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Discrepancy between Radiographic Damage and Functional Disability in Elderly People with Osteoarthritis: The Role of Pain Coping Strategies

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The aim of this study is twofold. First, to assess the level of agreement between radiographic damage and functional disability in older people with osteoarthritis. And second, to assess the role of coping skills and sensory pain parameters as sources of disagreement between these variables. To achieve this objective we assess, in a sample of 104 older people with osteoarthritis, the following variables: functional capacity, radiographic damage, pain coping strategies, pain intensity, pain frequency and pain duration. The results show a non-linear relationship between radiographic damage and functional disability, modified by the levels of the two variables. There was maximum agreement between low levels of radiographic damage and of functional impairment, whilst agreement decreased for moderate and high levels of radiographic damage. Certain coping strategies may help to explain this disparity.

Keywords osteoarthritis, elderly, chronic pain, coping strategies, radiographic damage, functional disability.

El presente trabajo persigue un doble objetivo. Primero, evaluar el grado de concordancia entre el deterioro radiológico y el nivel de capacidad funcional en las personas mayores con artrosis. En segundo lugar, analizar las fuentes de disparidad de tal concordancia, para lo que se estudia el papel de los parámetros sensoriales del dolor y de las estrategias de afrontamiento ante el mismo. Para ello se evaluaron, en una muestra de 104 personas mayores con artrosis, la capacidad funcional, el grado de deterioro físico -afectación radiológica-, las estrategias de afrontamiento al dolor y los parámetros sensoriales del dolor de intensidad, frecuencia y duración. Los resultados mostraron que la relación entre el deterioro radiológico y funcional no varía linealmente, sino que depende de los niveles de ambas variables, existiendo una concordancia máxima entre niveles bajos de deterioro funcional y de deterioro radiológico, mientras que disminuye para niveles moderados o elevados de deterioro radiológico. Ciertas estrategias cognitivas y conductuales de afrontamiento evaluadas parecen ayudar a explicar tal disparidad.

Palabras clave: artrosis, vejez, dolor crónico, estrategias de afrontamiento, deterioro radiológico, discapacidad funcional.

Osteoarthritis is the most common musculoskeletal disorder, making it an important cause of pain and functional disability (Picavet & Hazes, 2003). It is a degenerative joint disease characterized by a progressive degeneration of joints' cartilage and by osteohypertrophy, which both cause functional disability. The prevalence of arthritis increases considerably with age, and has a marked increase after the age of 50, while for people under 40 (Bijlsma, 2002), the radiological signs of arthritis are uncommon. Its prevalence is notably higher in women; in some places, the rate of arthritis in women is three or four times its rate in men (Carmona, Ballina, Gabriel & Laffon, 2001; Picavet & Hazes, 2003). Also, various studies have demonstrated the importance of psychological factors in adapting to this disorder and its associated symptoms, which include pain and functional disability (Bijsterbosch et al., 2009; McCracken, Goetsch & Semenchuk, 1998; Rapp, Rejeski & Millar, 2000; Steultjens, Dekker, & Bijlsma, 2001; Yung-Fang, Tsung-Lan, Yeur-Hur & Wen-Jen, 2008).

In spite of advances in our understanding of the disease and of the psychological factors it involves, the discrepancy between the structural signs of the disease (e.g. a radiology exam) and its clinical symptoms of pain and disability remains unexplained (Kean, Kean & Buchanan, 2004; Peat, Croft & Hay, 2001). Along that vein, some research has studied the relationship between symptoms of pain, functional disability and physical deterioration measured in terms of radiological severity. The correlation between pain intensity and radiological severity has been found to be significant in some studies yet in general, the correlation has not been very strong (Patrick, Aldrige, Hamilton, Manhire & Doherty, 1989) or even nonexistent (Hannan, Nelson & Pincus, 2000). Similarly, the association between one's radiology exam and his or her disability has been found to be weak (Dahaghin et al., 2005; Kean et al., 2004) or nonexistent (Ay & Evcik, 2008; Heuts et al., 2004).

New models of disability recognize the role played by psychosocial factors in exacerbating or assuaging disability. According to the International Classification of Functioning, Disability and Health (ICF), to analyze health one must take into account physical structures and bodily functioning as well as personal and environmental factors. These factors may moderate the association between the physical structures of the body, functioning and participation in activities. With this in mind, consider that only a small number of studies have analyzed the role of psychological variables in the relationship between radiological arthritis and disability. It has been observed that beliefs about disease and a person's disposition moderate the relationship between self-reported limitations in activity and the limitations that would be expected based on radiological deterioration (Botha-Sheepers et al., 2006). Also, it has been suggested that several psychological variables such as beliefs about pain (Bijsterbosch et al., 2009; Yung-Fang et al., 2008), coping with pain and self-efficacy predict

self-reported functional capacity in people suffering from arthritis, too, and even serve as better predictors than physical deterioration variables, including radiological severity (Rapp et al., 2000).

On another note, it has been demonstrated in patients with chronic pain from a range of etymologies that styles and strategies of coping with pain (Esteve, Ramírez-Maestre & López-Martínez, 2007; López-Martínez, Esteve-Zaragaza & Ramírez-Maestre, 2008; McCracken & Vowles, 2007; Rodríguez, Esteve & López, 2000) and some types of beliefs (Camacho & Anarte, 2001; Esteve et al, 2007; Johansen, 2008) are related to how people adapt to their pain, changing their experience of it in all its dimensions as well as subjects' behavior surrounding it. Also, it has been shown that some psychological factors are better predictors of one's adaptation to pain than the magnitude of the pathophysiological damage itself (Murphy, Dickens, Creed & Berstein, 1999; Rapp et al., 2000).

Returning to the subject of the association between one's coping style and his or her functional disability, this has been analyzed in studies of diverse pathologies including osteoarthritis and rheumatoid arthritis, suggesting that an active coping style is correlated with a better functional state (López-Martínez et al., 2008) and lower levels of disability (Keefe et al., 1987). Meanwhile, passive coping, or coping focused on the disease, is correlated with greater physical disability (Johansen, 2008; Samwel, Evers, Crul & Karrimaat, 2006). However, not all studies on the subject have found evidence to suggest a relationship between active coping strategies and functional capacity (Stephen, Druley & Zautra, 2002).

Upon analyzing the role played by the main pain coping strategies in functional capacity for people with chronic pain, it becomes clear that the findings have been contradictory, and that there has been a shortage of studies conducted in elderly populations. One type of coping strategy that has been widely studied and whose importance to adapting to pain has been supported by numerous studies is: catastrophizing, which refers to the tendency to expect and exaggerate negative results in the presence or absence of nociceptor stimulation (Sullivan, Bishop & Pivik, 1995). Other studies of both elderly and young people have found an association between the use of the catastrophizing strategy and functional disability (Jensen, Turner & Romano, 2007; Turner, Jensen & Romano, 2000; Turner, Jensen, Warms & Cardenas, 2002; Rapp et al., 2000). Similar results have been found for the prayer strategy (Dozois, Dobson, Wong, Huges & Long, 1996; Lin & Ward, 1996; Rapp et al., 2000). For other coping strategies such as ignoring the pain and distracting oneself, results have been inconclusive. Regarding the strategy of ignoring the pain, the majority of studies have suggested an absence in correlation between its use and functional capacity (Turner et al., 2002; Dozois et al., 1996), but other studies have found it to be related to a lower level of disability (Turner et al., 2000) and others,

with greater disability (Lin & Ward, 1996; Robinson et al., 1997). As for the strategy of distracting oneself, some studies relate this with greater functional capacity (Schmitz et al., 1996) while others associate it with greater disability (Robinson et al., 1997; Turner et al., 2001). With respect to the use of positive self-statements, the majority of studies of elderly people and young people alike have found no association between its use and disability (Turner et al., 2000; Turner et al., 2002). However, some studies of young people have associated it with a greater level of activity in general (Robinson et al., 1997). Last, in the case of the reinterpreting pain sensations strategy, there has been no association found with functional disability in the majority of studies (Turner et al., 2000; Turner et al., 2002; Turner, Dworkin, Mand, Huggins & Truelove, 2001), though in one study of elderly people afflicted with arthritis, it was found to be correlated with a better observable, physical state, but not with perceived functional capacity (Rapp et al., 2000).

Given that arthritis is one of the leading causes of functional disability in the elderly, and in spite of the fact that the literature about the relationship between coping with pain and functional disability leads one to believe that it may play a fundamental role in the discrepancy between the structural signs of the disorder and disability, no study known to these authors analyzes the role of strategies to cope with pain in the discrepancy between radiological deterioration and disability in a sample of elderly people with arthritis.

The objective of the present study, then, is to analyze the relationship between physical, radiological deterioration and functional capacity in elderly people with osteoarthritis, as well as the role of coping with pain and the sensory dimension of the experience of pain in this relationship. To achieve this objective, we analyzed the level of agreement between functional and radiological deterioration. Later, we tried to determine the possible sources of disparity in this relationship. The role of sensory parameters in the experience of pain was analyzed, too, along with different strategies of coping with it. It was hypothesized that there would be a weak relationship between level of functional capacity and the extent of radiological deterioration. Furthermore, pain coping strategies should play a fundamental role in that relationship such that when faced with radiological deterioration, the better one's ability to cope is, the better his or her functional capacity will be.

Methods

Participants

The sample consisted of 104 elderly people (85.6% women, 14.4% men) diagnosed with osteoarthritis by a rheumatologist. The mean age of the sample was 74.32 years old ($SD = 12.6$; range: 65-96 years old). For women,

the average age was 74.6 ($SD = 10.6$) years old and for men it was 76.5 ($SD = 10.9$). The exclusion criteria were the following: suffering from a serious, chronic illness besides arthritis such as infectious, metabolic, renal, endocrine or neuromuscular disease, cancer or organic brain syndrome; suffering from chronic pain disorders such as chronic headache, fibromyalgia, etc.; the presence of disorders that imply any functional disability other than osteoarthritis; having a body mass index greater than 30kg/m²; the presence of psychotic symptoms, a history of psychosis or any other major psychiatric disorder; presently taking a course of psychoactive medication or normal use of analgesics (a maximum daily dose of 1000mg of acetaminophen or aspirin or 600mg of ibuprofen was allowed); any sensory disability that impedes correct participation in the study (adequate visual and auditory acuity were required); as well as any physical or mental condition that could incapacitate someone from offering their informed consent consciously and voluntarily. The entire sample lives in the Community of Madrid but 51.9% are community-dwelling while 48.1% live in nursing homes. The average amount of time that has passed since the onset of the disease for the whole sample was 16.4 years ($SD = 12.32$; max: 6, min: 1), it was 19.4 years in the nursing homes ($SD = 13.8$; max: 60, min: 1) and 14.6 years ($SD = 9.3$; max: 40, min: 1) for those living in the community. As for pain localization, the number of places each subject feels pain ranges from 1 to 13. The majority of participants (65%) experience pain in between 1 and 4 places. The knees (61.5%) and the lumbar spine (51.9%) were the most common localizations followed by the hands (34.6%) and hips (18.3%). Regarding civil status, 46.2% were widows or widowers, 40% were married and 13.5% were single. As for educational level, 69.2% completed elementary school, 11.5% had no education, 8.7% had completed secondary school, 5.8% had received a higher education and 1% either did not know or did not answer this question for some other reason. All the subjects evaluated were literate, even those who had not finished their basic education. The average pain intensity perceived by subjects was 6.64 ($SD = 2.31$) on a scale ranging from 0 to 10. Finally, please note that when the study was conducted, no participant was receiving or had ever received any type of cognitive-behavioral therapy with the objective of managing their pain.

Materials

Sensory Parameters. Following the directions for evaluating pain among the elderly published in a 2007 consensus document (Hadjistavropoulos et al., 2007), as well as the recommendations of other studies (American Geriatrics Society Panel on Persistent Pain in Older Persons, 2002; Herr, 2005), the intensity, frequency and duration of pain episodes were also evaluated. *Pain*

intensity was identified as the average pain perceived by the subject in the last two weeks. It was evaluated on an 11 point scale with numerical boxes from zero to ten; the boxes ranged in shade and intensity of the color red. To evaluate pain *episode frequency* the participant was asked about the frequency of their pain episodes in the last six months, which was evaluated by a four point, ordinal scale: 1= he or she experiences at least one pain episode everyday, 2 = he or she has a pain episode at least one day per week, 3 = he or she experiences a pain episode at least one day per month and 4 = he or she rarely experiences a pain episode (less than one day per month). The *average duration of pain episodes* was evaluated on a three-point, nominal scale: 1 = continuous pain without interruption, 2 = long episodes of more than 12 hours' duration and 3 = short episodes of less than 12 hours' duration.

Time since the beginning of the pain episodes. The number of years that have passed since the beginning of pain episodes due to arthritis up to the moment of the subject's evaluation.

Coping strategies. The Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) was used. This 48-item, self-report questionnaire identifies 7 coping strategies: distraction, reinterpreting pain sensations, self-statements, ignoring pain sensations, prayer, catastrophizing and increasing activity. Before collecting the data for this evaluation, the original version of the measure in English was translated into Spanish. To do so, a team of three bilingual translators was employed. They are familiar with both American and Spanish culture and have a theoretical understanding of the subject being evaluated by the different instruments being translated. These steps were followed in translating the questionnaires: a) Two members of the team separately translate from English to Spanish. b) They reach a consensus on that translation. c) The third member of the team translates the instrument, now in Spanish, back into English (point 2). d) The new version (from point 3) of the scale is tested against the original to find any discrepancy. e) A definitive translation into Spanish is reached as a group with the consensus of the three members of the team. Cronbach's alpha coefficient for the different scales ranged from .86 to .73 for the present sample. Convergent validity was established by applying the Spanish language version of the Vanderbilt Pain Management Inventory (VPMI, Brown & Nicassio, 1987; Spanish version by Esteve, López & Ramírez, 1999). The coefficient of the correlation between the active coping subscale and the coping strategies traditionally considered active (distraction, positive self-statements, reinterpreting pain sensations, increased activity) were positive and significant with a 99% level of confidence, with Pearson's correlation coefficients ranging from .81 to .40. Meanwhile, strategies traditionally considered passive (catastrophizing, prayer) were found to have a statistically significant, negative correlation with the passive coping subscale (.78 and .40, respectively).

Physical, radiological deterioration. An expert radiologist took anteroposterior radiographs of the affected joints. Anteroposterior projection radiographs were taken of both knees, weight-bearing and in 45° flexion (Rosembreg, Paulos, Parker, Coward & Scott, 1988). Radiographs of the hip were taken with the patient standing on two feet with the feet internally rotated 15°± 5° (Auleley, Giradeau, Dougados & Ravaud, 2000). Based on information provided by the radiological exam, two rheumatologists (T.G. and J.G.) from outside the public health center to which each participant belonged evaluated deterioration by following the directions prescribed by Altman and his team (1987) in their system to classify radiological severity in arthritis. This way, we took stock of the signs of radiological degeneration, diminished joint space, subchondral sclerosis and osteophytes, or bone spurs, and evaluated them on a scale with four levels of deterioration (0 none, 1 slight, 2 moderate, 3 severe). If these signs were absent, or if one's physiological lordosis had been corrected, he or she was considered normal. Radiological effect was assessed according to the minimum intervertebral space between the effected vertebrae. None of the evaluators had access to participants' data. Inter-evaluator consensus was reached by following these steps: If the discrepancy between two evaluators' assessments was greater than 1 level, or when one of the evaluators assigned a radiograph a 0, and the other a 1, a consensus meeting was held. For any smaller discrepancy, the greater score was used (Odding, Valkenburg, Algra, Vandernouweland, Grobbee & Hofman, 1998; Rapp, Rejeski & Miller, 2000). For knee radiographs, the knee with the score indicating the greatest effect was used (Rapp et al., 2000).

Functional deterioration. This was assessed by the Spanish language version of the Health Assessment Questionnaire (Fries, Spitz & Young, 1982; Spanish version by Esteve-Vives, Batlle-Gualda & Reig, 1991). This questionnaire is comprised of 20 questions about activities in daily life, which are grouped into eight categories: dressing and bathing, getting up, eating, walking, hygiene, holding, stretching and other activities. The scale was filled out by a rheumatologist by observing the functional behavior of the participant. It has adequate construct and criterion validity, as well as good test-retest reliability (.89) (Esteve-Vives et al., 1991; 1993). Also, it has proven adequate at evaluating the functional capacity of arthritis patients (Bruce & Fries, 2004) and it has been used in samples of arthritis patients in many places, studies' whose primary objective was to analyze the relationship between radiological findings and disability (Dahaghin, Bierma-Zeinstra, Ginai, Pols, Hazes & Koes, 2005; Odding et al., 1998). It has also been used in studies that analyze the relationship between certain psychological variables and functional deterioration in arthritis (Bijsterbosch et al., 2009). Cronbach's alpha coefficient for the present study's sample was .84.

Procedure

While conducting the present study, the guidelines established by the Declaration of Helsinki were respected at all times. People living in nursing homes were recruited by a doctor at the center; they selected all residents who met the inclusion/exclusion criteria and asked for their voluntary participation in the study. Of the 60 people picked at the onset, four turned down participation and six could not be evaluated for reasons beyond the researcher's control. The community-dwelling participants were recruited at the rheumatology clinics of each participating public health center; there their participation in the study was solicited. Of those who accepted participation, the first 10 to come to the clinic in each center were evaluated, so their selection may be considered random. All participants signed informed consent forms in which the objective of the study and the conditions of participation were described. Two procedures were followed to administer the instruments. The evaluations of physical, radiological deterioration and functional deterioration variables were done by rheumatologists, who turned in the completed scales to the research team. The radiological deterioration test was performed by two expert rheumatologists who are not affiliated with the health centers collaborating in this study. They did not have access to participants' data. The evaluation of functional deterioration, on the other hand, was performed by each participant's usual rheumatologist, but they did not have access to the rest of the data and evaluations. The rest of the instruments were applied through an interview with psychologists without previous access to participants' medical information. At all times, the necessary measures were taken to maintain and assure confidentiality and to protect the data.

Results

Prior to performing the pertinent analyses, the consistency of the scores was tested by sub-sample (nursing homes, community-dwelling), both for coping and perception variables and for radiological and functional deterioration. To do so, two multivariate analyses of variance (MANOVAs) were performed using the *modus vivendi* variable (nursing homes vs. community-dwelling) as a between-subjects factor and exercising effective control over civil status, sex and age by incorporating those variables as additional between-subjects factors, or as covariables (in the case of age). In the first analysis, coping and perception variables were used as dependent variables. Wilks' lambda was used as a criterion to do a significance comparison at the multivariate level, and the results of that analysis indicate there is no primary, multivariate effect of the *modus vivendi* variable on coping and perception variables, $F(10,76) = .951$; $p = .493$. In the second analysis, the objective was to confirm the consistency between

the two samples in their radiological and functional deterioration, which were included as dependent variables. In this case, no primary multivariate effect was found on the part of the *modus vivendi* variable either ($F(3,73) = .531$; $p = .519$). The results of the two MANOVAs allow us to conclude that the scores for the variables analyzed are consistent independently of participants' *modus vivendi*, so it was deemed appropriate to analyze the total sample and justifiable to generalize the data to both types of elderly populations.

Before performing the analyses, the radiological and functional deterioration variables were dichotomized on two levels: radiological deterioration with no/slight functional deterioration and radiological deterioration with moderate/severe functional deterioration. Once this was done, the next step was to analyze whether or not there is an association between radiological deterioration and the functional deterioration reported by a doctor (with both variables dichotomized). The Spearman correlation coefficient was calculated and a direct relationship between the two variables was concluded because it yielded a positive and statistically significant value ($r = .61$, $p < .01$). However, a more thorough analysis of the relationship between radiological and functional deterioration revealed that the way in which the two are related does not vary linearly; it depends on the levels of the two variables. Table 1 shows the combined data from the two variables once they were dichotomized, which revealed statistically significant ($\chi^2 = 29.71$; $p < .001$) differences between radiological and functional deterioration.

The results indicate maximum agreement between low levels of functional deterioration and radiological deterioration (93.3% of similarity), while this agreement decreased for elevated levels of radiological deterioration. That is to say, participants with no or slight radiological deterioration have a very high probability of exhibiting little or no functional deterioration, while participants with a moderate or severe level of radiological deterioration have about a 50% probability of exhibiting moderate or severe functional deterioration. Thus, the majority of patients may be classified into one of the following three groups: Group 1, no or slight radiological deterioration and little or no functional deterioration; Group 2, moderate or severe radiological deterioration and little or no functional deterioration; Group 3, moderate or severe radiological deterioration and moderate or severe functional deterioration.

The next objective was to establish coping and perception of pain as sources of variability and lack of agreement between radiological and functional deterioration. In order to examine this, two types of analysis were performed. First, to determine whether significant differences exist between the three groups of participants, simple analyses of variance were applied (ANOVA), the dependent variables being the different coping strategies evaluated as well as the intensity, frequency and duration of pain, and the time since its

Table 1

Table of Contingency between Radiological and Functional Deterioration

		Functional Deterioration	
		None/Slight	Moderate/ Severe
Radiological Deterioration	None/Slight	% Radiological Deterioration 93.3%	5.7%
		% Functional Deterioration 67.7%	9.1%
		Standardized Residuals 2.3	-3.2
	Moderate/ Severe	% Radiological Deterioration 40.0%	60.0%
		% Functional Deterioration 32.3%	90.9%
		Standardized Residuals -2.2	3.0

onset. The criterion variable, then, was the deterioration group to which the patient belonged (Table 2). Statistically significant differences were found in the use of the positive self-statements, $F(2,178) = 5.27, p = .007$, catastrophizing, $F(2,178) = 9.885, p < .001$, and increased activity, $F(2,178) = .804, p = .010$, strategies. Applying Scheffé's method indicated that participants in groups 1 and 2 employ the self-statements coping strategy more and catastrophizing less as compared to group 3. Also, participants in group 2 use increased activity and self-statements significantly more than group 3. For the other coping strategies and topographic parameters of pain, no significant differences were found to exist between the three groups.

Finally, we determined to what extent the variables that were found to correlate with deterioration group

through a simple analysis of variance (ANOVA) were useful in discriminating between the different groups at the multivariate level. To do this, a discriminant analysis was done using self-statements, catastrophizing and increased activity as the independent variables and deterioration group as the dependent variable. However, in this case, only groups 2 and 3 were considered because they are better suited to this final objective of the study. We first tried to identify the sources of variance that create the different levels of functional adaptation even when the severity of the lesion is the same. Box's M value was not found to be significant (Box's $M = 9.755$; $F(6,11121) = 1.508$; $p = .171$), so homoscedacity of the variance-covariance matrix was assumed. A statistically significant canonical discriminant function was obtained ($\chi^2(3) = 22.41, p < .001$), the value

Table 2

Differences in Pain and Coping According to Radiological and Functional Deterioration Group

Variable	Group 1		Group 2		Group 3		F	Scheffé
	M	SD	M	SD	M	SD		
Intensity	6.64	(2.4)	6.80	(2.1)	6.8	(1.8)	.06	--
Duration	2.52	(.7)	2.45	(.7)	2.33	(.9)	.52	--
Frequency	3.74	(.7)	3.7	(.9)	3.7	(.9)	.05	--
Time since beginning of pain (years)	16.89	(12.8)	14.50	(9.1)	19.00	(14.1)	.63	--
Self-statements	20.8	(8.9)	24.7	(9.4)	16.45	(8.6)	5.27 **	2-3
Catastrophizing	9.98	(8.2)	6.0	(6.3)	16.3	(9.7)	9.85 **	1-3 2-3
Increased activity	13.55	(9.12)	17.90	(9.2)	10.23	(7.3)	4.08 *	2-3
Distraction	8.3	(6.6)	7.6	(7.2)	5.7	(6.7)	1.34	--
Ignoring sensations	12.5	(9.6)	16.6	(8.9)	10.9	(8.6)	2.37	--
Prayer	14.76	(8.7)	16.20	(9.7)	16.57	(6.4)	.43	--
Reinterpreting pain sensations	3.68	(6.2)	4.3	(7.4)	2.9	(5.4)	.31	--

Note: * $p < .05$ ** $p < .01$

Group 1: None/slight Radiological Deterioration and none/slight functional deterioration

Group 2: Moderate/severe Radiological Deterioration and none/slight functional deterioration

Group 3: Moderate/severe Radiological Deterioration and moderate/severe functional deterioration

of the canonical correlation being .62 (eigenvalue = .62; Wilks' lambda = .618). The canonical correlation squared reflects the percentage of variance in the discriminant dependent variable due to the set of independent variables in the function (Huberty, 1994; Kecka, 1980). Thus, it may be concluded that 38.44% of the variance in deterioration group is explained by the set of independent variables. The centroids were -.944 for the group with no/slight functional deterioration and .629 for the group with moderate/severe functional deterioration. The variables that formed part of the function and their respective discriminant weights were catastrophizing (.76), increased activity (-.60) and self-statements (-.58). The discriminant weights were used to interpret the discriminatory capacity of the dependent variables, following Hair, Anderson, Tatham & Black's (1998) recommendations. The classification matrix for the original classification shows the percentage of cases correctly grouped. The percentage of cases correctly grouped by the function was 86%. The percentage of people correctly grouped in the group 3 was 96.7%. For the group 2 the percentage of cases correctly grouped was 70 %. The cut-off point for classification was chosen by considering the earlier probabilities and according to the groups' sizes. In order to determine if this precision in classification was significantly greater than what might have been expected by chance, the proportional chance criterion was calculated based on the groups' earlier probabilities. The index of correct classification by chance was found to be 52%. The function's 86% rate of correct classification far exceeds this percentage. Nevertheless, to determine whether the 86% classification precision obtained was statistically significant in comparison to the proportional randomness criterion, two indices were calculated. First, Press's Q index was calculated and compared to the critical value, defined as the Chi-square value with $k-1$ degrees of freedom (k = number of groups) and a confidence level of .99 (Hair et al., 1998). The Press's Q value obtained was 25.92, which far exceeds the critical value for χ^2 with $k-1$ degrees of freedom (6.635), so the discriminatory power of the function was deemed to be significantly better than what would have occurred by chance. Index I of the effect size was also calculated, which describes the exactness of classification as an index of improvement on the estimation reached by chance, showing the classifying exactitude of the function in terms of the groups' overlap, suggesting how much better we may predict which group an individual belongs to using the function (Huberty & Lowman, 2000; Hwang, 2001) than by chance. Index I shows a moderate-high value ($I = .67$) according to Cohen's criteria (Cohen, 1988). In light of the value obtained, it may be concluded according to a simple rule (Hwang, 2001) that by using this discriminant function, 67% fewer errors occur than if the classification were done by chance. For lack of general rules to determine how much the precision of a model should exceed the percentage of classification by chance (Hair et al., 1998),

25% improvement on the rate of correct classification by chance is recommended to consider a model useful (Hair et al., 1998; Schwab, 2003). As such, the present function may be considered to create a 67% improvement on what would have occurred by chance, suggesting good exactness in classifying these variables.

Discussion

People who suffer from osteoarthritis experience regular pain and functional disability. Several studies suggest that the physical severity of the disease measured in terms of radiological deterioration is not a good predictor of these symptoms (Ay & Evcik, 2008; Hannan et al., 2000; Heuts et al., 2004). Based on that finding, this study has approached two goals. The first goal was to test the level of association between the physical severity of the osteoarthritis and its functional repercussions in an elderly population. Second, we wished to analyze the role of pain topography and coping variables in the discrepancy between the physical and functional levels of deterioration.

The findings of previous studies suggest that if there is one, the relationship between radiological and functional deterioration in osteoarthritis is weak (Dahaghin et al., 2005; Heuts et al., 2004). The present study adds to the contributions of other authors by showing that in a sample of elderly people with osteoarthritis, the degree of association between radiological deterioration and its associated functional repercussions depends on the level of each variable. On that note, we have found a high level of agreement between slight levels of radiological and functional deterioration, while more extensive radiological deterioration is not clearly associated with significant functional deterioration in view of the fact that 40% of subjects with more intense radiological deterioration did not exhibit a similar level of disability.

The significant differences in functional deterioration of people that have similar moderate to severe radiological deterioration begs us to consider other relevant factors aside from physical pathology to explain those differences. The results of the present study show that if we compare subjects with acute radiological deterioration, the ones that use strategies to cope with pain that are traditionally considered active, such as positive self-statements have a significantly better functional capacity, while passive strategies such as catastrophizing are associated with greater disability. These results support the hypothesis that an active coping style focused on the problem itself is associated with greater adaptation and functional capacity and less need for psychological adjustment (Esteve et al., 2007; Keefe et al., 1987; López-Martínez et al., 2008; McCracken & Vowles, 2007; Samwel et al., 2006; Steultjens et al., 2001). In studying the types of strategies used, we have observed that people with better functional capacity, for the most part, employ the self-statements and

increased activity strategies, which supports the findings of Keefe's (1992) & Robinson's (1997) studies about strategy use and pain. This finding also supports the models that indicate non-evasive coping is correlated with greater functional capacity in people with arthritis (Dekker, Tola, Afdemkampe & Winckers, 1993) and other pain disorders (Johansen, 2008; McCracken & Samuel, 2007), although the evidence is not always in clear support of this trend (Turner et al., 2002). Furthermore, it was observed that people with worse functional capacity exhibit a greater incidence of catastrophizing reactions when faced with pain. This fact confirms the maladaptive role of this strategy in the case of elderly people with osteoarthritis, also identified in other studies at the functional and emotional levels as it relates to perceived pain intensity. In this way, the data are coherent with previous studies conducted on patients with osteoarthritis (Jensen et al., 2007; McCracken et al., 1998; Turner et al., 2000; Turner et al., 2002; Rapp et al., 2000) and other pain disorders (Esteve et al., 2007; López-López et al., 2008). Similarly, they support the idea that the catastrophizing reaction is important to consider when planning treatment in that eliminating it would favor a better functional adaptation. Along these lines, it has been observed in other research that effectiveness of and adherence to treatment decreases in the presence of catastrophizing reactions (Turk, Rudy & Sorkin, 1993), whereas a decrease in these reactions is correlated with greater functional and emotional adjustment (Jensen et al., 2007).

One interesting result of the present study is the fact that people with significant radiological deterioration without demonstrable functional deterioration (group 2) used the strategy of increasing activity more than any other group, even more than people with slight radiological and functional damage (group 1). One might believe that greater physical-radiological damage would lead to a group of patients who more often use the increased activity strategy to cope with pain in a planned, explicit and conscious way to optimize functional capacity. In other words, these people (with elevated radiological deterioration and good functional capacity) would use the increased activity coping strategy to deal with pain by choosing and optimizing functioning (Baltes & Baltes, 1990) deliberately. For people with less radiological deterioration (and high functional capacity), the increasing activity strategy would be used with a similar frequency, but more naturally as opposed to deliberately, such that though their rates of use may be the same, the second group would not report it as much. This hypothesis proposes there are no significant differences between groups 1 and 2 in their actual use of this strategy and emphasizes the gap in reporting it, but this assertion would require confirmatory research.

The rest of the coping strategies (distraction, ignoring sensations, prayer and reinterpreting pain sensations) did

not prove useful individually at differentiating between people grouped differently according to the severity of their lesions and functional deterioration. There does not seem to be a relationship between pain's topographical parameters (duration, frequency and intensity) and patients' groupings either. This result supports research to suggest the pain-adaptation binomial depends more on psychological variables like coping than they do directly on variables related to the sensory dimension of the pain (Jensen et al., 2007; López-López et al., 2008; Murphy et al., 1999) and lays in contrast to others that found pain intensity to be correlated with disability (Molenaar et al., 2002).

One must ask whether combining the different coping strategies, for which significant differences were found between the deterioration groups, is useful in distinguishing between the two levels of functional deterioration (none/slight-moderate/severe) that people may exhibit in spite of having the same moderate/severe level of radiological damage. On that note, the results of the discriminant analysis show that together, the variables catastrophizing, self-statements and increased activity adequately classify 86% of people with moderate-severe radiological deterioration into their respective levels of functional deterioration, catastrophizing being the most important strategy in doing so. Above all, the data suggests that research on pain and coping with chronic illness be expanded since the data are compatible with and, largely, agree with the discussion about the universality and relative effectiveness of coping strategies (Ibáñez, Back, Khachikian & Norris, 2004; Wortman & Lehman, 1985). The coping strategies with discriminatory power in this study could be considered universal; they were relevant to adapting to a wide variety of contexts and situations for the majority of people. Similarly, they could be considered preventative given that increased activity and self-statements, combined with a low incidence of the catastrophizing strategy, act to consistently moderate the way in which people cope with illness. The rest of the strategies evaluated may be considered more temporary and specific, depending on contextual factors; they are effective at managing specific pain episodes, but are not universally effective (Ibáñez et al., 2004). The data, then, would support the idea that promoting universal and preventative strategies for people that suffer from chronic disease, as opposed to specific, non-universal strategies, is more useful at optimizing an individual's functioning in everyday life (National Advisory Mental Health Council, 2001). Lastly, for elderly people with arthritis, coping strategies related to maladaptive, negative thinking and catastrophizing limit an individual's ability to cope with pain, like in other populations studied previously (Gil, Williams, Keefe, & Beckham, 1990). This fact supports the hypothesis, which is becoming more and more common in this field, that ruminating about health and the experience of pain (Johansen, 2008; Kirkegaard et al. 2004; Sullivan, Lynch & Clark, 2005) is tremendously important, as is the

need to intervene and reduce automatic negative thinking and its recurrence as a fundamental part of cognitive-behavioral treatment of pain in the elderly.

Generally speaking, the results of the present study provide additional evidence of the importance of psychological variables, especially pain coping strategies, to one's adjustment to illness among elderly people with arthritis, specifically when it comes to managing functioning. Nevertheless, certain limitations of this study should not go without mention. The first is due to the correlational nature of the data, which does not allow one to draw conclusions about causation. Second, it would have been helpful to include a self-report measure of participants' functional capacity in order to compare those results with the results collected by doctors. Regarding the evaluation instruments employed, for evaluating functional deterioration, it would have been desirable to use more specific instruments designed to evaluate functioning in arthritis patients such as the Western Ontario and McMaster Universities' (WOMAC; Bellamy et al., 1988; adaptation by Batlle-Gualda, Esteve-Vives, Piera, Hargreaves & Cutts, 1999) instrument and/or other indices of global functional deterioration such as the ACR Functional Status Criteria for Rheumatoid Arthritis, which could have perhaps supplied data relevant to this study. On a related note, to evaluate coping strategies, applying a version that had been validated for a larger sample size would have improved the reliability and validity of the measure. Also, there are some variables of a different kind that were not evaluated that could influence the experience of pain and disability such as social support, socioeconomic status, depression, physical therapy and/or psychological therapy aside from cognitive-behavioral therapy (Faucet & Levine, 1991; Truyols et al., 2008; Vallejo, 2008). Also note that the data collected refer to people whose pain is caused by osteoarthritis, so generalization to other types of pain should be made with caution. For different types of pain, the functional relationships between the study's variables may vary (Camacho & Anarte, 2003). Finally, the sample was only comprised of elderly people, and mostly women. That fact allows for the results to be generalized to an elderly population, especially a female, elderly population. This is noteworthy because of the lack of studies of this population and because osteoarthritis is more prevalent among women. On the other hand, it also makes it more difficult to generalize to other age groups since prior studies have suggested that age may be related to the perception of pain (Ramírez-Maestre, Esteve, López-Martínez & Anarte, 2001). At the same time, the fact that the sample contains a greater percentage of women than men, though it does reflect the distribution by sex of this disease, it could make it more difficult to generalize the results to a male population. Meanwhile, previous studies suggest that there may be differences related to sex in perception of pain (Ramírez-Maestre et al., 2001).

References

- American Geriatrics Society Panel on Persistent Pain in Older Persons (2002). Clinical practice guidelines: The management of persistent pain in older persons. *Journal of American Geriatric Society*, 50(6), 1-20
- Altman, R. D., Fries, J. F., Bloch, D. A., Carstens, J., Cooke, T. D., & Genant, H. (1987). Radiographic assessment of progression in osteoarthritis. *Arthritis and Rheumatism*, 30, 214-25.
- Auleley, G.R., Giradeau, B., Dougados, M., & Ravaud, P. (2000). Radiographic assessment of hip osteoarthritis progression: impact of Reading procedures for longitudinal studies. *Annals of Rheumatic Diseases*, 59, 422-427
- Ay, S., & Evcik, D. (2008). Effectiveness of pain, disease severity and radiological grading on disability of daily living activities in knee osteoarthritis. *Romatizma*, 23, 14-17.
- Batlle-Gualda, E., Esteve-Vives, J., Piera, M. C., Hargreaves, R., & Cutts J. (1999). Adaptación transcultural del cuestionario WOMAC específico para artrosis de rodilla y cadera. [Transcultural adaptation of WOMAC questionnaire for knee and hip osteoarthritis]. *Revista Española de Reumatología*, 26, 38-45.
- Bellamy, N., Buchanan, W. W. Goldsmith, C. H., Campbell, J., & Stitt, L. W. (1988). Validation study of WOMAC: A health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *Journal of Rheumatology*, 15, 1833-1840.
- Bijlsma, J. W. (2002). Analgesia and the patient with osteoarthritis. *American Journal Therapy*, 9, 189-197
- Bijsterbosch, J., Scharloo, M., Visser, A. W., Watt, I., Meulenbelt, I., Huizinga, T. W. et al (2009). Illness perceptions in patients with osteoarthritis: Change over time and association with disability. *Arthritis and Rheumatism*, 61, 1054-1061.
- Botha-Scheepers, S., Riyazi, N., Kroon, H. M., Scharloo, M., Houwing-Duistermaat, J. J., Slagboom, E., et al (2006). Activity limitations in the lower extremities in patients with osteoarthritis: the modifying effects of illness perceptions and mental health. *Osteoarthritis Cartilage*, 14, 1104-1110
- Bruce, B., & Fries, J. (2004). Longitudinal comparison of the Health Assessment Questionnaire (HAQ) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). *Arthritis and Rheumatism*, 51,730-737.
- Camacho, L. M., & Anarte, M. T. (2001). Importancia de las creencias en la modulación del dolor crónico: concepto y evaluación [Importance of pain beliefs in pain modulation:concept and evaluation]. *Apuntes de Psicología*, 19, 453-470
- Camacho, L. M., & Anarte, M. T. (2003). Creencias, afrontamiento y estado de ánimo deprimido en pacientes con dolor crónico [Beliefs, coping, and depressive mood state in chronic pain patients]. *Psicothema* 15, 464-470
- Carmona, L., Ballina, J., Gabriel, R., & Laffon, A. (2001).The burden of musculoskeletal diseases in the general population of Spain. Results from a national survey. *Annals of The Rheumatic Diseases*, 60, 1040-1045

- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. 2nd Ed. Hillsdale, NJ: LEA.
- Dahaghin, S., Bierma-Zeinstra, S. M. A., Ginai, A. Z., Pols, H. A. P., Hazes, J. M. W., & Koes, B. W. (2005). Prevalence and pattern of radiographic hand osteoarthritis and association with pain and disability (the Rotterdam study). *Annals of The Rheumatic Diseases*, 64, 682-687
- Dekker, J., Tola, P., Afdemkampe, G., & Winckers, M. (1993). Negative affect, pain and disability in osteoarthritis patients. The mediating role of muscle weakness. *Behavioral Research and Therapy*, 31, 203-206.
- Dozois, D. J. A., Dobson, K. S., Wong, M., Hughes, D., & Long, A. (1995). Factors associated with rehabilitation outcome in patients with low back pain (LBP): prediction of employment outcome at 9-month follow-up. *Rehabilitation Psychology*, 40, 243-259.
- Esteve, R., López, A. E., & Ramírez, C. (1999). Evaluación de estrategias de afrontamiento al dolor crónico. [Assessment of pain coping strategies]. *Revista de Psicología de la Salud*, 11, 77-102
- Esteve, R., Ramírez-Maestre, C., & López-Martínez, A. E. (2007). Adjustment to chronic pain: the role of pain acceptance, coping strategies, and pain-related cognitions. *Annals of Behavioral Medicine*, 33, 179-188.
- Esteve-Vives, J., Batlle-Gualda, E., & Reig, A. (1991). Adaptación del Health Assessment Questionnaire a la población española. [Adaptation of Health Assessment Questionnaire to Spanish population]. *Revista Española de Reumatología*, 18, 258-262.
- Esteve-Vives, J., Batlle-Gualda, E., Reig, A., & Grupo para la Adaptación del HAQ a la Población Española. (1993). Spanish version of the Health Assessment Questionnaire: reliability, validity and transcultural equivalency. *Journal of Rheumatology*, 20(12), 2116-2122.
- Faucett, J. A., & Levine, J. D. (1991). The contributions of interpersonal conflict to chronic pain in the presence or absence of organic pathology. *Pain*, 44, 35-43
- Fries, J. F., Spitz, P. W., & Young, D. Y. (1982). The dimensions of health outcomes: the Health Assessment Questionnaire, disability and pain scales. *Journal of Rheumatology*, 9, 789-793.
- Gil, K. M., Williams, D. A., Keefe, F. J., & Beckham, J. C. (1990). The relationship of negative thoughts to pain and psychological distress. *Behavior Therapy*, 21, 349-362.
- Hannan, M. T., Felson, D. T., & Pincus, T. (2000). Analysis of the discordance between radiographic changes and knee pain in osteoarthritis of the knee. *Journal of Rheumatology*, 27, 1513-1517
- Hadjistavropoulos, T., Herr, K., Turk, D. C., Fine, P. G., Dworkin, R. H., Helme, R., et al (2007). An Interdisciplinary Expert Consensus Statement on Assessment of Pain in Older Persons. *The Clinical Journal of Pain*, 23, 1-43.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multiple discriminant analysis and logistic regression. Multivariate data analysis* (5th ed.) (pp. 239-325). Upper Saddle River, NJ: Prentice-Hall
- Heuts, P. H., Vlaeyen J. W., Roelofs, J., Bie, R. A., Aretz, K., van Weel, C., et al. (2004). Pain-related fear and daily functioning in patients with osteoarthritis. *Pain*, 110, 228-35.
- Herr K. (2005). Pain assessment in older adults with verbal communication skills. In: J. Gibson, & D. K. Weiner, eds. *Pain in Older Adults* (pp. 111-133). Seattle, WA: IASP Press.,
- Herrero, A. M., Ramírez-Maestre, C., & González, V. (2008). Personality, Cognitive appraisal and adjustment in chronic pain patients. *The Spanish Journal of Psychology*, 11, 531-542
- Huberty, C. J. (1994). *Applied discriminant analysis*. New York: Wiley and Sons.
- Huberty, C. J., & Lowman, L. L. (2000). Group Overlap as a Basis for Effect Size. *Educational and Psychological Measurement*, 60(4), 543-563
- Hwang, D. Y. (2001). *Issues in predictive discriminant analysis: Using and interpreting the leave-one-out jackknife method and the improvement-over chance "I" index effect size*. Paper presented at the Annual Meeting of the Southwest Educational Research Association, New Orleans, LA.
- Jensen, M. P., Turner, J. A., & Romano, J. M. (2007). Changes after multidisciplinary pain treatment in patient pain beliefs and coping are associated with concurrent changes in patient functioning. *Pain*, 131, 38-47.
- Johansen, S. A. (2008). Cognitive features, self-management, and disability level associated with chronic back pain. *Dissertation Abstracts International: Section B: The Sciences and Engineering*, 69, 1373
- Kean, W. F., Kean, R., & Buchanan, W. W. (2004). Osteoarthritis: Symptoms, signs and source of pain. *Inflammopharmacology*, 12, 3-31
- Keefe, F. J. (1992). Behavioral and cognitive-behavioral approaches to chronic pain. Recent advances and future directions. *Journal of Consulting and Clinical Psychology*, 60, 528-536.
- Keefe, F. J., Cadwell, D. S., Queen, K. T., Gil, K. M., Martínez, S., & Crisson, L. (1987). Pain coping strategies in osteoarthritis patients. *Journal of Consulting and Clinical Psychology*, 2, 208-212.
- Kirkegaard, D., Yung, M., Hokland, M., Viidik, A., Olesen, F., Avlund, K., et al. (2004). Negative Thoughts and Health: Associations Among Rumination, Immunity, and Health Care Utilization in a Young and Elderly Sample. *Psychosomatic Medicine*, 66, 363-371
- Klecka, W. R. (1980). *Discriminant analysis. Quantitative Applications in the Social Sciences Series*. Thousand Oaks, CA: Sage Publications.
- Lin, C., & Ward, S. E. (1996). Perceiver self-efficacy and outcome expectancies in coping with chronic low back pain. *Research in Nursing and Health*, 19, 299-310.
- López, A., Montorio, I., Izal, M., & Velasco, L. (2008). The role of psychological variables in explaining depression in older people with chronic pain. *Aging and mental health*, 12, 735-745
- Lopez-Martinez, A. E., Esteve-Zarazaga, R., & Ramírez-Maestre, C. (2008). Perceived social support and coping responses are independent variables explaining pain adjustment among chronic pain patients. *Journal of Pain*, 9, 373, 379.
- McCracken, L. M., Goetsch, V. L., & Semenchuk, E. M. (1998). Coping with pain produced by physical activity in persons with chronic low back pain: immediate assessment following a specific pain event. *Behavioural Medicine*, 24, 29-34

- McCracken, L. M., & Vowles, K. E. (2007). Psychological flexibility and traditional pain management strategies in relation to patient functioning with chronic pain: an examination of a revised instrument. *Journal of Pain*, 8, 700-707.
- McCracken, L. M., & Samuel, V. M. (2007). The role of avoidance, pacing, and other activity patterns in chronic pain. *Pain*, 130 (1-2), 119-125.
- Molenaar, E. T. H., Voskuyl, A. E., & Dijkmans, B. A. C. (2002). Functional disability in relation to radiological damage and disease activity in patients with rheumatoid arthritis in remission. *The Journal of Rheumatology*, 29, 267-270.
- Murphy, H., Dickens, C., Creed, F., & Berstein, R. (1999). Depression, illness perception and coping in rheumatoid arthritis. *Journal of Psychosomatic Research*, 46, 155-164.
- National Advisory Mental Health Council Workgroup on Mental Disorders Prevention Research (2001). Priorities for Prevention Research at NIMH, *Prevention & Treatment*, 4, (www.journals.apa.org/prevention/volume4/pre0040017a.html)
- Odding, E. Valkenburg, H. A., Algra, D., Vandernouweland, F. A., & Grobbee, D. E. (1998). Associations of radiological osteoarthritis of the hip and knee with locomotor disability in the Rotterdam Study, *Annals of The Rheumatic Diseases*, 57, 203-8.
- Hofman, A. (1998). Associations of radiological osteoarthritis of the hip and knee with locomotor disability in the Rotterdam Study. *Annals of the Rheumatic Diseases*, 57, 203-208.
- Peat, G., Croft, P., & Hay, E. (2001). Clinical assessment of the osteoarthritis patient. *Best Practice & Research, Clinical Rheumatology*, 15, 527-544.
- Picavet, H. S., & Hazes, J. M. (2003). Prevalence of self reported musculoskeletal diseases is high. *Annals of The Rheumatic Diseases*, 62, 644-650.
- Patrick, M., Aldridge, S., Hamilton, E., Manhire, A., & Doherty, M. (1989). A controlled study of hand function in nodal and erosive osteoarthritis. *Annals of The Rheumatic Diseases*, 48, 978-982.
- Ramírez-Maestre, C., Esteve, R., López-Martínez, A. E., & Anarte, M. T. (2001). Diferencias en la percepción de dolor relacionadas con las variables sexo y edad. *Revista de la Sociedad Española de Dolor*, 8, 562-568.
- Rapp, S. R., Rejeski, W., & Millar, M. E. (2000). Physical function among older adults with knee pain: The role of pain coping skills. *Arthritis Care and Research*, 13(5), 270-279.
- Robinson, M. E., Riley, J. L., Myers, C. D., Sadler, I. J., Kvaal, S. A., Geisser, M. E., et al. (1997). The Coping Strategies Questionnaire: a large sample, item level factor analysis. *Clinical Journal of Pain*, 13, 43-49.
- Rodríguez, M. J., Esteve, R., & López, A. E. (2000). Dolor crónico y estrategias de afrontamiento en dolor crónico oncológico. [Chronic pain and pain coping strategies in oncological pain] *Psicothema*, 12, 339-345.
- Rosenberg T., Paulos L., Parker R., Coward D., & Scott S. (1988). The forty-five-degree posteroanterior flexion weight-bearing radiograph of the knee. *Journal of Bone and Joint Surgery Am*, 70, 1479-83.
- Rosentiel, A. K., & Keefe, F. J. (1983). The use of coping strategies in chronic low back pain patients: relationship to patient characteristics and current adjustment. *Pain*, 17, 33-44.
- Samuel, H. J. A., Evers, A. W. M., Crul, B. J. P., & Karrimaat, F. W. (2006). The role of helplessness, fear of pain, and passive pain-coping in chronic pain patients. *Clinical Journal of Pain*, 22, 245-251.
- Schwab, A. J. (2003). *Strategy for complete discriminant analysis*. Class lecture notes power-point for sw388r7. Retrieved March 22, 2005, <http://www.utexas.edu/Courses/schwab/sw38847/SolvingProblems>.
- Stephens, M. A. P., Druley, J. A., & Zautra, A. J. (2002). Older adults' recovery from surgery for osteoarthritis of the knee. psychosocial resources and constraints as predictors of outcomes. *Health Psychology*, 21, 377-383.
- Steultjens, M. P. M., Dekker, J., & Bijlsma J. W. J. (2001). Coping pain and disability in osteoarthritis: a longitudinal study. *Journal of Rheumatology*, 28, 1068-1072.
- Sullivan, M. J. L., Bishop, S., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment*, 7, 524-532.
- Sullivan, M. J. L., Lynch, M. E., & Clark, A. J. (2005). Dimensions of catastrophic thinking associated with pain experience and disability in patients with neuropathic pain conditions. *Pain*, 113, 310-315.
- Truyols, M. M., Pérez, J., Medinas, M. M., Palmer, A., & Sesé, A. (2008). Aspectos psicológicos relevantes en el estudio y tratamiento del dolor crónico. *Clínica y Salud*, 19, 295-320.
- Tsai, Y. F., Chu, T. L., Lai, Y. H., & Chen, W. J. (2008). Pain experiences, control beliefs and coping strategies in Chinese elders with osteoarthritis. *Journal of Clinical Nursing*, 17, 596-603.
- Turk, D. C., Rudy, T. E., & Sorkin, B. A. (1993). Neglected topics in chronic pain treatment outcome studies: determination of success. *Pain*, 53, 3-16.
- Turner, J. A., Dworkin, S. F., Mancl, L. L., Huggins, K. H., & Truelove, E. L. (2001). The roles of beliefs, catastrophizing, and coping in the functioning of patients with temporomandibular disorders. *Pain*, 92, 41-51.
- Turner, J. A., Jensen, M. P., & Romano, J. M. (2000). Do beliefs, coping and catastrophizing independently predict functioning in patients with chronic pain? *Pain*, 85, 115-125.
- Turner, J. A., Jensen, M. P., Warms, C. A., & Cardenas, D. D. (2002). Catastrophizing is associated with pain intensity, psychological distress and pain related disability among individuals with chronic pain after spinal cord injury. *Pain*, 98, 127-134.
- Vallejo, M. A. (2008). Perspectivas en el estudio y tratamiento psicológico del dolor crónico. [Perspectives in the study and psychological treatment of chronic pain] *Clínica y Salud*, 19, 417-430.