerative disks. No Modic change was observed in L1-L2 and L2-L3 segments of any patients. Only one patient showed type 1 Modic change in L3-L4 segment. Multi level Modic changes were observed in L3-L4 and L4-L5 segments of 2 patients and L4-L5 and L5-S1 segments of 3 patients. At least one of the multi level Modic changes was determined as Type 1 (Table-2).

When subgroups of Modic changes were evaluated ,in 16 patients (43.24%) Type 1, in 21 patients (56.75%) Type 2 was observed. It was determined that Type 1 changes are mostly in L4-L5 (9/16, 56.25%) and Type 2 changes are mostly in L5-S1 (13/21, 61.90%) adjacent segments. Modic Type 3 change was not seen in any of the segments. In our study the prevalence of Modic changes was (29,62%). When considering total disk levels 6.8% (disk levels of 37/540) was noted. 35 (94.59%) of the Modic changes were observed in L4-L5 and L5-S1 levels. Number of determined Modic changes were 16 (% 43.24) in L4-L5 level and 19 (51.35%) in L5-S1 level (Table-2).

Modic changes were observed in 10 disk levels of 8 female patients (25%) and in 27 disk levels of 24 male (31.57%) patients. It was determined that 2 of the multi level changes were female, while 3 of them were male. When female and male genders were statistically compared, even though the percentage of Modic changes observed in male was higher, there was no statistically significant difference determined ($p>0.05$).

Distribution of Modic type changes according to occupational groups are shown in Table-1 and Table-3. Determined modic changes were 30% for the group with heavy workload, 35.71% for standing workers and 26.66% for sedentary workers. Comparison between occupational groups showed no statistically significant difference in terms of Modic types and prevalence of Modic changes ($p>0.05$).

**Table-1.** Relation between age, gender and occupational distribution of patients with degenerative disc disease and Modic changes.

| | | Number of Patients Average | Age | | DDD* | | Modic** | |
|---|---|---|---|---|---|---|---|---|
| | | | Range | n | % | n | % | |
| **Men** | | 76 | 30,84 | 20-40 | 35 | 46,05 | 24 | 31,57 |
| **Women** | | 32 | 31,34 | 20-40 | 14 | 43,75 | 8 | 25 |
| **Total** | | 108 | 30,99 | 20-40 | 49 | 45,37 | 32 | 29,62 |
| **Sedentary** | **Men** | 38 | 30,84 | 22-40 | 14 | 36,84 | 11 | 28,94 |
| | **Women** | 22 | 31,45 | 20-40 | 9 | 40,90 | 5 | 22,72 |
| | **Total** | 60 | 31,06 | 20-40 | 23 | 38,33 | 16 | 26,66 |
| **Middle** | **Men** | 18 | 30,05 | 22-38 | 10 | 55,55 | 7 | 38,88 |
| | **Women** | 10 | 31,10 | 24-36 | 5 | 50 | 3 | 30 |
| | **Total** | 28 | 30,42 | 22-38 | 15 | 53,57 | 10 | 35,71 |
| **Heavy** | **Men** | 20 | 31,55 | 20-40 | 11 | 55 | 6 | 30 |
| | **Women** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | **Total** | 20 | 31,55 | 20-40 | 11 | 55 | 6 | 30 |

*DDD: Number of patients with degenerative disc disease at least one level
**MODIC: Number of patients with any type of Modic changes at least one level

**Table-2.** Distribution of degenerative changes, Modic changes and Modic Types according to all examined disc levels.

| LEVEL | DEGENERATIVE DISC | MODIC CHANGES | TYPES OF MODIC CHANGES | | |
|---|---|---|---|---|---|
| | | | TYPE 1 | TYPE 2 | TYPE 3 |
| **L1-L2** | 2 | 0 | 0 | 0 | 0 |
| **L2-L3** | 5 | 0 | 0 | 0 | 0 |
| **L3-L4** | 8 | 2 | 1 | 1 | 0 |
| **L4-L5** | 28 | 16 | 9 | 7 | 0 |
| **L5-S1** | 35 | 19 | 6 | 13 | 0 |
| **Total** | 78 (14.44%) | 37 (6.8%) | 16 | 21 | 0 |

**Table-3.** Distribution of Modic changes according to occupational groups [Multilevel changes are shown with (+)]

| | | Number of patients | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Degenerated Disc** | **Modic Changes** | **Modic Type 1** | **Modic Type 2** | **Modic Type 3** | **Multi level Modic Changes** |
| **Group 1** | E | 14 | 11 | 3 | 8 | 0 | |
| | K | 9 | 5 | 1 (+) | 4 | 0 | + |
| | D | 23 | 16 | 4 | 12 | 0 | |
| **Group 2** | E | 10 | 7 | 4 (+) | 3 | 0 | + |
| | K | 5 | 3 | 2 | 1 (+) | 0 | + |
| | D | 15 | 10 | 6 | 4 | 0 | |
| **Group 3** | E | 11 | 6 | 2 (++) | 4 | 0 | ++ |
| | K | 0 | 0 | 0 | 0 | 0 | |
| | D | 11 | 6 | 2 | 4 | 0 | |
| **All Working Groups** | | 49 | 32 | 12 (16) | 20 (21) | 0 | 5 |

## DISCUSSION:

Modic changes, first described in 1980, are associated with degenerative disks and seen almost together. These are MRI changes in bone marrow and end plates adjacent to degenerative lumbar disks. As mentioned above, according to T1 and T2 weighted sequences Modic et al described 3 different types of changes[4,17,18]. These types present different stages of the same pathological process[3].

Modic et al also investigated histopathological changes in end plates. They found out that, Type-1 changes were associated with fibrous degeneration and fissuring of end plates and hypervascularization of the vertebral body, adjacent to degenerated endplate. Type-2 changes were associated with fatty replacement in bone marrow. Also, they concluded that Type-1 changes reflected the inflammatory phase of degenerative disk disease, whereas Type-2 changes reflected chronic and stable phase of degenerative process. Later, they found sclerotic Type 3 changes as the final stage of degeneration[1,4,5,17,18]. Modic classification has been evaluated as reliable and reproducible, simple and easy to apply and useful in clinical research and practice[8].

In patients with degenerative disk disease (DDD), prevalence of Modic Changes has been reported as between 19%-59%[3,4,17,20]. The wide range of prevalence of Modic changes is the result of sampling errors and variations among the studied populations[20]. In our study we have found a prevalence of 29.62%. We aimed to investigate Modic changes in symptomatic young patients.

Modic changes are seen less often in asymptomatic individuals[7,16,20,24]. Weishaupt et al studied 60 asymptomatic individuals between the ages of 20-50 and reported a prevalence of 3%-10%[27]. Kjaer et al investigated 40-year old Danes and found the prevalence of 9.6% without DDD, while it's 34.1% with DDD[12]. Jensen et al reported median prevalence rates in a review article. In symptomatic group, median prevalence was 43% and in asymptomatic group, the median prevalence of Modic changes was 6%. In this study, they also reported an increase of 11% in the prevalence per 10 years [7].

Since disk degeneration and intradiscal destruction are age-related problems, the occurrence of Modic changes increases with age[17]. Kuisma et al reported that Modic changes are associated with age positively (P = 0.009)[18]. In the present

study, the population was limited with young patients (with mean age 30.99). This was the reason of the lower rate in the prevalence of Modic Changes.

All of the recent publications agrees with the relation between age and Modic changes[14]. Most of the earlier studies, conducted in a wide range of ages showed that the prevalence of Modic changes tended to be higher in older population[7,20]. Takatalo et al studied with young adults between the ages 20 to 22 and found 1.4% of Modic changes were at least level one[23]. Only 2 Modic changes were observed in the 13-year-old Danish population [11].

There is a disagreement about the dominant type of Modic changes. Several studies have shown that Modic type 2 changes are the most frequent with a percentage up to 90% [4,9,13,14,18]. On the other hand, some studies have suggested that type 1 Modic changes may be more common with a percentage of up to 68% [3,10,28]. We observed type 1 changes in 16 patients (43.24%) and type 2 changes in 21 patients (56.75%). In our study, type-2 predominance was found.

First, Modic et al described a linear progression pattern from Modic type-1 to Modic type-2, and then to Modic type-3 [8,10,19]. Kuisma et al followed lumbar spine Modic changes for 3 years[13]. They found Modic Type 2 lesions can convert to Modic type-1. They concluded that type-2 changes may be less stable than previously assumed.

Hutton et al investigated natural history of Modic changes and reported dynamic reversible changes[5]. They suggested that Modic changes should not be used as a surgical or clinical outcome measure. Also, one of the their results was that Modic changes do not necessarily follow a progressive pattern from Type-1 to Type-2 and then to Type-3. With the reflection of natural history, predominance of Modic type changes may be various[14].

Modic changes are most common at L4-L5 and L5-S1[10,18,19,21]. This changes are mostly seen as adjacent to disk degeneration[4,9,17,18]. In our study, we observed 43.24% at L4-L5 and 51.35% at L5-S1. 94.59% of Modic changes have been found at the lowest two levels of the lumbar spine. Also, disk degenerations were mostly seen in lower lumbar regions. Wang et al reported 74.5% of endplates with Modic changes were in the lower lumbar region (with mean age 51.4)[26]. Martinez-Quinones et al reported that percentage of Modic changes in the lower lumbar region is 98% (with mean age 30.45) similar to our study[16]. We assumed that in young patients it is quite rare to observe Modic changes in upper lumbar regions.

Infective discitis may mimic Type-1 Modic changes as low signal intensity on T1WI and high signal intensity on T2WI. The presence of increased signal intensity on T2WI, eroded vertebral endplates and epidural or paraspinal inflammation should orient the diagnosis toward an infectious process. In addition to radiologic signs, laboratory tests such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) can help differential diagnosis[6,15].

Relation between modic changes with degenerative disk segment and male gender is emphasized in many publications[9,10]. Karchevsky and colleagues presented that within etiological factors, especially male gender has a distinct relation with Modic changes[9]. On the other hand, our study did not reveal a significant difference between gender and Modic changes, while entire Modic changes were observed in an adjacent segment to the degenerated disk.

After all, it is still not revealed why Modic changes are observed in some of the degenerated disks and not observed in some others. Predisposing factor is the typology of age, men gender and working samples[3].

In our study, we investigated the effect of occupation type to the emergence of Modic changes. There are not many studies in the literature, which investigate the relation between the occupation and Modic changes. Schenk et al compared nurses and women with desk work jobs, who suffer from back pain and observed that Modic changes are at similar rates (30.4% ve 29.4%) in both occupational groups[21]. Kuisma et al compared train workers and sedentary workers and reached to similar results related Modic changes in both occupational groups[14]. In our study, we also determined similar rates of Modic changes in different occupational groups.

Prevalence of Modic changes in symptomatic young adult patients was 29,62%. Especially, localization in lower lumbar area was significant. Contribution of this study to literature was the relation between occupational groups and Modic changes, and no significant difference was determined. A remarkable point in our study was that we observed similar rates of Modic changes in sedentary workers and workers with heavier jobs. We concluded that occupation type has no effect on the emergence of Modic changes.

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