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Pain Catastrophizing in College Athletes' at Eastern Kentucky University

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It is a known fact that athletes become susceptible to injuries with more athletic injury exposures, and that pain is the most common symptom paired with injury. Pain catastrophizing is a phenomenon that is caused by negative thinking that has been shown to reduce treatment outcomes in patient populations. Pain catastrophizing has been studied in different populations, usually with specific body part injuries, showing it is a relevant factor in the outcome of rehabilitation. Nobody has researched the prevalence of pain catastrophizing in highly athletic populations. In Division I athletes at Eastern Kentucky University, 291 athletes were surveyed using the Pain Catastrophizing Scale (PCS). It was found that 14% of the athletes surveyed were classified as pain catastrophizers. Athletes were also given a demographic patient identifier sheet which indicated that athletes with a current injury, previous injury, or playing with pain were at a higher risk of being a pain catastrophizer. Also, athletes with a previous injury were 3.4x more likely to be a pain catastrophizer. This can be useful when clinically rehabilitating athletes that score highly on the PCS.

Keywords and phrases: pain catastrophizing scale, athletes, Eastern Kentucky University, rehabilitating, pain, and catastrophizing.

Table of Contents:

List of tables:

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Introduction

With every sport that is played, there is risk of injury. Each time an athlete participates in a practice, scrimmage, or game (events defined as athletic injury exposures), a risk of injury is present. Previous work has identified the risk of injury for specific anatomical joints, with the ankle and knee having the greatest risk of injury (3-5 injuries for every 10,000 exposures) (Hootman & Dick, 2007). Fortunately, allied health professionals attempt to prevent these injuries with interventions designed to enhance the body's ability to withstand the traumas that can lead to injury. However, musculoskeletal injuries are not 100% preventable which requires these same professionals to rehabilitate injuries after they occur. Unfortunately, there are still many unanswered questions about the factors that impede the rehabilitation of musculoskeletal injury, one of which is the individual variation in pain perception.

Among medical practitioners pain is defined as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage" (Merskey & Bogduk, 1994, p. 209). Essentially, the perception of pain is unique to each person. Pain was once believed to occur similarly between individuals with some experts suggesting that specific pathways existed for each type of sensation experienced (Moayedi & Davis, 2013). For example, around the year 1600, Rene Decartes suggested that negative sensations (i.e. pain) traveled along a specific pathway to the brain which caused bile, phlegm, and negative spirits to be released thus causing the negative sensation we call pain (Moayedi

& Davis, 2013). Various other theories were proposed over time with the clinical world eventually accepting the gate-control theory of pain perception (Melzack & Wall 1965). Simply stated, the gate-control theory suggested that pain traveled on one type of nerve fiber while non-painful sensations traveled on another type of fiber. However, unlike Decartes' theory of pain perception, the gate-control theory suggested that the sensations were regulated by the brain with non-painful sensations closing the gate and not making it through to the brain for a response while painful sensations would be allowed through the gate in order for the brain to provide the correct reaction. Although the gate-control is accepted and has been the most testable of all proposed theories on pain perception, recent research has shown that pain perception is much more complex than originally thought (Louw & Puentedura, 2013).

There are various reasons that can cause pain perception to be complex including differences in pain threshold, pain tolerance, placebo effects, central sensitization, and pain catastrophizing (Diatchenko, 2004; Salwin & Zajac, 2016; Alfano, 2015; Sanzarello, I., 2016). Recently, pain catastrophizing has been identified as a key factor that can alter pain processing and in turn inhibit the recovery from injury.

Pain catastrophizing is defined as: "It is a distinct phenomenon which is characterized by feelings of helplessness, active rumination and excessive magnification of cognitions and feelings toward the painful situation" (Leung, 2012). The dictionary has described helplessness, "unable to help oneself; weak or dependent" (*Merriam-Webster*, n.d.). In the case of injury, helplessness is

when a patient doesn't think they can get help for their injury or to decrease the pain they feel. Merriam-Webster describes rumination as, "to go over in the mind repeatedly and often casually or slowly" (*Merriam-Webster*, n.d.). Rumination for a patient is to constantly think about the injury and pain being suffered. Finally, magnification is defined as, "to cause to seem greater or more important; attribute too much importance to; exaggerate" (*Merriam-Webster*, n.d.). Self-explanatory this means that the patient exaggerates the amount of pain that they may be in. Pain catastrophizing is important in the athletic population because it can lead to other psychological issues impeding rehabilitation. (Bergbom, Boersma, Overmeer, Linton, 2011; Slepian et al, 2014). Also, pain catastrophizing can be brought upon by painful stimulus, which is prevalent in the athletic population due to the amount of injuries sustained because of athletic exposure.

A challenging part for clinicians' today is being able to relate with patients' when they claim they are in pain. It is a subjective measure that many different scales and surveys have been developed to try and put a number on to better objectify a patient's pain perception. Clinically, it is common for a physician, physical therapist, or athletic trainer to ask the question; "On a scale of 0-10 how bad is your pain right now?" The concern however is that although the clinician is attempting to objectify pain level, the patient is providing a personal opinion about his or her pain level which is inherently subjective. Of greater concern, is that the traditional numeric pain rating scale does not provide any clarity as to why the pain is present or how the patient processes pain. It is possible that

factors beyond the anatomic injury such as previous injury experiences, trauma, and/or pain catastrophizing could be present which could negatively affect the treatment decisions made by the clinician.

Currently there is extensive literature on the PCS, but none of the literature focused on college level athletes. Therefore, the primary purpose for this study was to discover the frequency of pain catastrophizing in collegiate level athletes. Second, our hope was to determine if athletes with a history of injury would have a higher frequency of pain catastrophizing compared to athletes without a history of injury. The hypothesis that developed was that less than 10% of all athletes who complete the PCS would be classified as having pain catastrophizing characteristics and athletes with a history of injury would have a greater incidence of pain catastrophizing compared to athletes without a history of injury.

Literature Review

Acute pain is described by *The Federation of State Medical Boards* as: “the normal, predicted physiological response to an adverse chemical, thermal or mechanical stimulus… associated with surgery, trauma and acute illness” (Model, 1998, p. 3). In athletic training it is known that acute injury is defined as; “ An injury with sudden onset and short duration” (Prentice, 2015, p. 938). Naturally a patient who experiences an acute injury experiences a large amount of pain during a short duration of time. Making their memory of the injury negative and containing the idea of pain and agony suffered. Think of a simple acute ankle

sprain for instance. A basketball player jumps up for a rebound and lands wrong, twisting their ankle and shouting in agony, that sort of injury happens every day. That patient, depending on their history, severity, and drive to heal will likely be injured for 2-3 weeks. But, during the initial 0-48 hour period of major swelling and stiffness the patient experiences a majority of their pain. This early painful stage stands out in the patients mind when recalling that specific injury.

Chronic injury is the opposite of acute; it is “an injury with a long onset and long duration” (Prentice, 2015, p. 938). The opposite thought applies to this situation; the patient being injured generally has less pain that progressively magnifies if healing doesn’t occur correctly. A common injury that is considered acute would be anything tendonitis. Tendonitis is the inflammation of the tendon of a muscle. It starts out with a small ache usually in repetitive sports such as tennis, baseball, and golf. Then the pain gets worse and starts to ache at different times, sometimes in the morning, most commonly during and at the end of the activity that stresses the muscle. On a pain scale of 0-10 tendonitis usually falls at a 3 or 4 before it gets so debilitating that the patient can’t participate in their activity or sport. “it is estimated that approximately 25-30 percent of Americans live with chronic pain, and that up to 50 percent of us will suffer from chronic pain at some time during our lives” (Silver, 2009, p. 11).

Understanding the concept of catastrophizing is a pivotal part of looking at the research already published. “Catastrophizing is anxiety…individuals with panic disorder interpret anxiety-produced bodily sensations (e.g. palpitations, breathlessness) in a catastrophic fashion (Turner, 2001, p. 65). Turner also

discussed later that Albert Ellis was the pioneer of catastrophizing and also the founder of rational-emotional therapy. He described catastrophizing, “How terrible the situation is; I positively cannot stand it” (Turner, 2001 p. 65).
Ida Flink considered the development of the conceptualization, she thinks of catastrophizing as repetitive negative thinking. Repetitive negative thinking is; “A style of thinking about one’s problems (current, past, or future) of negative experiences (past or anticipated) that is repetitive, at least partly intrusive, and is difficult to disengage from” (Ehring, 2011, p 226). Flink argues that pain catastrophizing has been focused too much on the outcome of the pain and disability but not why it has occurred. They are calling for a realization of why it is occurring as a coping strategy and think that the PCS should be accompanied by an interview procedure to see the full abstraction of the worries (Flink, 2013).

The PCS has been widely researched and shown to have an effect and show positive difference in race, age, and gender specifics. With knowing that there are differences in these demographics it has been more widely researched because it can positively show differences in sample size populations. “Pain catastrophizing also functions as a variable which can alter the prognosis and level of physical disability” (Lueng 2012). Making it easier for clinicians to pass out a 13-question outcome measure and to better understand psychologically where the patient is at and if more than musculoskeletal rehabilitation is needed.

It is known in orthopedic and sports medicine that a history of injury leads to future injury. Once a tissue is damaged and heals it is never quite as strong as it once was. Another question that needs to be addressed then with that

understanding is does history of injury have association with PCS scores in athletes? A study done in the southern United States looked close to this question. They wanted to know how injury during an athlete's collegiate sport affected their life after college. They found that a large number of the athletes were still experiencing the affects of the sport they played in college and concluded that help needs to be found for this cohort of close to 800 participants after graduation (Kerr, 2014).

Simon and Docherty also studied the health related quality of life of athletes. Their study consisted of patients between the ages of 40-65 who either; (1) played a college sport at a Division I university in the Midwestern United States, or (2) played club, recreation, or intramural sports at the same institution. The participants were given a demographic questionnaire along with the Patient-Reported Outcomes Measure Information System (PROMIS). They discovered that athletes who played a varsity sport at the Division I level were more likely to suffer from one of the following: physical function, depression, fatigue, pain interference, and sleep disturbances. They former athletes also reported lower quality of life along with more chronic and major injuries than the non-athletic cohort did (Simon, 2013). Unfortunately, there is no concrete research regarding the relationship between history of injury and pain catastrophizing scores in athletes.

Athlete's ability to cope with their pain is another area being studied. A study in France took 205 combat athletes and tested their pain coping behavior.

They were able to conclude that the more athletes that catastrophized their pain, the less likely they were to play through their pain (Deroche, 2011).

In Slovenia, a study was conducted with athletes sustaining knee injuries. They looked at more severe injuries (6 month recovery) versus less severe (1 month recovery). They also observed the coping strategies of the athletes' during the process. "Interestingly, athletes with more severe injuries used more positive coping (individual coping response), and less negative pain-coping strategies (catastrophizing) than the athletes with less severe injuries" (Masten, 2014, p. 4).

Jennifer Prugh concentrated on overhead athletes using multiple different pain scales. Prugh decided to break down the PCS into its three subcategories, and compare them to decide which ones had a significant impact on the overall PCS score. They concluded that rumination and magnification had a strong significance in the PCS overall score and helplessness only had a moderate association with the total PCS score (Prugh, 2012).

In a study at Queen's University in Ontario, Canada Paparizos was able to show a correlation between the PCS and pain scale. The correlation did not come in the form of the athletes chosen for the study though. "For participants with no formal ballet training, higher catastrophizing scores were related to higher pain reports" meaning that the higher the PCS score, also the more frequent the pain reports for the 26 non-dancers (Paparizos, 2005).

ACL studies are very common when pain is being researched due to the large amount of pain and long process of recovery from such an injury. Tripp et al

studied fear of injury, negative effect, and catastrophizing in recreational athletes with ACL injuries. They found that, “fear of re-injury, negative affect, and catastrophizing were all significantly correlated with athletes’ confidence in their ability to return to their sport, … only negative affect was uniquely associated with athletic confidence” (Tripp, 2007, p. 78). This study was unable to find a correlation with pain catastrophizing in their sport indexes, but other studies have shown that catastrophizing can lead to fear of re-injury (Tripp, 2007).

Methods

Participants

The sample size consisted of 291 National Collegiate Athletic Association Division I athletes at Eastern Kentucky University. The athletes were recruited and tested by sport. The sports included were as follows: men’s golf, women’s golf, women’s soccer, softball, baseball, football, men’s basketball, women’s basketball, women’s volleyball, men’s cheerleading, women’s cheerleading, women’s dance team, men’s cross country, women’s cross country, men’s track and field, women’s track and field, men’s tennis, and women’s tennis. The following inclusion criterion was required to participate in the study: Ages 18-35; ability to read, speak, comprehend English; and medically cleared to participate in athletics. Subjects were excluded if they had a current disease, illness, or condition medically disqualifying the individual from participating in competitive athletics and/or a current musculoskeletal injury preventing them from going through baseline testing and preventing full participation in athletics.

Procedures

This study followed a cross sectional survey design. The team sports coaches of all 18-varsity sports at Eastern Kentucky University were contacted via email. Permission was requested to obtain the information required to complete the research. Before the surveys were distributed the survey was explained. The purpose was shared as well that no identifying information would be collected from the athletes. All subjects who participated in this study were currently enrolled in college and participating in National College Athletic Association (NCAA) Division I athletics. To answer the primary question, the participants were all given the 13-question outcome measure and asked to complete and return it. The participants were also given a page long demographic sheet that would be able to identify the athletes' sex, sport, age, years played, presence of pain, presence of current injury, and previous injury history. These questions were used in grouping the different scores with how the injury history presented, which helped to answer the second question.

Study Questionnaires

The survey used in this study is called the Pain Catastrophizing Scale (PCS). The PCS is a 13-question outcome measure developed in 1995 by Sullivan *et al.* that is comprised of the three subcategories described above. The PCS works on a 5 point scale per question and has a high test-retest correlation of (r=.75) for the same individual across a 6-week time period (Lueng, 2012).

Data Reduction

The research team manually entered all paper questionnaire data into an electronic database. The 13 PCS responses were summed to produce a total score. Using previous literature a catastrophizer was classified by a score of 30 or greater while a non-catastrophizer was classified by a score of less than 30. Questions #1, 2, 3, 4, 5, & 12 were totaled to calculate helplessness. Questions #8, 9, 10, 11 were totaled to calculate rumination. Questions #6, 7, 13 were totaled to calculate magnification.

Statistical Analysis

Demographic variables were summarized with continuous variables presented as means and standard deviations while categorical variables presented as frequencies and percentages. To answer the primary question, we calculated the total number of athletes who scored ≥30 on the PCS and divided the value by the total number of athletes who submitted a survey. Independent t-tests were performed to determine if differences existed in PCS score between: 1) athletes playing with pain and those not playing with pain; 2) athletes currently injured and those not currently injured; and 3) athletes with previous injury and those without previous injury. Finally, a binary logistic regression was performed to determine if any demographic variable could successfully predict pain catastrophizing behavior.

Results

Demographic information was obtained from the 291 athletes at Eastern Kentucky University participating in 18 varsity sports (Table 1). 40 (14%) of the surveyed athletes scored >30 on the PCS which classified them as a pain catastrophizer (Table 2). Athletes who were currently injured, previously injured, and playing with pain had higher PCS scores compared to athletes who did not qualify for any of the categories (Table 3). The effect sizes were moderate ranging from .50 to .61 for the demographic categories. The logistic regression revealed that an athlete was 3.4x more likely to become a pain catastrophizer if a history of injury was present.

Discussion

Self-reported outcome questionnaires have been used heavily various studies to show that pain catastrophizing can affect patient's treatment outcomes. (Slepian *et al*, 2014; Bergbom, Boersma, Overmeer, Linton, 2011). These questionnaires are distributed after an injury occurs to determine if patients are considered catastrophizers. The studies that had been conducted previously did not focus on athletes or on a specific population.. Thus, this study chose to survey the athletic population finding that pain catastrophization is present in upper level collegiate athletes and that history of injury contributes to catastrophizing behavior.

The main finding in the statistics was that 40 of the 291 athletes (14%) scored ≥30 on the PCS. The hypothesis for the study was the 10% of the athletes' would have catastrophizing characteristics. Although the hypothesis was rejected, it is unknown if the 14% frequency is either high or low. In specific studies it has been shown that in patients with knee or back pain that 20-40% of these patients will catastrophize their pain (Domenech, Alfonso, Espejo, 2014; Picavet, Vlaeyen, Schouten, 2002). Unfortunately there are no general population statistics on pain catastrophizing of a group of people to compare this number to.

After running the statistical summary it was discovered that if an athlete was currently injured, previously injured, or playing with pain that they were more likely to have a higher PCS score. This finding was not entirely surprising, as previous work has shown that athletes and military cadets with a history of injury can have lower perceived ability to physically function. (Sciascia, Haegele, Lucas, Uhl, 2015; Simon and Docherty, 2014). Similarly, the logistic regression showed that if you had a history of previous injury you were 3.4 times more likely to be classified as a pain catastrophizer. This information could be deemed valuable to practicing clinicians who routinely evaluate and treat athletes. It is possible that the identification of 1) pain catastrophization and 2) a history of previous injury could allow clinicians to have an awareness of recovery expectations or an understanding of each individual athlete's method of perceiving pain when it occurs.

Limitations

This study was not without limitations. First, some coaches did not respond to the initial emails, which resulted in some athletes not completing the survey. Repeated attempts at contacting the coaches were made but were unsuccessful. Due to limited availability and contact with the athletes, some coaches did not allow athletes the allotted time to fully complete the survey. In some cases, the surveys were left with the team to be completed when time became available with the expectation that the completed surveys would be returned to the research team. Another limitation to be considered was that the location of the study occurred at a single university in one state. A wider range of schools might give different results and would make the results more diverse. The PCS was only distributed one time in a cross sectional manner. In a future study giving the athletes the survey multiple times over the course of a season or academic year would widen the knowledge of pain catastrophizing and how it occurs differently in different athletes. Finally, the definition of injury wasn't specified. Athletes were told to fill out the survey based off of their own experience. The National Collegiate Athletic Association (NCAA) defines injury; "an injury counts as when you miss 1 full day of team activities." Specifying the term might have given a wider range of subjects reporting a previous injury or not.

Conclusions

This study identified the frequency of pain catastrophization in a collegiate athletic population. Additionally, similar to previous literature, a history of injury negatively affected the pain catastrophizing scale results where an athlete with a history of injury had a higher pain catastrophizing score. This outcome measure of pain catastrophizing may be included in preseason physical examinations and indicate that particular athletes need further monitoring or care during the season. Although this has not yet been determined, prospective collection and use of preseason pain catastrophizing scale questionnaire may guide goal setting in rehabilitation and return to participation. This can help provide a patient-specific measure on which clinicians can base clinical decisions.

Table 1: Descriptive Statistics for Demographic Variables

	Overall (n=290)
Age (years)	
Mean (SD)	19 (2)
Range	17-24

Time Playing Sport (years)	
Mean (SD)	12 (4)
Range	1-19
Sex	
Male	154 (53%)
Female	136 (47%)
Year in College	
Freshman	126 (48%)
Sophomore	41 (16%)
Junior	51 (20%)
Senior	33 (13%)
5th Year Senior or Graduate	6 (3%)
Current Injury	
Yes	46 (16%)
No	244 (84%)
Currently Playing with Pain	
Yes	79 (28%)
No	208 (72%)
Average Pain Rating	
Mean (SD)	3.5 (2)
Range	0-10
Previous Injury	
Yes	178 (61%)
No	112 (39%)

SD = standard deviation

Table 2: Descriptive Statistics Based on PCS Status

	PCS<30 (n=250)	PCS≥30 (n=40)	P-Value
Age (years)			
Mean (SD)	19 (1)	20 (2)	0.003
Range	17-24	18-23	

Time Playing Sport (years)			
Mean (SD)	12 (4)	13 (4)	0.23
Range	1-19	1-18	
Sex			
Male	130 (84%)	24 (16%)	0.59
Female	120 (88%)	16 (12%)	
Current Injury			
Yes	36 (78%)	10 (22%)	0.09
No	215 (88%)	30 (12%)	
Currently Playing with Pain			
Yes	62 (78%)	17 (22%)	0.02
No	185 (89%)	23 (11%)	
Average Pain Rating			
Mean (SD)	3 (2)	5 (2)	0.02
Range	0-7	0-10	
Previous Injury			
Yes	145 (81%)	33 (19%)	0.003
No	105 (94%)	7 (6%)	
No Injury (current or previous)			
Yes	91 (93%)	7 (7%)	0.02
No	159 (83%)	33 (17%)	

SD = standard deviation

Table 3: Pain Catastrophizing Scale Total Score by Injury and Pain Status

	N	Mean ± SD	Min	Max	95% CI	P-Value	Effect Size	Effect Size 95% CI
Current Injury	46	24 ± 9	13	49	21, 26	<0.001	0.61	0.29, 0.93
No Current Injury	244	19 ± 8	13	52	18, 20			

Previous Injury	178	21 ± 9	13	52	20, 23	<0.001	0.50	0.26, 0.74
No Previous Injury	112	17 ± 6	13	37	16, 18			
Playing with Pain	79	23 ± 9	13	52	21, 25	<0.001	0.53	0.26, 0.79
Not Playing with Pain	208	19 ± 7	13	52	18, 20			

SD=standard deviation; CI=confidence interval

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