Theories on Common Adolescent Pain Syndromes

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Pain is a prevalent condition among adolescents. In fact, 30–40% of children and adolescents report experiencing pain at least once a week (Palermo 2000), and 5–25% of adolescents report some form of recurrent or chronic pain (Perquin et al. 2000; Goodman and McGrath 1991). Of those reporting recurrent pain, 30–40% of children report pain episodes at least once a week (Kristjansdottir 1997). In terms of specific pain conditions, data indicate that the most common chronic pain conditions among adolescents are headaches, abdominal pain, back pain, and musculoskeletal pain (Goodman and McGrath 1991; Morsy 2006).

Data also suggest that pain can be a long-term condition for children. In community samples, El-Metwally and colleagues (2004) found that 54% of children reporting musculoskeletal pain continued to experience pain at a 1-year follow-up. Not surprisingly, pain is also a long-term condition in clinic-referred samples. Martin and colleagues (2007) found that the majority (62%) of children who presented for treatment at a multidisciplinary clinic continued to report pain from 1 to 6 years later.

It is interesting to note that reports of chronic and recurrent pain tend to differ between sexes and across development. Prevalence data consistently suggest that reports of pain are more common in girls than boys (McGrath et al. 2000; Viry et al. 1999), a pattern that is fairly consistent across pain conditions and nationalities (Haugland et al. 2001).

Outcomes

As chronic pain among adolescents is such a prevalent issue, it is important to note the impact of such conditions on the lives of these individuals. The daily lives of adolescents living with chronic pain are permeated by their conditions. Not only are these individuals’ physical capabilities impacted, so too are their familial relationships, social development, education, perception of academic ability, and sleep.
Not surprisingly, the families of adolescents with a chronic pain condition are greatly affected. Caring for an adolescent with chronic pain requires a great deal of time, energy, and emotional attention. The constant demands placed upon family members, especially parents, can be draining for some. The effects on families of chronic pain patients have been greatly studied among patients with sickle cell disease (SCD) and various rheumatological conditions. Midence and colleagues (1993) administered a survey to mothers of adolescents with sickle cell disease and found that these mothers felt hopeless and frustrated when their child was experiencing a pain episode. Families with an adolescent musculoskeletal pain patient have also been found to experience a great deal of family distress (Aasland et al. 1997). In addition to the emotional burden placed on these families, they often experience financial difficulties, resulting from associated health-care costs as well as the missed days of work when caring for the ill child (Palermo 2000).

Chronic pain can also impact an adolescent’s social involvement. Adolescence is typically a period of increased social involvement; however, for those afflicted by chronic pain, it may be a time of social withdrawal. Langeveld and colleagues (1997) found that adolescents with chronic headaches experienced a decrease in the amount of time spent with their peers. Similarly, adolescents with SCD experience a decrease in the amount of time spent socializing with peers, as well as time spent in activities with peers (Puggle et al. 1996; Langeveld et al. 1997).

The impact on an adolescent’s school attendance and performance has been well-studied. In fact, chronic pain conditions are responsible for more school absences than any other chronic condition (Palermo 2000). Among chronic pain conditions, headache and arthritis account for the majority of school absences (Newacheck and Taylor 1992). SCD also contributes to the high absenteeism rate among chronic pain patients, with an absenteeism rate of 21% (Shapiro et al. 1995). In addition to increased school absenteeism, chronic pain can impact an adolescent’s perception of his/her academic abilities, as well as school-related stress. One study by Walker and colleagues (1998) found that adolescents with irritable bowel syndrome (IBS) and other chronic abdominal pain experience lower perceptions of academic ability. Flato and colleagues (1998) studied adolescents with juvenile rheumatoid arthritis (JRA) and discovered that half of these adolescents reported feeling as though their pain conditions impacted their schoolwork.

Sleep is critically important to an individual’s health and well-being, especially during childhood and adolescence, when a great deal of growth and development occurs. Sleep deprivation impacts many areas of an adult’s life, and this is also true for adolescents. Unfortunately, chronic pain appears to interfere with adolescents meeting duration and quality of sleep requirements. In terms of specific conditions, adolescents with chronic or recurring headaches or migraines experience disturbances in their sleep (Bruni et al. 1997), as do those with JRA. In a literature review by Palermo (2000), adolescents with JRA are reportedly prone to waking during the night and to parasomnias. Adolescents with SCD are also at an increased risk for experiencing sleep deprivation, leading to fatigue, increased pain, and higher rates of school absences (Palermo 2000).

Theories on Adolescent Pain

Introduction to the Biopsychosocial Model

From the time of Descartes, pain has traditionally been discussed within a biomedical model. This model operates within a nociceptive framework, suggesting a one-to-one correspondence between nociceptive input and pain sensation. In the context of chronic pain, the biomedical model maintains that psychological or behavioral concerns may result from pain but do not influence the pain itself (MacLaren et al. 2007).

Despite the assertion of the biomedical model that pain is directly related to physiology, it is notable that a number of chronic pain conditions have little overt evidence of pathophysiology and
there is wide variability in individuals’ responses to the same potentially painful stimulus. As early as the 1960s, researchers began to acknowledge the contribution of more than just nociceptive input to the pain experience. The Gate Control Theory (GTC); (Melzack and Wall 1965) was the first model to recognize the contribution of central mechanisms in the pain response. Offering an alternative to the Cartesian concept of pain, the GTC posited that peripheral afferent stimulation could be modulated by descending neural impulses and that the experience of pain resulted from a balance between these sensory and central inputs. Melzack and Casey (1968) went on to describe these central processes as cognitive-evaluative (i.e., thoughts) and affective-motivational (i.e., mood and anxiety), and identified the interaction between these processes and the sensory-discriminative process (i.e., nociception) as central to the pain experience. The most recent iteration of the GTC moves beyond a simple gating mechanism to a more complex set of neural networks, referred to by Melzack as the Neuromatrix (Melzack 1999). This new “Neuromatrix Theory” of pain extends Melzack and colleagues original conceptualization by introducing the roles of genetic and immunological influences on pain.

Moving from pain-specific to more general models, the biopsychosocial framework has emerged as a guiding conceptualization for the contributors to and impacts of chronic illnesses. In line with components discussed in the Gate Control and Neuromatrix theories, the biopsychosocial model highlights the important interactions between physiological, psychological, and sociocultural influences on medical conditions. The following sections provide a discussion of the contributors to pain within a biopsychosocial framework (Fig. 3.1). Biological factors are discussed within other chapters of this book, thus psychological and social influences are highlighted here. Following the presentation of influences on pain, the implications of the biopsychosocial model on treatment of pain are discussed and data are presented on the efficacy of psychological and multimodal interventions for chronic pain.

Fig. 3.1 The Pain Biopsychosocial Model. In the tripartite biopsychosocial model, one domain may play a greater role than another. The weight of each domain will depend on various factors within said domain

Psychological Influences

Affective Factors

Pain is, by definition, a sensory and emotional experience (IASP); thus it is not surprising that affective factors have been closely linked with chronic pain. In adults, comorbidity of chronic pain with anxiety and depression is well-established (Gatchel and Dersh 2002), and data in adolescents support similar relations. For example, children with recurrent abdominal pain have been found to have significantly higher incidences of depression and anxiety than children without pain (Campo et al. 2004).

Notably, the pattern of relations among anxiety, depression, and pain appear to be somewhat different in children and adolescents than in adults. Whereas depression is most commonly comorbid with pain in adults (Gatchel and Dersh 2002), anxiety appears to be the most common comorbid condition with pain in children and adolescents. In fact, Lipsitz and colleagues (2005) found that while 56% of children with
non-cardiac chest pain met criteria for anxiety disorders, only 4% of children met criteria for depression. Campo et al. (2004) found a higher incidence of depression in children with recurrent abdominal pain (46%) than in the general population, but it was notable that all but one of the children with depression also met criteria for an anxiety disorder. The prevalence of anxiety disorders in this study was 76%.

Whether anxiety and depression precede pain or are consequences of pain in adolescents is difficult to determine given the lack of prospective premorbid data available in this population. In adults, depression appears to be more of a consequence than an antecedent of the onset of chronic pain. Banks and Kerns (1996) offer a stress-diathesis model to explain the relationship between depression and pain in adults. In this model, preexisting risk factors for depression (e.g., negative schemas, attributions) may be dormant until triggered by the stress of chronic pain. Once triggered, activation of risk factors results in depression in vulnerable individuals (Gatchel and Dersh 2002). Although fairly well-established in adults, the diathesis-stress conceptualization of depression and pain has not yet been confirmed in adolescents and warrants further study.

The relation of anxiety to chronic pain has also been extensively studied in adults and has received increasing attention in adolescents. In regard to the nature of this relation, some authors suggest that it is not anxiety per se that influences pain, but rather how sensitive an individual is to the physiological sensations of anxiety—a characteristic known as “anxiety sensitivity” (Norton and Asmundson 2004). Individuals who are high in anxiety sensitivity tend to interpret physiological sensations of anxiety as more threatening than those who are low in anxiety sensitivity (Reiss et al. 1986). For example, a highly anxiety-sensitive person may interpret heart palpitations as a heart attack, while a lowly anxiety sensitive person may dismiss these sensations as harmless. In adults, anxiety sensitivity is a risk factor for anxiety disorders and has been linked to chronic pain (Stewart et al. 2006). In adolescents with chronic pain, anxiety sensitivity has been found to be significantly related to health-related quality of life, particularly self-esteem, behavior problems, and social functioning (Tsao et al. 2007).

Closely related to anxiety sensitivity is the specific fear of pain (Muris et al. 2007). Similar to general anxiety sensitivity, injury sensitivity is the worry about painful sensations and the attribution of pain sensations as harmful (Vlaeyen and Linton 2000). Injury sensitivity is a stronger predictor of pain catastrophizing and fear of pain than anxiety sensitivity (Vancleef et al. 2006).

A discussion of fear of pain would be remiss without noting that fear of pain is an adaptive response in acute pain situations. In these situations, fear is protective and serves as a motivator to avoid potentially dangerous situations (e.g., placing a hand on a hot stove). Fear of pain becomes maladaptive, however, in chronic pain conditions. In these cases, fear of pain generalizes beyond objectively dangerous situations to any activity that an individual perceives may be related to pain (e.g., walking, school attendance); this fear then results in avoidance of an increasingly large number of activities and transitions quickly to disability (Waddell et al. 1993). Kinesiophobia, the fear of movement due to pain or (re)injury, has emerged as a significant predictor of pain-related disability and distress across several painful conditions. (Pells et al. 2007; Roelofs et al. 2004). This fear of movement can be more disabling than the pain itself (Crombez et al. 1999). The degree of kinesiophobia positively correlates with pain severity and is estimated to be a better predictor of physical disability in patients with chronic pain than many previous indices (Pells et al. 2007).

It is possible that attentional mechanisms may mediate the relations among anxiety, anxiety sensitivity, fear of pain, and pain. An intriguing study by Boyer and colleagues (2006) demonstrated that children with RAP unconsciously attended to pain-related words (e.g., ouch) more than neutral (e.g., piano) or socially threatening words (e.g., bullied). At a conscious level however, children attended significantly less to pain-related words than neutral words. The authors interpreted these results in a two-stage attentional process by which
children with RAP are selectively hypervigilant to pain-related information but make conscious attempts to avoid or disengage from this information. Notably, children with higher anxiety demonstrated more of these attentional biases than children with lower anxiety.

**Temperament and Personality Factors**

Personality is generally defined as characteristic patterns of behavior, thoughts, and feelings that originate within an individual and influence how an individual responds to the environment (Carver and Scheier 2000). Early work in psychosomatic medicine attempted to reveal personality typologies associated with specific chronic pain conditions (i.e., headache personality), but this work has been challenged (Turk and Monarch 2002). Instead, current research focuses on how personality and early encounters interact with the pain experience. For example, similar to anxiety sensitivity, Conrad and colleagues (2007) found that patients with chronic pain scored significantly higher on Harm Avoidance temperament than individuals without pain. Data from this study also indicated that patients with chronic pain scored significantly lower on personality dimensions of self-directedness and cooperativeness. Interestingly, the link between personality and pain may be bidirectional. Fishbain and colleagues (2006) conducted a meta-analysis of interactions between measures of pain and personality and found that measures of personality (e.g., Minnesota Multiphasic Personality Inventory scores) were significantly affected by improvements in pain following treatment. Thus, it appears in adults that personality may not only affect pain, but may also change as a result of pain experience.

Given the developmental changes that occur in personality during childhood and adolescence, research with these groups has focused on temperament – the childhood precursor to personality. Like personality, temperament is a consistent pattern of responding to the environment, and because it is evident from minutes after birth, is generally thought to be genetic in nature. A fair amount of work has been dedicated to exploring the interaction between pain and temperament, especially in the acute pain context (Broome et al. 1998). Recently, Rocha et al. (2003) found that temperamental characteristics, including negative mood, difficulty adapting to new situations, and withdrawal, were related to higher pain sensitivity to immunization in kindergarten children. In a follow-up study, this “pain sensitive” temperament predicted children’s health-care usage 7 years after the original assessment (Rocha et al. 2007). Several other studies have supported the role of children’s temperament in their responses to lumbar punctures (Chen et al. 2000) and postoperative pain (Kleiber et al. 2007). It is notable that although this work has identified temperamental types that appear to be “pain sensitive,” it is currently unknown whether these temperament types are reflective of a selective sensitivity to pain or an overall sensitivity to stimulation.

In terms of chronic pain, we are aware of only one study that has closely examined temperament in children and adolescents with these conditions. Conte and colleagues (2003) compared temperament in children with juvenile primary fibromyalgia syndrome (JFPS), arthritis, and no pain condition. Findings indicated that children with JFPS had significantly more temperamental instability than children with arthritis and those without pain. Although further research in temperamental influences on children’s chronic pain is required, it appears that temperamental characteristics that are related to acute pain sensitivity may also be related to adolescents’ chronic pain.

**Coping**

There is little question that living with a chronic pain condition is stressful for adolescents. Over time, adolescents develop patterns of thoughts, behaviors, and emotions that they use to cope with this stress, and a great deal of literature has been devoted to the study of these coping strategies. Coping has been defined as any “conscious volitional efforts to regulate emotion, cognition, behavior, physiology, and the environment in response to stressful events or circumstances”
Coping strategies are acquired over time in a developmental process that is affected by cognitive and social maturation and experience interacting with the environment (Fields and Prinz 1997). By adolescence, coping styles begin to stabilize, and may continue regardless of their degree of effectiveness (Compas et al. 2001).

A wide variety of cognitive and behavioral coping strategies have been identified. Cognitive strategies include distraction, wishful thinking, problem solving, and negative thinking, while behavioral strategies include decreasing physical and social activity, seeking emotional support, and information-seeking. Although a thorough review of the coping literature is beyond the scope of this chapter, it is important to note that authors have offered a host of theoretical conceptualizations of coping behavior. Lazarus and Folkman’s (1984) emotion- versus problem-focused conceptualization classifies strategies based on whether they function to modify the environment (problem-focused) or the self (emotion-focused). Other authors conceptualize coping on an approach-avoidance dimension (Roth and Cohen 1986), with approach strategies directed toward the stressful stimulus (e.g., problem solving) and avoidance strategies directed away from the stimulus (e.g., distraction). Although many conceptualizations are two-factor in nature, three-factor models have also been presented. In a study of pain-specific coping based in the approach/avoidance conceptualization, Reid and colleagues (1998) identified two subtypes of avoidant coping: problem-focused avoidance and emotion-focused avoidance. Emotion-focused avoidance strategies are those that attempt to avoid potentially negative feelings (e.g., internalizing, catastrophizing) whereas problem-focused avoidant strategies attempt to direct attention away from the stressful stimulus (e.g., distraction, positive self-talk).

Despite a wide array of conceptualizations, there is consistent evidence that some coping strategies are more adaptive than others in particular situations. For example, problem-focused or approach coping is most adaptive in situations where individuals have control over situations, whereas emotion-focused coping strategies are most adaptive in uncontrollable situations (Compas et al. 2001). In the context of pain, Reid and colleagues (1998) report that approach strategies (e.g., information seeking, problem solving) were related to decreased disability in children with rheumatoid arthritis, whereas emotion-focused avoidance strategies such as externalizing (e.g., yelling at others) were related to higher pain. Although approach strategies have received support for their efficacy, some authors argue that the uncontrollable nature of chronic pain lends itself more appropriately to the use of emotion-focused strategies (McCracken et al. 2007). In this framework, attempting to control an uncontrollable situation (i.e., pain) may be counterproductive. Alternatively, acceptance-based coping strategies focus on function in the presence of pain rather than attempts to eliminate pain (McCracken et al. 2007).

A particularly strong finding in the coping literature is the maladaptive nature of catastrophizing coping strategies. Catastrophizing coping involves exaggerated negative responses to actual or expected stress (Drahovzal et al. 2006) and was categorized by Reid and colleagues (1998) as an emotion-focused avoidance strategy. In cases of high catastrophizing, individuals expect future pain episodes and their consequences to be extremely severe (Sullivan et al. 2001) and thus experience increased distress and sensitivity to pain (Eccleston and Crombez 1999). Catastrophic thinking has been found to be related to increased pain intensity, increased disability, and lower pain tolerance (Vowles et al. 2007).

Trauma History

Experience with trauma in childhood has been associated with a variety of negative outcomes. In addition to an array of psychological effects, experience with early traumatic events has been associated with increased physical complaints. In a population based study, Chartier and colleagues (2007) found that a history of abuse was related to increased health-care usage, poorer self-reported health, more diagnosed health conditions, and pain that interfered with activity.
Of traumatic events in childhood, experience with abuse has received the most extensive study in chronic pain populations. Definitions of abuse vary based on assessment methods, but for the purposes of this section we will use those provided by Goldberg and colleagues (1999). These authors define physical abuse as physical acts of punishment that leave physical evidence (i.e., bruises and welts) and that are perpetrated by an adult in a position of authority on a child under the age of 18. Sexual abuse is defined as any sexual act performed by an adult on a child under the age of 18 (Goldberg et al. 1999). Verbal abuse is defined as “any pattern of consistent denigration, humiliation, and condemnation performed by a more powerful individual to a person under the age of 18 resulting in feelings of inferiority, lowered self-esteem, lowered self-worth, and stunted goals and ambitions.”

Most of the data on links between childhood abuse and traumatic experience have been in adults and most have used retrospective reports of history of trauma in patients with chronic pain. For example, Balousek et al. (2007) examined self-reported history of abuse in a large sample (n=1,009) of adults who were prescribed opioids to manage noncancer-related chronic pain. Prevalence of lifetime history of physical abuse was 47% for women and 22% of men. A similar gender distribution of history of sexual abuse was reported, with 35% of women and 10% of men reporting abuse. Comparisons trauma histories in community samples of individuals with and without chronic pain support the assertion that experience with abuse is a risk factor for chronic pain (Brown et al. 2005). There also appears to be variability across chronic pain conditions in trauma history. Goldberg et al. (1999) investigated the abuse and/or traumatic event history of 91 patients with four chronic pain conditions: facial pain, myofascial pain, fibromyalgia, and other pain. Of these 91 participants, there was a significant history of childhood verbal abuse (38%), physical abuse (>32%), and sexual abuse (22%) in the development of a chronic pain condition. Interestingly, the four pain groups were varyingly impacted by these different events. Of those participants with fibromyalgia, 25–47% experienced sexual abuse as a child.

Traumatic events other than abuse in childhood may also contribute to the development of chronic pain. Traumatic events within the family may include familial violence, parental alcoholism, parental drug abuse, divorce, or death. Goldberg and colleagues reported that more than 38% of their sample of adults with chronic pain had a family history of alcohol abuse and 15.3% had a family history of drug abuse. A family history of alcohol abuse was found to be most significant among participants with myofascial and facial pain.

Unfortunately, despite the preponderance of evidence for abuse and trauma history as a risk factor for chronic pain in adults, little is known about traumatic histories in adolescents with pain. Of the host of studies that have evaluated psychological and social correlates of pain in adolescents, to our knowledge, no study has evaluated trauma and abuse history. This appears to be the same case in the trauma literature, as studies of childhood and adolescent outcomes of trauma do not generally assess for chronic pain. However, the trauma literature does refer to chronic pain as “the next frontier” (Kendall-Tackett and Kendall-Tackett 2001).

### Social Influences

#### Parental Influences

There is little question that chronic pain in adolescents occurs within a family context and thus is both influenced by and serves as an influence on the family system. In fact, the family context is so important in chronic pain that some authors have argued that effective interventions must be directed toward both the adolescent and the family (Kazak et al. 2002).

The most general evidence for parental influences on children’s pain is in the form of family aggregation of pain. Early studies support the hypothesis that pain aggregates in families by demonstrating higher percentages of reports of pain in family members of chronic pain patients than in patients with non-chronic pain-related medical conditions (Violon and Giurgea 1984). In terms of the parent–child dyad, studies have shown...
that pain complaints are more likely in children of parents who also report pain (Levy et al. 2004; Mikail and von Baeyer 1990). Parents’ and children’s ratings of their own pain are also significantly correlated, as are the number of chronic pain conditions in the family and children’s ratings of their current pain (Schanberg et al. 2001).

One potential mechanism for the clustering of pain in families is parental modeling of pain behavior. Children of parents with pain are more likely to have pain than children with parents who do not have pain, and children appear to be particularly influenced by mothers with pain (Evans and Keenan 2007). Children of parents with pain also tend to report similar pain sites as their parent (Osborne et al. 1989; Evans and Keenan 2007). Evidence from laboratory-based studies supports the importance of modeling in children’s response to pain. Goodman and McGrath (1991) found that children of mothers who exaggerated their response during an experimental pain task later showed significantly lower pain thresholds during the same task than children whose mothers minimized their pain response. In other words, children’s pain thresholds were influenced by the way their mothers reacted to the same circumstances.

Children learn not just from their parents’ responses to pain, but also from the consequences of their parent’s pain. Walker and colleagues found that children with RAP and peptic disease who had family members with frequent illness believed that they, such as their ill relatives, would receive sympathy and fewer responsibilities as a result of chronic pain (Walker et al. 1993).

A second potential mechanism for parents’ impacts on adolescent’s chronic pain is via family relationships, or interaction patterns among parents and adolescents with pain. Parents of children with pain have been found to be more anxious than parents of children without pain (Ramchandani et al. 2006), and parents’ anxiety about their children’s pain influences the way in which parents interact with their children (van Tilburg et al. 2006). For example, in an attempt to protect the adolescent in pain, parents may allow children to escape from chores, limit family activities, or keep children home from school (Lipani et al. 2006). Parents may also provide additional attention, reassurance, or special privileges in an attempt to soothe adolescents when in pain. Although well-intentioned, these responses serve to reinforce pain behaviors in children and can lead to increased disability (Walker et al. 1993; Peterson and Palermo 2004).

In terms of adaptive responses, there are several parent behaviors that are related to decreased disability and pain. Sanders and colleagues (1996) found that particular parent behaviors were a significant predictor of improvement in children’s recurrent abdominal pain. Specifically, mothers’ use of adaptive caregiving strategies (e.g., encouraging active coping, ignoring pain complaints) was found to be a significant predictor of children’s pain improvements. Supporting the importance of parental behaviors, this study found that the effect of maternal caregiving was still evident after controlling for child age and child-coping behaviors.

School Influences

Adolescents spend a significant amount of their time in school and school-related activities. Unfortunately, pain often interferes with school and is related to increased school absences, missed schoolwork, and lost opportunities for social interactions. In fact, chronic and recurrent pain accounts for more absences than any other chronic illness (Palermo 2000).

An adolescent’s chronic pain condition can be impacted, in part, by their academic performance, perceived social support, and responses from teachers and peers. Generally, teachers may have difficulty understanding and knowing how to react to their students with chronic pain. Unlike physical disabilities or other chronic conditions with clear explanations, teachers may find it difficult to differentiate between acceptable and unacceptable behavior in children with chronic pain. A child’s academic performance and functioning can be directly affected by the way in which a teacher responds to the child (Logan et al. 2007). For example, if the teacher often allows a child to skip assignments or does not require the child’s participation, the child will likely be less motivated to perform well.
Peer Influences

Just as teachers’ perceptions and reactions to children with chronic pain impact the child, so too do the perceptions and reactions of peers. Nishina and colleagues (2005) suggest the possibility that peers view children with chronic pain as “sickly, timid, or weakly,” especially if the child is male (Midence et al. 1993; Nishina and Juvonen 2005). The authors further suggest that these perceptions may lead to bullying. In addition to appearing sick or weak, children’s frequent school absences result in fewer opportunities for social interactions with peers. Greco and colleagues (2007) found that the poor social skills of a child with chronic pain increase the likelihood that he or she will experience problems with his or her peers. These social problems were found to increase the anxiety of these children which, in turn, can lead to exacerbated pain episodes and further perpetuate the cycle.

Considerations in Treatment

The biopsychosocial model has important implications for the treatment of chronic pain in adolescents. This model highlights the importance of targeting multiple determinants of adolescents’ pain, namely those that are biological, psychological, and social in nature. A general introduction to psychological interventions is provided below, followed by a review of efficacy data on these interventions and a discussion of intervention delivery considerations.

Overview of Psychological Interventions

There is a range of psychological treatments available for chronic pain in adolescents. While there is some variability in the specific procedures, most interventions that have received empirical attention are cognitive and/or behavioral in nature and many involve family components. Although a thorough presentation of the nuances of cognitive, behavioral, cognitive–behavioral, and family systems orientations are beyond the scope of this chapter, general discussions of these concepts are helpful in understanding the components of interventions that have been evaluated for adolescent chronic pain.

In general, cognitive interventions are directed toward identifying and modifying maladaptive thoughts, beliefs, or expectations. In the context of chronic pain, cognitive treatments are based on evidence that certain patterns of cognitions (e.g., catastrophizing) are associated with increased pain, as discussed earlier in this chapter. In this vein, cognitive interventions help adolescents to identify links between thoughts and pain and to generate alternative thought patterns. Specific strategies to accomplish these goals include self-monitoring to identify maladaptive thoughts, evaluating and challenging negative cognitions, thought-stopping, and positive self-talk (Hicks et al. 2006; Robins et al. 2005). Cognitive pain control strategies are also available. Imagery, distraction, and hypnosis, all work via cognitive mechanisms to focus attentional resources away from pain. The use of interactive technology for distraction in pain management is gaining recognition. Videogames, virtual reality (VR) with and without display helmets and augmented reality (AR) have affected pain threshold and pain tolerance (Dahlquist et al. 2008; Mott et al. 2008). While the predominance of pediatric VR pain literature addresses acute, procedural pain (e.g., intravenous placement, burn dressing changes), there are some case reports of efficacy in chronic pain. Immersive virtual reality as a treatment for phantom limb pain resulted in decreased phantom pain during at least one session (Murray et al. 2007). Oneal reported on a 6-month trial of VR consisting of 33 sessions for a patient with neuropathic pain previously unresponsive to pharmacological therapy. Pain intensity decreased by one-third and lasted approximately 12 h after completion of a session (Oneal et al. 2008). Cognitive strategies have added benefits of inducing positive emotions that, according to GTC, can activate descending inhibitory pain control pathways (Melzack and Wall 1965). These findings are further supported by fMRI which has shown modulation in pain-related regions of the brain in response to cognitive interventions (Hoffman et al. 2004).
In concert with cognitive interventions, behavioral strategies are generally directed toward identifying and modifying antecedents (i.e., triggers) of pain and consequences that maintain pain and disability. In terms of antecedents, behavioral strategies such as relaxation and biofeedback target muscle tension as a potential trigger of pain. Relaxation strategies such as progressive muscle relaxation have a long history of effective use in the treatment of anxiety and have been applied to the treatment of chronic pain. Biofeedback is a mechanism by which relaxation can be taught and has the added advantage of providing adolescents with objective feedback about relaxation levels via physiological measures (e.g., EMG, galvanic skin response, finger temperature).

Activity pacing is another behavioral technique that targets common triggers of pain in adolescents: overexertion or avoidance of activity. Fear of pain and subsequent avoidance of activity is common in adult chronic pain populations (Bousema et al. 2007) and recent evidence suggests that activity limitations are also common in adolescents (Long et al. 2008). Alternatively, overexertion can also be related to pain. To address both over- and under-exertion, activity-pacing interventions teach adolescents how to set attainable goals and plan steps to attain these goals within moderate activity levels.

Other behavioral strategies address social contributors to children’s pain by targeting interventions toward individuals who interact with adolescents, rather than adolescents themselves. In most cases, these other individuals are family members and are usually parents. As discussed previously, family systems frameworks recognize that children’s pain occurs within a complex system of interactions; thus, behavioral interventions target the way in which family members interact with adolescents in pain. In older treatments, parents were trained as administrators of simple operant interventions such as time-out for pain behavior (Miller and Kratochwill 1979). More recently, simple operant procedures have been replaced with more complex conceptualizations of parental influences on pain that highlight the pattern of interactions between parents and adolescents with pain. Interventions based on this conceptualization target the ways by which families respond to both pain and well behavior in their adolescents. For example, parental roles in the management of adolescent pain are reframed from that of protector to that of coach (Robins et al. 2005). Under this conceptualization, parents are taught to coach their children in the use of coping skills rather than attending to pain behavior. Parents are taught to encourage coping by reinforcing well behaviors (e.g., school attendance, practicing coping skills) with attention or praise, and to minimize attention to pain behaviors. Minimizing attention to pain behavior requires parents to refrain from asking questions about pain and to refrain from “protecting” their adolescent by allowing escape from chores, school, or other activities.

**Efficacy of Psychological Interventions**

Evidence for the efficacy of psychological interventions in the treatment of adolescent chronic pain is accumulating. Indeed, the state of the science has warranted at least two meta-analyses (Hermann et al. 1995; Eccleston et al. 2002) and a series of review articles (Janicke et al. 1999; Chen et al. 2004). Most psychological treatment studies of pain in adolescents have used combinations of cognitive and behavioral techniques, typically referred to as cognitive behavioral therapy (CBT). The exact components sometimes vary, but CBT generally involves a combination of behavioral coping skills training (e.g., relaxation, activity pacing) and cognitive strategies (e.g., identifying and modifying maladaptive cognitions). Family interventions are often included as an additional component of CBT. Although the majority of studies evaluating psychological interventions for pain have been multicomponent CBT interventions, there have been a few studies that have evaluated behavioral interventions alone (e.g., biofeedback, relaxation).

In general, evidence suggests that psychological interventions are effective in the management of chronic pain in adolescents and are not associated with adverse outcomes (McGrath and Holahan 2003; Sanders et al. 1994). The strength
of evidence for the efficacy of interventions differs across pain conditions, however. Thus, studies evaluating efficacy of psychological interventions are discussed below by pain condition.

**Headache**

The majority of evidence for the efficacy of psychological interventions has been in the treatment of pediatric headache. In a systematic review of randomized controlled trial (RCT) of psychological interventions for chronic pain, Eccleston and colleagues (2002) identified 18 trials meeting RCT criteria, 15 of which were in pediatric headache. Another meta-analysis specific to pediatric headache included 23 studies that met RCT criteria (Trautmann et al. 2006). Interventions evaluated in studies in pediatric headache range from single-component interventions such as relaxation (McGrath et al. 1988) and biofeedback (Scharff et al. 2002) to multicomponent CBT interventions (Barry et al. 1997). Results of both meta-analyses indicate that psychological interventions are effective in the management of pediatric headache. Eccleston and colleagues report a number needed to treat (NNT) for a 50% reduction in pain as 2.32 across interventions and Trautman et al. (2006) report medium effect sizes from pretreatment to posttreatment for psychological interventions.

In terms of efficacies of specific interventions, Holden and colleagues conducted a systematic review to evaluate the level of evidence of psychological treatments for pediatric recurrent headaches based on criteria established by Chambless and Hollon (1998). Briefly, these criteria were used categorize interventions into “well-established” (i.e., at least two well-designed between-groups experiments conducted by at least two separate research groups demonstrating clinical superiority to psychological placebo or alternative treatments), “probably efficacious” (i.e., two experiments showing treatment is more efficacious than wait-list control or one or more studies meeting well-established criteria but conducted by one research group), or “promising” (i.e., two or more well-controlled studies with small numbers or by the same investigator). Results of this review indicated that relaxation therapies (relaxation training, self-hypnosis, guided imagery) qualified as well-established treatments for headache and thermal biofeedback alone was judged to be a probably efficacious treatment. However, conclusions regarding the relative efficacy of these two interventions are limited by methodological concerns. One study comparing the two indicated that relaxation and biofeedback were equally effective when compared to wait-list control (Fentress et al. 1986), while another demonstrated that autogenic training was superior to biofeedback (Labbe 1995). At the time of this review, CBT was classified as a promising intervention; however, this review was based on data available in 1999 and several well-designed studies evaluating CBT for headache have demonstrated efficacy since its publication.

**Recurrent Abdominal Pain**

Although not as well-studied as in treatment for headache, psychological interventions for recurrent abdominal pain (RAP) have also been evaluated. Although some early reports of case studies using operant methods were reported (Miller and Kratochwill 1979), the majority of interventions for RAP have been CBT. The systematic reviews by Eccleston et al. (2002) and Janicke and Finney (ref) identified two RAP trials, both evaluating CBT (Sanders et al. 1989, 1994). In the first of these studies (Sanders et al. 1989), CBT including parent training in behavioral contingency management and child training in relaxation and cognitive strategies was compared to a wait-list control. Results indicated improvement in RAP symptoms in both groups, but a quicker improvement and a higher proportion of children who were pain-free in the CBT condition. A second study by these authors compared a similar intervention to standard pediatric care and showed significantly less pain relapse in children who received CBT. On the basis of the same Chambless recommendations used by Holden (Holden et al. 1999), Janicke and Finney (Janicke et al. 1999) judged CBT to be a “probably efficacious treatment.”

Since the publication of Janicke and Finney and Eccleslton and colleagues, two additional studies have been published evaluating CBT in children with RAP. One study compared CBT
plus standard medical care to medical care alone (Robins et al. 2005). Results of this study indicated that children who participated in CBT had significantly less pain than those who received standard medical care alone immediately following treatment and at 1-year follow-up. Children in the CBT group also had significantly fewer school absences than children in the standard medical care group. The second study used the Internet to deliver CBT to children with RAP (Hicks et al. 2006). In an attempt to address issues with access to service, these authors developed a Web-based intervention that taught relaxation, cognitive strategies, and activity pacing, and included a relapse prevention component. Results of this study showed that significantly more children who received the intervention achieved clinically significant pain reductions than children who received standard medical care. Differences between Internet CBT and standard care groups were maintained at a 3-month follow-up. On the basis of these two additional studies, it is likely that a reexamination of evidence for CBT in the treatment of RAP would now classify this intervention as “well-established.”

Disease-related pain

Psychological treatments have also been evaluated for the treatment of disease-related pain, but the data in these conditions are far less developed than in headache or RAP (Walco et al. 1999). Data on rheumatologic conditions include two small-scale trials for Juvenile Rheumatoid Arthritis (JRA) and one RCT in Juvenile Primary Fibromyalgia Syndrome (JPFS). Lavigne et al. (1992) evaluated a treatment combining relaxation, biofeedback, and parent training in contingency management for JRA. A second study in JRA by Walco et al. (1992) evaluated an intervention combining relaxation and cognitive pain control strategies (e.g., imagery, meditation) combined with parent training. Both of these studies showed efficacy of intervention from pre-treatment to posttreatment, but very small sample sizes, lack of control groups, and high dropout preclude conclusions on the efficacy of CBT based on these studies. Kashikar-Zuck et al. (2005) compared children with JPFS who were randomly assigned CBT to those who were randomly assigned to self-monitoring. Results of this study were mixed; children in both groups improved on depressive symptoms and functional measures from pretreatment to posttreatment, although children who received CBT reported significantly greater efficacy in coping with pain. There was also a trend toward children in the CBT group reporting less pain intensity than children in the self-monitoring group. It is notable that both groups in this study received an intervention that was different from standard medical care and thus it is not possible to draw conclusions about how these treatments compare to standard care. In sum, data on psychological interventions in the management of rheumatologic conditions are promising, but definitive conclusions on effectiveness of these interventions are premature.

Psychological interventions for SCD–related pain have also received empirical attention (Chen et al. 2004). In one study, Gil et al. (Gil et al. 2001) compared a CBT intervention (relaxation, pleasant imagery, calming self-talk) to a standard care control. Results showed no difference between groups on pain and health-care usage, but children in the CBT group evidenced significantly more active coping. The authors followed-up these results and found that use of coping strategies, rather than simple group assignment, was related to pain outcomes; on the day in which children used coping strategies, they reported less pain and higher function. Several other studies of psychological interventions for SCD of differing levels of methodological rigor are available (Powers et al. 2002; Kaslow et al. 1997), but many of these interventions target outcomes in addition to pain (e.g., adherence, disease knowledge), complicating conclusions on pain management efficacy. Furthermore, some authors have argued that traditional CBT interventions may require culturally informed modifications (e.g., use of African American therapists, focus on family) to reach maximal effectiveness (Kaslow et al. 1997). Overall, however, Chen and colleagues conclude that CBT was a probably efficacious treatment based on the Chambless criteria.
Complex Regional Pain Syndrome

The role of psychological interventions in the management of CRPS is the least developed. To our knowledge, no well-controlled randomized studies have evaluated psychological interventions alone for CRPS in adolescents. Instead, evidence for the efficacy of these interventions for CRPS must be extrapolated from studies treating multiple pain conditions. For example, Eccleston and colleagues (Eccleston et al. 2003) report on the efficacy of an interdisciplinary treatment, including CBT, targeting functional gains for children with various chronic pain conditions (approximately one quarter of participants were diagnosed with CRPS). Results of this intensive residential treatment were promising, with significant improvements from pretreatment to post-treatment in measures of disability and mood. Especially notable in this study was that the CBT treatment was offered in the context of an interdisciplinary treatment in which adolescents participated in daily physical and occupational therapy. This type of treatment is in line with current recommendations for the treatment of CRPS, which stress the importance of immediate physical therapy with pharmacological and psychological interventions added in treatment refractory cases (Connelly and Schanberg 2006).

Considerations in Delivery of Psychological Interventions

Despite the mounting evidence for the efficacy of psychological and multidisciplinary treatments for pain in adolescents, there are challenges in delivering these treatments. One important consideration is how many children can be reached by an intervention. Traditional methods of delivering care require a great deal of time and resources on the part of the family. Travel to clinics for weekly appointments and the costs associated with missed work or school can serve as significant barriers to receiving treatment (Elgar and McGrath 2003). Families from low income or rural areas are at particular risk, given that they typically have access to fewer services than families in urban areas (Hunsley et al. 1997).

Advances in technology have provided unique opportunities to deliver care to adolescents who would not otherwise have access to psychological interventions. Although research on these delivery systems is still in its infancy, early work suggests that Web-based and CD-ROM administration may be effective and are not associated with more adverse effects than traditional in-person contact. For example, Connelly et al. (2006) found that a cognitive–behavioral intervention for pediatric headache delivered via CD-ROM intervention resulted in significant improvements in headache frequency, duration, and intensity when compared to standard medical care. These treatment gains were maintained at 2 and 3-month follow-up assessments. In a study of cognitive–behavioral treatment for recurrent abdominal pain delivered via the Internet, Hicks et al. (2006) found that 71% of children receiving this treatment had clinically significant improvements in their pain at 2 months, compared to only 14% of children treated with standard medical care. Taken together, early evidence for the efficacy of alternative delivery systems for cognitive–behavioral interventions appears promising, but requires further validation. Studies to date in this area have used only medical care as control conditions and have yet to compare alternative delivery systems to traditional in-person interventions.

Other studies have attempted to increase accessibility of cognitive–behavioral interventions by delivering these interventions in school settings. The most comprehensive series of studies in school settings has been conducted by Larsson and colleagues (2005, 1987). In an analysis of all adolescents treated in this series of studies, Larsson et al. (2005) concluded that school-based training in relaxation was effective in the management of tension-type headache, and to a slightly lower extent, migraine headache. These authors also examined the background of the individual providing relaxation training in schools. Results indicated that relaxation training delivered by a therapist was more effective than either self-management or relaxation training delivered by a school nurse.

The use of paraprofessionals is another means of reducing costs associated with delivering...
psychological interventions. Although school nurses were not as effective in delivering relaxation training as therapists in Larsson’s studies, there are data to suggest that paraprofessionals can be trained to deliver some pain management interventions. Master’s level paraprofessionals have been shown to be effective in the delivery of biofeedback interventions to children with headaches in primary care (Allen et al. 2002).

A final consideration in the delivery of psychological interventions for adolescents with chronic pain is the maintenance of treatment gains. Some of the studies evaluating interventions have used follow-up assessments to document the continued efficacy of their treatments, but only a few studies explicitly targeted maintenance of gain. Carson et al. (2006) evaluated the effect of adding maintenance training to traditional cognitive–behavioral interventions for rheumatoid arthritis. Maintenance training included cognitive strategies for coping with relapse, behavioral rehearsal to generalize treatment gains, and operant methods to reinforce continued use of coping skills. Contrary to hypotheses, outcomes of traditional cognitive–behavioral therapy were not significantly improved by the addition of maintenance training. High dropout rates in groups that showed initial treatment gains limited the interpretation of findings but raised an interesting question: are adolescents who improve quickly also likely to lose these gains quickly? Further research on the most effective ways to maintain treatment gains continues to be important.

In sum, the biopsychosocial model is an important framework in the treatment of chronic pain in adolescents. The recognition of psychological and social influences on pain has led to more comprehensive treatment strategies including cognitive and behavioral components. Currently, there is mounting evidence for the efficacy of psychological interventions in the treatment of chronic pain, especially in headache and recurrent abdominal pain. It is clear, however, that interdisciplinary strategies are the future of pain management and will lead to the largest treatment gains. Consideration of not only the “what” but also the “how” of delivering interventions will also continue to be important. Alternative delivery systems, including interventions delivered via computer or paraprofessionals, hold promise in increasing accessibility to comprehensive pain management services.

References


