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The Role of Pain Catastrophizing in The Pain and Functions of Young and Older Patients with Knee Osteoarthritis

Diz Osteoartriti Olan Genç ve Yaşlı Hastaların Ağrı ve Fonksiyonlarında Ağrıyı Felaketleştirmenin Rolü

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ABSTRACT

Our research aims to compare the impact of pain catastrophizing level on pain intensity, knee osteoarthritis-related symptoms, and methods of coping with pain in young and older adults with knee osteoarthritis (OA). One hundred twenty-eight patients with knee OA between the ages of 45-55 or 65-75 were included in our cross-sectional study. The sociodemographic data, WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index), Time Up and Go Test (TUG), pain intensity during activity and rest, pain catastrophizing levels, and pain coping scores of young and older participants with knee OA were recorded. The mean age of young patients with knee OA was 51.27±5.07 and older patients was 67.25±4.18 years. Older participants with knee OA had longer pain durations, higher WOMAC scores, and longer TUG durations ($p<0.05$). There was a correlation between the pain catastrophizing scores of young patients with knee OA and pain intensity during activity (r;0.374), WOMAC scores (r; 0.617), and passive coping methods (r; 0.450) ($p<0.001$). A correlation was identified between the pain catastrophizing scores of older patients with knee OA and pain intensity at rest (r;0.427), pain intensity during activity (r;0.530), pain duration (r; 0.312), WOMAC scores (r; 0.693), and active and passive coping methods (r;0.429, r;0.299, respectively) ($p<0.001$). Pain catastrophizing levels significantly correlate with pain intensity ($\beta=0.35$, $p<0.01$) and WOMAC scores ($\beta=0.60$, $p<0.001$) in younger patients and with pain intensity during activity ($\beta=0.50$, $p<0.001$) and at rest ($\beta=0.40$, $p<0.01$) in older patients. Older patients with knee OA catastrophize painful stimuli more than young patients with knee OA. This affects patients' pain intensity, methods of coping with pain, and knee OA-related symptoms more. Accordingly, in the clinical follow-up of patients with knee OA and determining rehabilitation approaches, it is necessary to consider that as age increases, patients are more affected by painful stimuli, and this affects patients' symptoms more.

Keywords: *Knee osteoarthritis, Pain catastrophizing, Mobility, Pain*

ÖZ

Araştırmamız, diz osteoartriti (OA) olan genç ve yaşlı yetişkinlerde ağrı felaketleştirme düzeyinin, ağrı şiddeti, diz OA ile ilişkili semptomlar ve ağrı ile başa çıkma yöntemleri üzerindeki etkisini karşılaştırmayı amaçlamaktadır. Çalışmamıza 45-55 yaş veya 65-75 yaş aralığında diz OA'lı 128 hasta dahil edildi. Genç ve yaşlı katılımcıların sosyodemografik verileri, WOMAC (Western Ontario and McMaster Universities Osteoarthritis İndeks) ve Zamanlı Kalk ve Yürü testi (ZKYT), aktivite sırasında ve istirahatte ağrı şiddeti, ağrı felaketleştirme düzeyleri ve ağrı ile başa çıkma skorları kaydedildi. Diz OA'lı genç hastaların ortalama yaşı 51,27±5,07 ve yaşlı hastaların ortalama yaşı 67,25±4,18 idi. Diz OA'lı yaşlı katılımcıların ağrı süresi daha uzun, WOMAC skorları daha yüksek ve ZKYT süreleri daha uzundu ($p<0.05$). Diz OA'lı genç hastaların ağrı felaketleştirme skorları ile aktivite sırasındaki ağrı şiddeti (r; 0,374), WOMAC skorları (r; 0,617) ve pasif başa çıkma yöntemleri (r; 0,450) arasında bir ilişki bulundu ($p<0,001$). Diz OA'lı yaşlı hastaların ağrı felaketleştirme skorları ile istirahatte ağrı şiddeti (r; 0,427), aktivite sırasındaki ağrı şiddeti (r; 0,530), ağrı süresi (r; 0,312), WOMAC skorları (r; 0,693) ve aktif ve pasif başa çıkma yöntemleri (sırasıyla r; 0,429, r; 0,299) arasında bir ilişki belirlendi ($p<0,001$). Ağrı felaketleştirme seviyeleri, genç hastalarda ağrı şiddeti ($\beta=0,35$, $p<0,01$) ve WOMAC skorları ($\beta=0,60$, $p<0,001$) ile, yaşlı hastalarda ise aktivite sırasında ağrı şiddeti ($\beta=0,50$, $p<0,001$) ve dinlenme anında ($\beta=0,40$, $p<0,01$) ile önemli ölçüde ilişkilidir.Diz OA'lı yaşlı hastalar, Diz OA'lı genç hastalardan daha fazla ağrılı uyarıları felaketleştirmektedir. Bu durum, hastaların ağrı şiddetini, ağrı ile başa çıkma yöntemlerini ve DOA ile ilişkili semptomları daha fazla etkilemektedir. Buna bağlı olarak, Diz OA'lı hastaların klinik takibinde ve rehabilitasyon yaklaşımlarının belirlenmesinde, yaşın artmasıyla birlikte hastaların ağrılı uyarılardan daha fazla etkilendiği ve bu durumun hastaların semptomlarını daha fazla etkilediği göz önünde bulundurulmalıdır.

Anahtar Kelimeler: *Diz osteoartriti, Ağrı felaketleştirme, Mobilite, Ağrı*

INTRODUCTION

Knee osteoarthritis (OA) represents the most common location of osteoarthritis in the lower extremities (1). Moreover, it is among the primary causes of pain and physical disability around the world, impacting about one-third of older adults (2). The direct and indirect financial costs of osteoarthritis, considerable physical limitations, decreased work productivity, and decreased health-related quality of life cause a significant burden on the public health system (3). Individuals with knee OA usually experience chronic pain, increased dysfunction and psychological problems (4). Pain is the most frequently observed symptom of knee osteoarthritis, which is a degenerative joint disease characterized by cartilage loss, osteophyte development, and limitation of motion in the knee.

Pain responses associated with knee OA are highly variable and frequently unrelated to the severity of the joint changes detected radiographically. The resulting pieces of evidence suggest that pain sensitivity takes an essential part in pain associated with knee OA. Most studies in the literature suggest that the central nervous system becomes hypersensitive in individuals with OA (5). Cognitive and behavioral responses to chronic pain significantly influence pain intensity and pain-related disability (6). In recent years, the level of pain catastrophizing in individuals with chronic pain has been an important research topic (7). It has been stated that pain catastrophizing is correlated with increased pain intensity.

Pain duration, intensity and associated knee OA symptoms increase with advancing age. Pain and functional loss are the major clinical factors that motivate individuals with knee OA in treatment process. It has been recently focused on the behavioral and psychological aspects of pain, particularly pain catastrophizing, to enhance patients' quality of life in updated treatment guidelines (8). Pain catastrophizing is a cognitive and emotional coping style that is regarded to be one of the most prominent psychological factors that contribute to the increase in acute and chronic pain. Pain catastrophizing has been indicated to alter the impacts of rehabilitation on musculoskeletal disorders (9). It is possible that high levels of pain intensity and disability will reflect a progressive reduction in physical function and pain catastrophizing. Hence, it is important to establish strategies to reduce this interactive cycle and examine the role of pain catastrophizing in subjects with knee OA (7).

People who catastrophize painful stimuli experience more severe pain than those who do not have catastrophizing thoughts about painful stimuli. With advancing age, the pain experiences of people change, and pain intensity increases. Therefore, showing the level of pain catastrophizing and pain-related coping methods in separate groups according to age may provide important perspectives on determining pain and its treatment in knee OA. This study aims to compare pain catastrophizing levels between young and older adults with knee OA and to investigate the relationship between these levels and pain intensity, OA-related symptoms, and pain coping methods, utilizing regression analysis to assess the impact

MATERIAL and METHOD

Our research, which was planned as a cross-sectional prospective study. Included volunteer patients between the ages of 45-55 or 65-75 years who presented to the Orthopedics and Traumatology outpatient clinic and were diagnosed with unilateral or bilateral knee osteoarthritis by a specialist orthopedist. All patients enrolled in the research were informed about the purpose of the research and the evaluations to be made, and verbal and written consent was obtained from the individuals that they participated in the study on a voluntary basis. Individuals who had undergone lower extremity surgery in the last three years or had joint problems, had any joint disease other than osteoarthritis, had osteoporosis, had communication problems, and had taken analgesics in the last 24 hours were not included in our study. The current cross-sectional study was reported following the “Strengthening the Reporting of Observational Studies in Epidemiology” (STROBE).

The participants enrolled in the research were evaluated by a physiotherapist who was an expert in the field by the face-to-face interview method. The study participants were evaluated by dividing them into two groups as young people with osteoarthritis (45-55 years old) and older adults with osteoarthritis (65-75 years old).

Sociodemographic Evaluation

An information questionnaire was created to determine the sociodemographic status of the study participants and filled out by the physiotherapist. In this information questionnaire, the personal information of the participants with knee OA and clinical data such as age, height, body weight, affected side, previous treatments, previous surgeries, comorbidities, medications used, the radiological stage of OA, and the duration of OA symptoms were recorded.

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

The WOMAC is a valid questionnaire providing information on OA symptoms such as joint stiffness, pain, and functional disability. The WOMAC is a disease-specific 24-item questionnaire that separately addresses pain intensity during activities of daily living and any limitations in physical functions in subjects with knee OA in the last 48 hours (10). A low total score indicates good health. The Turkish version of the questionnaire was studied by Tüzün et al. (11).

Visual Analogue Scale (VAS)

The VAS, whose validity was tested by Bryant (1993), was used to evaluate pain levels in this study. Each response was scored on a 100 mm vertical line, with 0 mm representing "none" and 100 mm representing "extreme pain" (12). Studies examining the relationship between VAS and pain intensity have indicated good validity (13).

Pain Catastrophizing Scale (PCS)

This scale evaluated the participants' catastrophic thoughts about pain. The PCS is a widely used self-report measure of pain-related catastrophic thoughts. The scale was developed by Sullivan et al. in 1995 and consists of three 13-item subscales. The evaluation is made out of a total of 52 points between 0-4 points, with 0 referring to "not at all" and 4 referring to "always." A high score means that the patient has a high level of pain catastrophizing (14). A total score above 30 represents a clinically significant level of catastrophizing (15).It has been demonstrated that the PCS exhibits acceptable psychometric properties (16).

Pain Coping Inventory (PCI)

It was developed by Kraaimaat and Evers in 2003 to determine active and passive strategies used by subjects with chronic pain to cope with pain. The PCI was adapted to Turkish by Hocaoğlu et al. in 2019 with 279 patients with chronic pain. This scale consists of 22 items measuring three active coping strategies (transformation, distraction, and reducing demands) and three passive coping strategies (ruminating, retreating, and resting). Every item is graded between '1 = hardly ever' and '4 = very often' (17).

Timed Up and Go Test (TUG Test)

The Timed Get Up and Go test represents a test that includes the steps of getting up from the chair in which the person is sitting and walking for 3 meters, turning and sitting down again, and records the time in which the patient completes these procedures. In a guide including physiotherapy applications for patients with hip and knee osteoarthritis, it is stated that it can be used to evaluate the physical function level. Completing the test in a shorter time means that the functional level is better (18).

Statistical Analysis

Statistical analyses in our study were performed using SPSS version 22 software (SPSS Inc., Chicago, IL, USA). Kolmogorov–Smirnov and Shapiro–Wilk tests were used to determine the distribution of the data. In our study, people with knee osteoarthritis were separated into two groups according to their age (young people with knee OA; 45-55 years old, older adults with knee OA; 65-75 years old). The groups' demographic and clinical characteristics were compared by the Mann-Whitney U test and Chi-square test. The correlation between the level of pain catastrophizing in young and older participants with knee OA, their pain levels at rest and during activity, and their OA-related symptoms and functional levels was analyzed by Spearman's correlation analysis. Rho values between 0-0.25 were expressed as weak, between 0.25-0.50 as moderate, between 0.50-0.75 as strong, and of 0.75 and above as very strong correlation (19). Additionally, multiple regression analysis was conducted to assess the impact of pain catastrophizing levels on pain intensity, OA-related symptoms, and coping methods, allowing for a comprehensive understanding of these relationships. A power analysis was performed to determine the sample size required to detect significant differences and correlations, indicating that a total of 64 participants in each group would provide adequate power (90%) for the study with a medium effect size (Cohen's d = 0.5), as referenced in Tanaka et al. (20).For all calculations, a significance level of 0.05 was considered.

RESULTS

A total of 128 participants, 64 young and 64 older patients, with clinically and radiologically diagnosed knee OA were enrolled in the present cross-sectional study. The mean age of young individuals with knee OA was 51.27±5.07 years, and the BMI was 30.37±4.77 kg/cm2. The mean age of older adults was 67.25±4.18 years, and the BMI was 30.52±4.05 kg/cm2. There was no difference between the sex distribution, educational status, and severity of knee OA between the two groups ($p>0.05$). According to K-L, a difference was detected between the two groups in terms of the severity of knee OA ($p<0.05$) (Table 1).

Table 1: Participants' Demographic Characteristics

	Young Individuals (45-55 Years) Median (IQR) N: 64	Older Adults (65-75 Years) Median (IQR) N: 64	p-value
Age (years)	52 (47-55)	66 (65-70)	0.001*
Height (cm)	162 (155-168)	160 (155-168)	0.790
Weight (kg)	78 (71-85)	81 (70-86)	0.634
BMI kg/cm^2)	31.16 (27.08-33.76)	29.76 (27.64-31.18)	0.831
Sex n (%)			
Female	40 (62.5)	36 (56.2))	0.182
Male	24 (38.5)	28 (44.8)	
Education n (%)			
Illiterate	10	11	
Primary education	28	26	0.335
Secondary education	14	15	
High school	8	7	
University	4	5	
K-L n (%)			
Grade 2	40	28	0.001**
Grade 3	22	10	
Grade 4	12	42	

*p<0.05; ** p<0.001, IQR; Interquartile Range, cm; centimeters, kg; kilogram

In the present study, older participants with knee OA had longer pain durations, higher WOMAC scores, and longer TUG durations ($p<0.05$). Moreover, a difference was revealed between young and older adults with knee OA in terms of pain catastrophizing scores ($p<0.05$) (Table 2). Table 3 shows the correlation between the Pain Catastrophizing Scale and pain intensity, pain duration, physical performance, WOMAC scores, and methods of coping with pain in young and older adults

with knee OA. According to this table, there was a moderate correlation between the pain catastrophizing scores of young participants with knee OA and pain intensity during activity (r; 0.374, p<0.001), a strong correlation with the WOMAC scores (r; 0.617, p<0.001), and a moderate correlation with passive coping methods (r; 0.450, p<0.001). A moderate correlation was identified between the pain catastrophizing scores of older participants with knee OA and pain intensity at rest (r; 0.427, p<0.001), a strong correlation with pain intensity during activity (r; 0.530, p<0.001), a moderate correlation with pain duration (r; 0.312, p<0.001), a moderate correlation with the WOMAC scores (r; 0.693, p<0.001), and a moderate correlation with active and passive coping methods (r; 0.429 p<0.001, r; 0.299, p<0.001, respectively) (Table 3).

Table 2: Comparison of Pain Levels, WOMAC Scores, Mobility, Coping with Pain, and Pain Catastrophizing Levels of Young and Older Adults with Knee OA

	Young Individuals (45-55 Years) Median (IQR) N: 64	**Older Adults (65-75 Years) Median (IQR) N: 64**	**P-value**
Pain duration (months)	12 (9-36)	48 (12- 102)	0.002*
VAS-rest	10 (0-40)	10 (0-50)	0.798
VAS-activity	80 (60-85)	80 (72-90)	0.162
WOMAC	32 (25-43)	41 (33-51)	0.001*
TUG	9.25 (8.13-11.58)	11.01 (9.44-12.15)	0.005*
Coping with Pain – Active Strategies	16 (13-18)	16 (14-18)	0.674
Coping with Pain – Passive Strategies	27 (22-31)	27 (25-30)	0.181
Pain Catastrophizing	14 (10-22)	16 (13-25)	0.005*

IQR, Interquartile Range; VAS, Visual Analogue Scale; WOMAC, Western Ontario and MacMaster Universities Osteoarthritis Index; TUG, Time up and Go; * p<0.05;

Table 3: The Relationship Between the Pain Catastrophizing Scale and Pain Severity, Pain Duration, Physical Performance, WOMAC Scores, and Pain Coping Methods in Young and Older Adults with Knee OA

Young Individuals with Knee OA	**PCS**	**VAS Rest**	**VAS Activity**	**Pain Duration**	**TUG**	**WOMAC**	**Active Coping Method**	**Passive Coping Method**
PCS	-	0.183	0.374**	0.007	0.117	0.617**	-0.079	0.450**
VAS Rest	0.183	-	0.341*	0.114	0.268*	0.438**	-0.302**	-0.15
VAS Activity	0.374**	0.341**	-	0.181	0.121	0.544**	-0.076	0.260*
Pain Duration	0.007	0.114	0.181	-	0.031	0.177	0.091	-0.021*
TUG	0.117	0.268*	0.122	0.031	-	0.336**	0.019	0.099
WOMAC	0.617**	0.438**	0.544**	0.177	0.336**	-	-0.195	0.294*
Active Coping Method	-0.079	-0.302**	-0.076	0.091	0.019	-0.195	-	0.191
Passive Coping Method	0.450**	-0.015*	-0.260*	-0.021*	0.099	0.294*	0.191	-
Older Adults with Knee OA	**PCS**	**VAS Rest**	**VAS Activity**	**Pain Duration**	**TUG**	**WOMAC**	**Active Coping Method**	**Passive Coping Method**
PCS	-	0.417**	0.530**	0.312*	0.071	0.693**	0.429**	0.299*
VAS Rest	0.417**	-	0.325**	0.056	0.005	0.454**	0.323**	0.103
VAS Activity	0.530**	0.325**	-	0.398**	0.156	0.647**	0.418**	-019
Pain Duration	0.312*	0.056	0.398**	-	0.177	0.241	0.459	-0.005
TUG	0.071	0.005	0.220	0.177	-	0.302*	0.067	0.249*
WOMAC	0.693**	0.454**	0.647**	0.241	0.302*	-	0.530**	0.402**
Active Coping Method	0.429**	0.323**	0.418**	0.094	0.067	0.530**	-	0.390**
Passive Coping Method	0.299*	0.103	-0.019	-0.005	0.249*	0.402**	0.390**	-

*p<0.05; ** p<0.001, PCS; Pain Catastrophizing Scale, VAS; Visual Analogue Scale, WOMAC; Western Ontario and McMaster Universities Osteoarthritis Index; TUG, Time up and Go Test

Pain catastrophizing levels also showed significant relationships with pain intensity, OA-related symptoms (WOMAC score), and pain coping methods. According to the regression analysis, in younger patients, pain catastrophizing levels were significantly positively associated with pain intensity (β=0.35, p<0.001), WOMAC scores (β=0.60, p<0.001), and passive coping methods (β=0.40, p<0.01). In older patients, pain catastrophizing levels were significantly associated with pain intensity (during activity: β = 0.50, p<0.001; at rest: β = 0.40, p < 0.01), WOMAC scores (β = 0.65, p < 0.001), pain duration (β = 0.30, p<0.05), and both active (β = 0.45, p<0.01) and passive coping methods (β = 0.35, p<0.05). The explanatory power of the model was R^2 =0.45 in younger patients and R^2=0.52 in older patients.

DISCUSSION and CONCLUSION

The current study compared the effect of pain catastrophizing level on pain intensity, knee OA-related symptoms, and methods of coping with pain in young and older adults with knee OA. Accordingly, with advancing age, knee OA severity according to K-L, pain duration, and knee OA-related symptoms increased, and physical performance worsened. Furthermore, older adults with knee OA had higher levels of pain catastrophizing in comparison with younger adults. While there was a correlation between pain catastrophizing levels of young adults with knee OA and pain intensity during activity, WOMAC scores and passive coping strategies with pain, pain catastrophizing levels of older adults with knee OA were correlated with pain intensity during activity and at rest, pain duration, WOMAC scores, and active and passive coping strategies with pain. The mentioned findings show that the level of pain catastrophizing is a more important parameter with advancing age in individuals with knee OA.

In our research, there was no difference between pain intensity at rest and during activity in both older and young adults with knee OA. Pain intensity due to knee OA does not change with advancing age, but the level of pain catastrophizing increases. In line with this, as an important result of our study, although pain intensity does not change as age progresses and OA duration increases in patients with knee OA, an increase in pain catastrophizing levels shows that the level of pain catastrophizing can be an important parameter to be considered, especially in older patients with knee OA.

Previous research has also reported that increased pain intensity and knee OA-related symptoms are associated with the level of pain catastrophizing (21,22). This situation is observed in a similar way in other populations with chronic pain (low back pain, pain due to rheumatoid arthritis, etc.) (23,24). Furthermore, it has been seen that a decrease in the level of pain catastrophizing is an effective factor in improving the physical performance of patients with the treatment applied to patients with chronic low back pain (25). Hayashi et al. (26) reported that patients with knee and hip arthroplasty had better mobility after surgery with a lower level of pain catastrophizing. Hence, it should be kept in mind that the level of pain catastrophizing may also be effective among the factors affecting the recovery of especially older adults with knee OA. Nevertheless, the studies have not stated how the pain catastrophizing levels of people with knee OA influence knee OA-related clinical symptoms and their methods of coping with pain. Our study showed that the level of pain catastrophizing in both young and older adults with knee OA was associated with pain intensity at rest, WOMAC scores, and passive methods of coping with pain.

In their study, Cano et al. (27) reported that the increased pain duration was a significant factor in increasing the level of pain catastrophizing. The reason why older adults with knee OA (65-75 years) have higher levels of pain catastrophizing than younger individuals (45-55) may be their longer pain durations (median 48 months). This result is consistent with the results of other studies in the literature.

The level of pain catastrophizing in young and older adults with knee OA was associated with the WOMAC scale scores assessing knee OA-related symptoms. However, our research could not detect an independent association between pain catastrophizing and physical performance or TUG scores. Whereas many studies in the literature have demonstrated that patients with shorter/good TUG durations have lower levels of pain catastrophizing some studies have shown no correlation between the level of pain catastrophizing and physical performance (28,29). There are numerous studies in the literature that affect pain and pain conditions in patients with knee OA, but there is not sufficient information about the difference in pain catastrophizing levels according to age groups (30). In our study, there are detailed examinations of the pain catastrophizing levels of young and older adults with knee OA and the parameters they may be associated with. One of the strengths of our study is showing separately with these examinations that the level of pain catastrophizing with advancing age can affect different symptoms in people with knee OA. Moreover, since the level of pain

catastrophizing is associated with both active and passive methods of coping with pain in older adults with knee OA, it may be an important parameter that should be evaluated in the clinical follow-up of individuals with knee OA.

Our study has a few limitations. First, the present research questioned only the OA-related knee pain intensity of subjects with knee OA and did not question the presence and severity of other musculoskeletal pain. This may have increased the level of pain catastrophizing, especially in older patients with widespread pain. Hence, it may be important to report patients with knee OA in other painful conditions while researching the levels of pain catastrophizing in future studies. Another limitation of our study is that the level of pain catastrophizing can vary according to the psychosocial status of individuals. Especially the depression status of individuals was not evaluated in the current study. In future research, it may be important to question the level of pain catastrophizing and depressive symptoms of individuals with knee OA in terms of presenting a more comprehensive perspective.

In conclusion, older adults with knee OA catastrophized painful stimuli more and accordingly reported that their pain intensity was higher. It has been seen that this condition affects people's knee-related symptoms such as WOMAC more than young people. These results may contribute to the need to change or diversify the content of the treatment programs to be created in treating knee OA according to age and the level of pain catastrophizing. Since the level of pain catastrophizing in older adults with knee OA is more closely associated with the symptoms of subjects with knee OA than young individuals with knee OA, the level of pain catastrophizing should definitely be considered in the clinical follow-up of patients and determining rehabilitation approaches, especially in older adults with knee OA.

Declaration of Ethical Code: In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

This study was approved by the Ethical Committee of Clinical Research of Suleyman Demirel University, Faculty of Medicine on 06 February 2020 (Approval Number: 20).

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