Pain, disability and catastrophizing in individuals with knee osteoarthritis

Dor, incapacidade e catastrofização em indivíduos com osteoartrite do joelho

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ABSTRACT

BACKGROUND AND OBJECTIVES: Knee osteoarthritis is among the leading sources of chronic disability and may lead to depression, anxiety and pain catastrophizing, enhancing perceived pain. This study aimed at investigating the influence of pain catastrophizing on attitudes and perception of pain, and in the functionality of individuals with knee osteoarthritis.

METHODS: This observational study involved 18 patients, who were assessed for weight and height, and completed the Pain-related Catastrophizing Thoughts Scale (PCTS), Survey of Pain Attitudes (SPA), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the visual analog scale (VAS). Symptoms and disability were assessed by the Lequesne Index, functional mobility was evaluated by the Timed Up and Go (TUG) test. Pressure pain tolerance thresholds (PPT) were assessed by a digital algometer.

RESULTS: Mean body mass index of the sample was classified as obese (32,2±4,3). When split by the median of PCTS, differences were observed in most domains of SPA. Patients with more catastrophic thoughts took longer to perform TUG and presented more pain, joint stiffness and worse functionality (WOMAC). Despite the tendency to report more pain (VAS) in patients above the median score of PCTS, no differences were observed between groups with higher or lower catastrophizing regarding PPT. Positive and significant associations between the Rumination factor of PCTS and WOMAC outcomes were observed, as well as between the Hopelessness factor and TUG, Lequesne and WOMAC.

CONCLUSION: The higher the presence of catastrophic thoughts, the worse the attitudes towards pain and the physical functionality of knee osteoarthritis patients.

Keywords: Catastrophization, Knee, Osteoarthritis, Pain, Physical functional performance.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A osteoartrite do joelho está entre as principais causas de incapacidade crônica e pode levar à depressão, ansiedade e catastrofização, intensificando a percepção da dor. Este estudo teve como objetivo investigar a influência da catastrofização da dor nas atitudes e na percepção da dor e a funcionalidade de indivíduos com osteoartrite do joelho.

MÉTODOS: Dezoito pacientes foram avaliados quanto ao peso e à estatura, e completaram a Escala de Pensamentos Catastróficos Sobre a Dor (EPCD), Inventário de Atitudes frente à Dor (IAD), *Western Ontario and McMaster Universities Osteoarthritis Index* (WOMAC) e escala analógica visual (EAV). Os sintomas e a incapacidade foram avaliados pelo Índice de Lequesne, a mobilidade funcional foi avaliada pelo teste *Timed Up and Go* (TUG). Os limiares de tolerância à dor à pressão (LTDP) foram avaliados por um algômetro digital.

RESULTADOS: A média do índice de massa corporal da amostra foi classificado como obesa (32,2±4,3). Quando divididas pela mediana do EPCD, foram observadas diferenças na maioria dos domínios do IAD. Pacientes com pensamentos mais catastróficos demoraram mais para realizar o TUG e apresentaram mais dor, rigidez articular e pior funcionalidade (WOMAC). Apesar da tendência de relatar mais dor (EAV) em pacientes acima do escore mediano do EPCD, não foram observadas diferenças entre os grupos com maior ou menor catastrofização em relação aos LTDP. Foram observadas associações positivas e significantes entre o fator Ruminação da EPCD e o WOMAC, bem como entre o fator Desesperança e TUG, Lequesne e WOMAC.

CONCLUSÃO: Quanto maior a presença de pensamentos catastróficos piores as atitudes em relação à dor e funcionalidade física dos pacientes com osteoartrite do joelho.

Descritores: Catastrofização, Desempenho físico funcional, Dor, Osteoartrite do joelho.

INTRODUCTION

Knee osteoarthritis (OA) is a degenerative joint disease that causes pain and joint stiffness. It is among the leading sources of chronic disability[1]. It is estimated that 250 million people world-

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wide have OA, a progressive, complex and multifactorial disease that may produce chronic pain[1,2]. Despite total knee arthroplasty (TKA) in many cases being the best therapeutic treatment option[2], around one fourth of the patients undergoing this procedure present no pain relief or functional restoration after surgery, without a detectable medical cause[3]. Besides, it is known that OA may lead to depression, anxiety and pain catastrophizing, and these psychosocial factors may enhance pain, even after TKA[4].

Studies initiated in the 1980s on psychosocial aspects of pain have pointed out that regardless of the medical diagnosis or degree of physical damage involved, cognitive factors such as fear of movement (kinesiophobia), fear of being more injured, and negative beliefs or catastrophizing, the tendency to increase the sensation of pain and to feel hopeless in the face of it, influence pain management, in addition to contributing to the individual's perception and maintenance of disability[5]. In addition, psychological variables, such as pain catastrophizing, are predictors of longer hospital stay in the post-surgical period for the treatment of knee OA[3].

Because the relationship between psychosocial factors and chronic pain is multifaceted, some authors advocate an explanatory model based on the behavioral avoidance of pain[6,7]. In this respect, the fear of chronic pain imposes a circular interaction between the cognitive focus of pain catastrophizing, the perception of pain, and the fear of movement and re-injury. As a result of this interaction, the individual distances himself from activities and social situations, increasing the risk of developing an unhealthy lifestyle and to aggravate pain[7].

Pain catastrophizing is a negative thought process that focuses excessively on the sensations of pain, real or not, with the perception of intolerance and inability to deal with it[8]. Catastrophizing is a negative cognitive-affective process that has at its base the presence of automatic negative thoughts such as "pain is killing me"; "if the pain continues like this I will not be able to move on" and is an important predictor of pain-related outcomes[8]. Among the main negative outcomes, the increase in physical disability[9], the increase in the incidence of depression and anxiety[10] and the decrease in quality of life[11] are highlighted.

Catastrophic thoughts related to pain usually involve stages ranging from pessimism and the perception of inability to alleviate the pain, to despair and constant analysis of the problem, reaching, consequently, an increase in the inability to cope with pain[6]. Factors commonly associated with pain catastrophizing are rumination, magnification and hopelessness. Rumination involves the occurrence of negative repetitive thoughts related to the painful experience; magnification is the expectation that pain intensity and perception will always increase; and hopelessness is characterized by the feeling and belief of lack of support or ability to deal with pain[12].

A mechanism by which catastrophizing can increase pain and disability is through its effects on the social environment. According to the Community Coping Model, expressions of pain of individuals with high levels of pain catastrophizing serve to maximize the likelihood that suffering will be managed within a social environment/interpersonal context[13]. Within this model, the exaggerated expression of pain would serve to increase the likelihood of empathetic responses and assistance from others. In addition, pain catastrophizing would induce a reduction in the performance demands and expectations in the social environment in relation to the individual who expresses it, facilitating the management of interpersonal conflicts[13]. However, pain catastrophizing leads to a series of maladaptive outcomes for the individual, such as the maintenance of pain and the development of chronic pain[14], in addition to a worse prognosis in medical and psychological treatments[15,16].

Thus, in the present study, the investigation concerned the influence of pain catastrophizing on attitudes and perceptions of pain, as well as in the functionality of individuals with knee OA. The idea of pain catastrophizing as a psychosocial variable was explored, and the fact that its effects need to be further studied in individuals with knee OA who have not undergone surgery, since literature points out to a greater risk of future pain and decreased functionality in these individuals. Furthermore, the objective was also to contribute to the planning of interventions designed to promote the physical and mental health of patients with this clinical condition, with different levels of pain catastrophizing.

METHODS

An analytical observational study with a quantitative approach and convenience sample selection. Eighteen people of both genders with knee OA were selected among patients referred to the physical therapy service of a private University Clinic in the city of São Paulo (Brazil) by the public health care system.

Participants were older than 50 years of age, presented clinical and radiological signs of knee OA assessed by x-ray images and pain perception equal to or above 4 in the visual analogue scale from zero to 10.

After signing the Free and Informed Consent Term (FICT), participants were invited to a private room to be individually evaluated by the research instruments.

The Pain-related Catastrophizing Thoughts Scale (PCTS) is an instrument composed of 9 items on a Likert scale (from zero to 5 points). The total score is the sum of the items divided by the number of items answered (zero to 5). There are no cutoff points, and higher scores indicate a greater presence of catastrophic thoughts[17]. PCTS has two components: rumination and hopelessness, obtained by averaging the scores of the questions related to each of them.

The Survey of Pain Attitudes (SPA) is a self-administered instrument, in which the individual indicates his or her agreement with each of the 28 statements on a Likert scale of zero to 4 points. The score for each of the 7 domains is calculated by adding the responses of each item, divided by the number of items, resulting in a score between zero and 4[18]. The desirable score for each domain is: control = 4, emotion = 4, disability = 0, physical damage = 0, drugs = 0, solicitude = 0 and medical cure = 0[19].

To assess pain, joint stiffness and functionality, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was employed[20]. The instrument assesses the perception of pain, stiffness and functionality in the 48 hours before its

application. The scores vary from zero to 4 in each of the 24 items (the higher the score, the worse the symptom).

Symptoms and disability were also assessed using Lequesne Algofunctional Index[21]. The instrument consists of 11 items, six about pain and discomfort, one about the maximum walking distance and four about the activities of daily living. Scores range from zero to 24, from no disability to extremely severe disability. Only questions related to knee OA were employed in this study.

Research participants were also assessed for weight and height. Weight was measured with patients barefoot and wearing light clothes, on a digital scale graduated in 0.1 kg. Height was assessed using a stadiometer graduated in 0.1cm. The body mass index (BMI, kg/m^2) was calculated by dividing the weight by the squared height.

To assess functional mobility, the Timed Up and Go (TUG) test was used. It consists of measuring in seconds the time spent by the patient to get up from a chair, walk 3 meters, return and sit down again. Three attempts were conducted, and the shortest time obtained was used for the analysis[22].

Pressure pain tolerance thresholds (PPT) were assessed using a digital algometer (J Tech, Salt Lake City, UT, USA). The device contains a rubber end of 1cm^2 in diameter. Pressure was applied at a constant speed of 1 kg/s to the level at which the patient reported the onset of pain or discomfort, and the final amount of force applied was recorded[23,24]. The regions evaluated were: long adductor, vastus lateralis, vastus medialis, patellar tendon, center of the patella and tibialis anterior. These points have been previously described by other studies[25,26].

This research followed the ethical regulations of the National Health Council Resolution 466/12 and 510/16 and the Declaration of Helsinki. The study was approved by the local ethics committee, opinion number 1.815.849.

Statistical analysis

Data were analyzed in the statistical package SPSS v.24 for Windows. The normality of the data was tested by the Shapiro-Wilk test. Descriptive statistics were performed, and the comparison between groups above or below the median of PCTS, was performed using Student's t test for independent samples or Mann-Whitney U test. To establish possible associations between PCTS factors and the other study variables, Pearson or Spearman correlation test was used. Results were classified as follows: 0.0 to 0.19 - very weak association; 0.2 to 0.39 - weak association; 0.4 to 0.69 - moderate association; 0.7 to 0.89 - strong association; 0.9 to 1.0 - very strong association. In all cases, the descriptive level α was set at 5%. A priori sample size calculation revealed that, for an α of 5% and effect size of 0.5, at least 17 patients would be necessary for a power (1-β) of 0.4.

RESULTS

Eighteen patients with knee OA participated in this study. 77.8% (n=14) of them were women. Most participants presented bilateral involvement (n=8), 6 patients had OA in the right knee only, and 4 in the left knee. The mean body mass index of the sample was classified as obese (32.2±4.3). When they were split by the median of PCTS (1.27), statistically significant differences were observed in most domains of SPA (Table 1), indicating that, the higher the presence of catastrophic thoughts: 1. the more the patient believes that his/her emotions interfere in his/her painful experience (domain 1); 2. the least he/she believes in a medical cure for his/her pain (domain 3); 3. the more he/she believes that the pain means he/she is hurting himself/herself and that he/she should avoid physical exercises (domain 4); 4. the more he/she believes to be disabled by the pain; and 5. the more he/she searches for drugs as a way to treat the pain (domain 7).

Table 1. Survey of pain attitudes

Domains	Below median score of PCTS	Above median score of PCTS	p-value
1. Solicitude	2.0±1.4	2.5±1.4	0.47
2. Emotion	1.0±1.0	2.4±1.2	0.02
3. Cure	2.8±0.6	2.1±0.8	0.05
4. Control	2.3±0.5	2.5±0.7	0.62
5. Physical damage	1.1±0.3	1.8±0.7	0.01
6. Disability	0.9±0.6	1.8±0.7	0.02
7. Drugs	1.5±1.1	3.0±0.9	0.006

SPA = Survey of Pain Attitudes; PCTS = Pain-related Catastrophizing Thoughts Scale.

It took longer for patients that presented more catastrophic thoughts about pain to perform TUG, and they also presented more pain, joint stiffness and worse functionality when assessed by WOMAC (Table 2).

Table 2. Functionality Assessment

	Below median score of PCTS	Above median score of PCTS	p-value
BMI	32.8±4.9	31.6±3.8	0.56
TUG	10.7±1.4	13.3±1.7	0.003
WOMAC pain	40±19.8	61.7±25.0	0.05
WOMAC joint stiffness	33.3±21.6	63.8±20.2	0.007
WOMAC functionality	21.7±15.9	59.6±21.8	0.001
Lequesne	6.7±4.9	11.3±5.9	0.09

PCTS = Pain-related Catastrophizing Thoughts Scale; BMI = Body Mass Index; TUG = Timed Up and Go Test; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; Lequesne = Lequesne's Algofunctional Index.

Despite the tendency to report more pain perception (VAS) among the patients above the median score of PCTS, no significant differences were observed between groups with higher or lower catastrophizing regarding pain tolerance (Table 3).

In order to better understand the mechanisms of pain catastrophizing and its influence on patients' pain experience, correlation analyzes were conducted between Rumination and Hopelessness factors of the PCTS and the instruments of functionality and pain (Table 4). Positive and significant associations between Rumination and WOMAC measurements (pain, joint stiffness

Table 3. Pain assessment

	Below median score of PCTS	Above median score of PCTS	p-value
VAS	3.9±3.2	6.7±2.6	0.06*
PPT Adductor longus	4.4±1.9	4.5±2.6	0.79**
PPT Vastus lateralis	5.9±2.2	6.8±3.4	0.55*
PPT Vastus medialis	5.6±2.3	6.3±2.5	0.58*
PPT Patellar tendon	7.1±2.6	8.8±3.4	0.24*
PPT Center of patella	5.8±2.7	7.8±4.3	0.48**
PPT Tibialis anterior	6.5±1.6	7.3±2.1	0.36*

PCTS = Pain-related Catastrophizing Thoughts Scale; VAS = visual analog scale; PPT = Pressure Pain Tolerance Threshold. * Student's *t* Test for independent samples, **Mann-Whitney's U test.

Table 4. Correlations (r) between the components of PCTS and pain and functionality

	Rumination	Hopelessness
BMI	0.01	-0.12
TUG	0.60	0.64‡
WOMAC pain	0.53‡	0.42
WOMAC joint stiffness	0.64‡	0.61*
WOMAC functionality	0.58*	0.67*
Lequesne	0.42	0.56*
VAS	0.37	0.05
PPT adductor longus	-0.36	-0.16
PPT vastus lateralis	-0.31	-0.33
PPT vastus medialis	-0.14	-0.01
PPT patellar tendon	-0.16	0.15
PPT center of patella	-0.09	0.02
PPT tibialis anterior	-0.21	-0.13

*p<0.05; ‡p<0.01 PCTS: Pain-Related Catastrophizing Thoughts Scale, BMI = Body Mass Index; TUG = Timed Up and Go Test; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; VAS = visual analog scale; PPT = pressure pain tolerance threshold.

and functionality) were observed, as well as positive and significant associations between Hopelessness and TUG, Lequesne and WOMAC measurements (joint stiffness and functionality).

DISCUSSION

Median PCTS score of participants was 1.64±1.27, lower than the validation study of the Brazilian version of the instrument[17]. Unlike the sample of the present study, a large number of young and elderly patients with chronic pain from several etiologies participated in the latter study. Despite this observation, patients of the present study who presented scores above the median of PCTS had a significantly higher pain perception (VAS and WOMAC pain), worse physical function (TUG and WOMAC functionality) and more stiffness (WOMAC joint stiffness) when compared with the ones below median value of the instrument. On the other hand, objective pain measurements (PPT) did not reveal significant differences between these two study groups.

As for functionality, data from this study corroborate the ones by a previous study[27], who also observed that pain catastrophizing contributed to the reduction of physical function.

It has already been demonstrated that catastrophizing is related to central hypersensitivity in patients with knee OA[28]. Patients with higher levels of catastrophizing present more central sensitization, which is associated to the increase in clinical pain[28]. Nonetheless, when evaluated for PPT, patients did not significantly differ regardless of having lower or higher levels of pain catastrophizing. This may indicate that, as they suffer from chronic pain caused by OA, irrespectively of the level of catastrophizing, all patients in this study presented central sensitization.

Precise pain assessment may assist therapeutic strategies and the selection of appropriate analgesic drugs. In the group of patients above median value of PCTS, pain perception assessed by WOMAC was higher than in the ones below it. In order to acknowledge how pain catastrophizing affects this perception, the components of PCTS (rumination and hopelessness) and of WOMAC (pain, joint stiffness and functionality) were analyzed. This type of evaluation has already been recommended by a previous study[29].

The positive association between pain, stiffness and rumination indicates that repetitive negative thoughts and focused pain symptoms may worsen perceived pain in patients with knee OA. In addition, rumination also affects patients' functionality[29]. Previous studies highlight that rumination is not the main component of pain catastrophizing that influences perceived pain and functionality[29,30]. A previous study[30] found significant but weak associations between rumination and pain experience in patients with neuropathic pain (diabetic neuropathy, post-herpetic neuralgia). Other authors[29] investigated the effects of the different components of catastrophizing on pain perception and functionality of patients with chronic pain (92.5% had multiple pain sites, 70% of whom presented lower back pain) and found significant correlations between rumination and severity measures (r=0.20) and pain interference (r=0.19) reported by patients. These correlations were weak, however, of the average points obtained on the pain catastrophizing scale (33.85), almost half were due to the rumination component (16.06).

The moderate correlations observed in the present study demonstrate that, in patients with knee OA, rumination may considerably influence pain perception. As rumination is an attentional component, involving a narrowing of attention to past and/or present negative experiences, the increased pain experienced by these patients may be related to difficulties of concentrating on other things.

Hopelessness was moderately associated with TUG, Lequesne and WOMAC (joint stiffness and functionality). There seems to be a consensus that hopelessness is the measure that best explains the effect of pain catastrophizing on patients' pain experience and functionality[8,29,30]. In another study[30], hopelessness was moderately correlated with perceived pain (r=0.50), and it was the measure most strongly associated with functionality in

the hierarchical regression model. In a previous study[29] significant correlations were found between hopelessness and severity measures (r=0.35), and also with pain interference (r=0.47), in addition to hopelessness presenting a unique variation in most of the adopted criterion variables related to pain in the hierarchical regression model employed.

In a study[31] that analyzed psychosocial variables of behavioral avoidance of pain (such as kinesiophobia and catastrophizing beliefs, as predictors of postural stability in patients with hip and knee OA), authors demonstrated that 34.3 to 36.9% of the variation in measures of physical functioning could be due to the avoidance of activities because of kinesiophobia and hopelessness.

Hopelessness is the main component of pain catastrophizing, related to the inability to cope with pain. It may be the result of countless unsuccessful attempts to seek support and mitigate pain both in patients with chronic, neuropathic pain and in patients with knee OA, as demonstrated by the behavioral pain avoidance model[6,7].

Furthermore, pain catastrophizing interferes with the daily functionality of patients with knee OA[32]. A study[32] that followed 121 patients with knee OA over a seven-day period and found that daily physical activity was associated with higher levels of knee pain among patients with high catastrophizing level when compared with the ones who presented a low catastrophizing level.

Although the present study is limited to correlational data, the results raise the possibility that patients with knee OA with catastrophic thoughts of increased pain, both in terms of rumination and hopelessness, need a comprehensive treatment that takes into account the dimension of emotional health. The frequent expression of pain may lead health professionals and family members not to take seriously the symptoms of patients with OA, depriving them of more intensive treatments that could be beneficial for pain control[33].

This study has some limitations. Some authors report the importance of the social context in pain catastrophizing, since it can arise in individuals who trust a support and assistance system from others[34,35], however, this aspect was not evaluated in the present study. The relatively reduced sample size limits the generalization of the results. Despite that, the findings herein provide important information about the role of psychological factors on the physical function and pain of patients with OA.

CONCLUSION

The greater the presence of catastrophic thoughts, the worse are the attitudes towards pain and the physical functionality of patients with knee osteoarthritis.

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