Assessment and Management of Pain Syndromes and Arthritis Pain in Children and Adolescents

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Increasingly, pediatric rheumatologists are faced with the challenge of assessing, diagnosing, and managing pain in children and adolescents. Recent research suggests that musculoskeletal pain may be the most common complaint for which children are referred to pediatric rheumatologists and is present in approximately 50\% of all new patients [1]. A small percentage of these patients is diagnosed with a form of juvenile idiopathic arthritis (JIA), which is marked by clinically significant pain. A larger percentage is diagnosed with a musculoskeletal pain syndrome. Research indicates that approximately 25\% of new patients presenting to pediatric rheumatology clinics are diagnosed with a pain syndrome, such as fibromyalgia, complex regional pain syndrome (CRPS), localized pain syndrome, or low back pain.

Given the frequency of musculoskeletal pain as a presenting complaint, understanding the nature of chronic musculoskeletal pain in children is advantageous for general pediatric practitioners and subspecialists. This understanding includes familiarity with the pain experience of healthy...
children and with the range of factors that influence pain reporting in healthy children and in children who have chronic disease. In addition, clinicians should understand how to use pain-assessment instruments and be able to recognize and treat pain syndromes and disease-related pain. It is now well recognized that pain is multidimensional and is understood best within the context of a biopsychosocial model that incorporates biologic, environmental, and cognitive behavioral mechanisms in the development and maintenance of pain (Fig. 1). Awareness of this model enhances clinicians’ ability to manage pain in children by increasing recognition of the factors influencing pain perception and highlighting the full range of pharmacologic and nonpharmacologic treatment methods available to treat pediatric pain.

This article introduces issues related to pain in children who have musculoskeletal pain syndromes and rheumatic disease, using juvenile primary fibromyalgia syndrome (JPFS) and JIA as models. A brief summary of the prevalence of pain in healthy children is followed by a summary of existing pain-assessment techniques. The remainder of the article describes the pain experience of children who have JPFS or JIA and discusses issues related to pain management.

![Biopsychosocial model of pain](image-url)
Musculoskeletal pain in healthy children

Health care professionals often underestimate the prevalence of musculoskeletal pain in healthy children, although it is a common presenting complaint to general pediatricians [2–4]. Estimates of the epidemiologic prevalence of musculoskeletal pain in general pediatric populations range from 5% to 20% [5–9], with a few studies reporting prevalence estimates as high as 30% [10–13]. Almost all complaints of musculoskeletal pain in children and adolescents are benign in nature, with symptoms attributable mainly to trauma (30%), overuse (28%), normal skeletal growth variation (18%), and growing pains (8%) [2]. Regardless of cause, chronic musculoskeletal pain occurs more commonly in girls [14–20] and in older children [14,18,21–26]. In one large epidemiologic study, the prevalence of pain increased with age, whereas gender differences became apparent at or just before puberty. Teenaged girls were found to be the group affected most frequently, with a prevalence of chronic musculoskeletal pain of nearly 50% [25].

Musculoskeletal pain in otherwise healthy children can persist for several months or even years. In one study, 7% of school-aged children who had low back pain reported pain symptoms lasting longer than 3 months [14]. More recently, El-Metwally and colleagues [11,27] demonstrated higher rates of persistence in samples of children who had generalized musculoskeletal pain and chronic lower limb pain. For example, more than 50% of school-aged children reported persistent musculoskeletal pain at 1-year follow-up, of which 65% continued to report pain at 4 years [11]. Similarly, in a sample of children reporting chronic lower limb pain, 30% reported recurrence or persistence at 1- and 4-year-follow-up [27]. Persistent musculoskeletal pain, in particular pain lasting more than 3 months, is associated with significant psychologic impairment, including higher levels of depression, behavior problems, and anxiety. These impairments create functional disability, including disruptions in school attendance and social relationships [14,28–31]. Multiple factors that may influence the onset and maintenance of musculoskeletal pain include genetics [32], environmental and familial factors [9], anatomic factors [33], psychosocial and emotional factors [34–38], childhood stressful events [39], and illness or pain behavior [40–42]. More recent studies, in particular, highlight the importance of psychosocial factors, such as stress and depressive symptoms, as predictors of pediatric musculoskeletal pain rather than physical factors, such as computer use, physical activity, and schoolbag weight [35,36,38].

Assessment of pain in children

Until recently, the study of pain in children was hindered by a lack of reliable and valid instruments for pediatric pain assessment. This lack
probably contributed to the general underestimation of pain in healthy children and in children who have chronic disease. Currently, a variety of developmentally based pediatric pain-assessment tools exists for use in research and clinical settings (Table 1). These tools include self-reporting measures, such as the Varni/Thompson pediatric pain questionnaire (PPQ), the Oucher Scale and other facial scales, and 100-mm visual analog scales (VAS), and more objective measures of pain, including behavioral observation. Self-reporting pain measures generally are used to ascertain an estimate of children’s pain intensity at the time of the assessment (eg, “current pain” or “pain now”) or during a prescribed time period (eg, “worst pain in the past week”). This latter type of assessment, however, is subject to recall bias [43] and may not accurately capture the day-to-day pain experiences of children who have JIA or pediatric pain syndromes. Electronic and paper pain diaries, however, recently have been shown effective in the assessment and monitoring of daily pain in children who have chronic and recurrent pain.

**Self-reporting pain measures**

The PPQ is a comprehensive, multidimensional tool often used in pediatric rheumatology that incorporates several techniques, such as VAS, a body map, and a list of pain descriptors. It is administered through structured interviews with parents or children. Parts of it (eg, VAS) are useful in children as young as 5 years of age [44,45]. Because it is comprehensive in scope, however, the PPQ in its entirety is cumbersome for use in a clinic setting.

More clinically useful assessment tools with demonstrated reliability and validity in many populations of children include the Oucher facial scale and a 100-mm pain thermometer. The Oucher facial scale (Fig. 2), is demonstrated to be a measure of pain affect. It consists of six photographs of a child’s face displaying varying degrees of discomfort alongside an 11-point, 0-to-100 numeric scale [46,47]. White, African American, and Hispanic versions are available [34,48]. Children are asked to select a rating that corresponds with their own levels of discomfort. Other facial scales validated for use with children include those developed by Bieri and colleagues [49], Hicks and colleagues [50], McGrath and colleagues [51], and Wong and Baker [52]. An example, the Wong-Baker FACES scale, is shown in Fig. 3. As with the Oucher scale, these facial scales are shown to reflect pain affect, not solely pain intensity. For example, a child may report less pain if asked while sitting on the mother’s lap than when the mother is out of the room and the child is feeling scared. On the pain thermometer, which is a variation of VAS, children rate current pain intensity by drawing a line on the vertical thermometer anchored by “no pain” and “pain as bad as it can be” (Fig. 4) [53–55]. Facial scales and the pain thermometer are simple to administer and understandable by some preschool-aged children over 3 years of age [56–58].
Body maps can facilitate children’s reports of location of pain [44,59]. On the PPQ, children are given a simple outline with front and back views of a human body and asked to shade the areas of the body that hurt using different colors to reflect pain intensity [44]. It is suggested that use of a body map is useful particularly for children ages 5 to 7, who have concrete definitions for pain consistent with their cognitive development. An example of a body map is shown in Fig. 5.

**Behavioral observation of pain**

In children who are preverbal, nonverbal, or cognitively impaired, the primary method of assessing pain is by behavioral observation [60]. Behavioral observation systems (eg, a behavioral scale for scoring postoperative pain in young children–face, legs, activity, cry, consolability) include recordings of overt pain behaviors, such as changes in facial expression, verbalization, and postural changes [61]. It should be noted, however, that most well-validated pain behavioral observation systems are suited best for assessment of pain during acute pain events (eg, postsurgical pain) where there is the highest likelihood that overt behavioral signs of pain are manifest. Children who have chronic or recurrent pain conditions may have habituated to pain over time and display less overt behavioral signs of pain even during times of pain flare [60].

One example of a behavioral observation system for assessment of pain and pain behaviors in school-aged children and adolescents who have JIA was developed by Jaworski and colleagues [62]. In this assessment method, trained observers code pain behaviors exhibited by children while they perform a 10-minute standard video-recorded protocol of activities. The activities include sitting, walking, standing, and reclining. Although there is limited use of this measure to date, in research and clinical settings, initial evidence for its validity was demonstrated by a positive correlation between the frequency of children’s pain behaviors and the children’s pain reports and parent and physician ratings of children’s pain intensity [62]. Future research will be important to elucidate the psychometric properties of this behavioral observation system further and its generalizability to the clinical setting.

**Pain diaries**

Recent research has documented the usefulness of pain diaries in the assessment and monitoring of chronic and recurrent pain associated with various pediatric conditions, including headaches [63,64], sickle cell disease [65], and juvenile arthritis [64,66–68]. The content of the pain diary has varied across studies but includes, most commonly, components of validated self-report pain measures to assess pain duration, intensity, and location on a day-to-day basis (eg, VAS or body maps). To date, the majority of published research on pain diaries has examined diaries completed once daily at
<table>
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<tr>
<th>Assessment tool</th>
<th>Description</th>
<th>Recommended age range</th>
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<tbody>
<tr>
<td><strong>Comprehensive instrument</strong></td>
<td></td>
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<tr>
<td>PPQ [44,45]</td>
<td>Comprehensive, multidimensional instrument incorporating a VAS, body map, and list of pain descriptors</td>
<td>4–17 years</td>
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<tr>
<td><strong>Facial scales</strong></td>
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<tr>
<td>Oucher [46–48]</td>
<td>Measures pain affect. Six photos of a child’s face with varying degrees of discomfort alongside an 11-point numeric scale ranging from 0 to 100.</td>
<td>3–12 years</td>
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<tr>
<td>Wong-Baker FACES [52]</td>
<td>Six cartoon-like faces beginning with a smiling face for “no pain” and ending with a tearful face for “worst pain.” Each face is assigned a rating of 0 to 5.</td>
<td>3 years and older but most reliable and valid in children over 5 years</td>
</tr>
<tr>
<td>Faces pain scale [49]</td>
<td>Seven line-drawn faces that convey increasing levels of pain intensity. Each face is assigned a rating of 0 to 6.</td>
<td>3 years and older, but most reliable and valid in children over 5 years</td>
</tr>
<tr>
<td>Facial affective scale [51]</td>
<td>Measures pain affect. Nine faces convey increasing levels of distress. Each face is assigned a value ranging from 0 to 1. 0 represents maximum positive affect and 1 represents maximum negative affect.</td>
<td>3 years and older, but most reliable and valid in children over 5 years</td>
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<td><strong>Visual analog scales</strong></td>
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<tr>
<td>Horizontal line (eg, PPQ) [44,45]</td>
<td>100-mm line anchored by words such as “no hurting, no discomfort, no pain” and “hurting a whole lot, very uncomfortable, severe pain.” Children mark though line to indicate pain intensity.</td>
<td>Most reliable and valid in children ages 5 years and above</td>
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(continued on next page)
night and returned in provided envelopes. In the clinic setting, this translates to children bringing completed diaries with them to clinic visits. There are limitations to paper-and-pencil diary methodology, however, that may have an impact on their clinical usefulness [64]. Concerns have been raised that end-of-day pain reports by children can be influenced negatively by attention span and poor recall of a day’s events [68,69].

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<tr>
<td>Vertical line/pain thermometer [53–55]</td>
<td>100-mm line (or thermometer) anchored by words such as “no pain at all” and “pain as bad as it can be.” Children mark through the line or draw a line on the thermometer to indicate pain intensity.</td>
<td>3 years and above. Younger children are better able to grasp concept of VAS when line is vertical</td>
</tr>
<tr>
<td>Body outline figures</td>
<td>Measures pain location. Children are asked to color in areas of the body that hurt. May use different colors to represent varying pain intensity.</td>
<td>4 years and above. Particularly useful for ages 5 to 7 years</td>
</tr>
<tr>
<td>Body map (eg, PPQ) [44, 45, 59]</td>
<td>Measures pain location. Children are asked to color in areas of the body that hurt. May use different colors to represent varying pain intensity.</td>
<td>4 years and above. Particularly useful for ages 5 to 7 years</td>
</tr>
<tr>
<td>Observation of pain behaviors</td>
<td>Trained observers code pain behaviors while children perform a series of activities such as walking and sitting.</td>
<td>6–17 years</td>
</tr>
<tr>
<td>Observation system for pain behavior in children who have chronic arthritis [62]</td>
<td>Trained observers code pain behaviors while children perform a series of activities such as walking and sitting.</td>
<td>6–17 years</td>
</tr>
<tr>
<td>Pain diaries</td>
<td>Completed by children once daily for a prescribed period of time. Can include measures pain intensity, location, and duration (eg, VAS or body maps).</td>
<td>8–17 years</td>
</tr>
<tr>
<td>Paper-and-pencil format [65, 66]</td>
<td>Completed by children multiple times per day for a prescribed time period. Captures “real-time” pain experiences in a naturalistic setting. Can include measures of pain intensity, location, and duration (eg, VAS or body maps).</td>
<td>8–17 years</td>
</tr>
<tr>
<td>Electronic format via handheld computers [68, 71]</td>
<td>Completed by children multiple times per day for a prescribed time period. Captures “real-time” pain experiences in a naturalistic setting. Can include measures of pain intensity, location, and duration (eg, VAS or body maps).</td>
<td>8–17 years</td>
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To assess child pain more accurately, pediatric pain researchers have begun to study the ecologic momentary assessment of pain (ie, real-time or in the moment pain experiences) via electronic diaries on handheld computers or personal digital assistants (PDAs) [64,68,70,71]. Using this methodology, children can rate their current pain multiple times per day during a given time period. In direct comparison studies of electronic versus paper diaries, electronic diaries yield more accurate information [64,72]. Stinson and colleagues [68] recently reported on the feasibility of e-Ouch in a small sample of adolescents who had JIA. The e-Ouch pain diary is administered via a PDA and obtains thrice-daily pain ratings on VAS sliders and body maps. Although currently limited to the research setting,
electronic diaries soon may aid in determining response to therapy in the clinical setting.

In sum, a variety of tools exists to assist practitioners in assessing pain in children. These tools should be used to supplement the clinical interview during which information about pain characteristics, such as symptom duration, intensity, alleviating and aggravating factors, progression, and radiation, are obtained. Practitioners should strive to gather information from children directly in addition to interviewing parents. Direct information from the patient is important particularly in school-aged children and adolescents, because research suggests that parents may not be the most...
accurate reporters of children’s pain intensity. Discrepancies more likely occur at higher levels of pain intensity [73–75] and are influenced by depressive symptoms in children and parental attitudes about children’s level of functional impairment [76]. Finally, when assessing acute pain flares in preschool-aged and young children, practitioners should consider behavioral observation to supplement child self-report, as children in this age group may misunderstand self-report scales and are influenced more heavily by emotional or situational factors (eg, the presence of a parent in the room) [77,78].

Idiopathic musculoskeletal pain syndromes

Because of the high incidence of musculoskeletal pain in healthy children, it may be difficult for practitioners to identify which children have idiopathic musculoskeletal pain syndromes. Moreover, these syndromes are understood poorly, with little known about cause and course [15]. Along with orthopedists and primary care physicians, rheumatologists increasingly are called on to diagnose and manage these syndromes. These syndromes are among the most common causes for referral to pediatric rheumatologists, compromising approximately 25% of all new patients [79]. Growing pains, CRPS, localized pain syndromes, low back pain, and chronic sports-related pain syndromes (eg, Osgood-Schlatter disease) are included in this group. A more comprehensive list of idiopathic pain syndromes is given in Box 1.
Box 1. Common musculoskeletal pain syndromes in children by anatomic region

Shoulder
Impingement syndrome

Elbow
Little league elbow
Panner’s disease
Avulsion fractures
Osteochondritis dissecans
Tennis elbow

Arm
CRPS
Localized hypermobility syndrome

Pelvis and hip
Avulsion injuries
Legg-Calvé-Perthes syndrome
Slipped capital femoral epiphysis
Congenital hip dysplasia

Knee
Osteochondritis dissecans
Osgood-Schlatter disease
Sindig-Larsen syndrome
Patellofemoral syndrome
Malalignment syndromes

Leg
Shin splints
Stress fractures
Compartment syndromes
Growing pains
CRPS
Localized hypermobility syndrome

Foot
Plantar fasciitis
Tarsal coalition
Stress fractures
Achilles tendonitis
Juvenile bunion

Spine
Musculoskeletal strain
Complex regional pain syndrome in children

CRPS, previously known as reflex sympathetic dystrophy, is characterized by burning pain, allodynia, and swelling of distal extremities along with autonomic dysfunction after injury to the extremity (Box 2) [80,81]. Although most pediatric patients who have CRPS present with a history of minor trauma or repeated stress injury (eg, caused by competitive sports),

Box 2. Diagnostic criteria for complex regional pain syndrome

A diagnosis of CRPS requires regional pain and sensory symptoms plus two neuropathic pain descriptors and two physical signs of autonomic dysfunction.

Neuropathic descriptors
- Burning
- Dysesthesia
- Paresthesia
- Allodynia
- Cold hyperalgesia

Autonomic dysfunction
- Cyanosis
- Mottling
- Hyperhidrosis
- Coolness (≥3°C)
- Edema

many are unable to identify a precipitating event [82]. The incidence of CRPS in children is unknown, in large part because it is underdiagnosed and often diagnosed late, with the diagnosis frequently delayed by nearly a year. The usual age of onset is between 9 and 15 years, and girls outnumber boys by as much as 6:1. Childhood CRPS differs from the adult form in that lower extremities are affected more commonly in children [81,83–85]. The role of psychologic stress [83,86,87] and parental influence [81] continues to be controversial.

Treatment of childhood CRPS, as for other pain syndromes, seeks to improve function as much as relieve pain. These two desirable outcomes may not go hand in hand, however. It is common for children to continue to complain of pain even while they are resuming normal function. As a result, families and providers need to outline clearly the goals by which to measure treatment successes. Recommended treatment modalities include aggressive physical and occupational therapy, cognitive behavioral interventions, and sympathetic nerve blocks. A multistage treatment approach is advocated in which physical therapy is started as soon as the diagnosis is made and cognitive-behavioral interventions added as needed. Physical therapy 3 to 4 times per week is recommended, and children may need analgesic premedication at the onset. Initial treatment is limited to desensitization and moves to weight-bearing, range-of-motion, and other functional activities. Only in refractory cases should more aggressive approaches, such as sympathetic and epidural nerve blocks, be undertaken and only under the auspices of pediatric pain specialists. The intent of pharmacologic and other adjunctive treatments of CPRS should be to provide sufficient pain relief, such that children can participate in aggressive physical rehabilitation. If identified and treated early, the majority of children and adolescents who have CPRS can be treated successfully with aggressive physical therapy and cognitive-behavioral interventions [88–90]. Moreover, multiple studies show noninvasive treatments, in particular cognitive behavioral therapy and physical therapy, are at least as efficacious as nerve blocks in children [80,82,83,86,88,91].

Fibromyalgia in children

A more common pain syndrome seen by pediatric rheumatologists is JPFS: approximately 25% to 40% of children who have chronic pain syndromes fulfill criteria for JPFS [42,92]. It is characterized by widespread, persistent pain, sleep disturbance, fatigue, and the presence of multiple, discrete tender points on physical examination. JPFS is uniquely frustrating for patients and health care providers, because children often present with high subjective distress but few objective abnormalities on standard physical examination and laboratory screening. There are limited epidemiologic data on the prevalence of JPFS. It first was described in 1985 by Yunus and Masi [92], who developed diagnostic criteria based on 33 children who suffered from persistent pain and sleep
difficulties. The prevalence of JPFS has been estimated to be as high as 6% in school-aged children when less stringent diagnostic criteria for adults set forth by the American College of Rheumatology (ACR) are used [93,94]. It is diagnosed most commonly in prepubertal or adolescent girls; the average age of onset is 13 years [42,92,95]. Symptoms may begin at an earlier age, however, and also occur in young men [95].

Recently, the American Pain Society published consensus statements concerning the diagnosis and treatment of JPFS [96]. The consensus statements advocated that the diagnosis of JPFS be made only after a developmentally based assessment of pain that involves children and parent components. The assessment should include a detailed pain history, behavioral observation, evaluation of physiologic cues, evaluation of comorbid mood disturbance, and evaluation of functional status (eg, school attendance). The diagnostic criteria that should be used for fibromyalgia in children, however, have not been determined. To date, the ACR criteria have not been validated in children [97], and the only reliable criteria are those first set forth by Yunus and Masi (Box 3) [92]. Yunus and Masi’s criteria include the presence of diffuse musculoskeletal pain in at least three areas of the body that persists for at least 3 months in the absence of an underlying condition. Results of laboratory tests are normal and physical examination reveals at least 5 of 18 well-defined tender points, although a recent study suggests that adolescents who have JPFS evidence an average of 15 of 18 tender points similar to adults [98]. During physical examination, patients who have JPFS show few pain behaviors and move around with no evident difficulty [21], but they report high pain intensity and use words, such as “miserable,” “intense,” and “unbearable,” when describing their pain [21,99]. The Yunus and Masi [92] criteria also require 3 of 10 minor criteria or associated symptoms be present for diagnosis. These include nonrestorative sleep (100%), fatigue (91%), chronic anxiety or tension (56%), chronic headaches (54%), subjective soft tissue swelling (61%), and pain modulated by physical activity, weather, and anxiety or stress. There is considerable overlap between the symptoms accompanying JPFS and symptoms associated with other functional disorders, including irritable bowel disease, migraines, temporomandibular joint disorder, myofascial pain syndromes, premenstrual syndrome, mood and anxiety disorders, and chronic fatigue syndrome [100]. All these disorders may be part of a larger spectrum of related syndromes [101,102].

**Course and prognosis of juvenile primary fibromyalgia syndrome**

As in adults, children who have fibromyalgia experience significant pain, suffering, and disability [103,104]. In addition, longitudinal studies conducted at academic centers report that children who have JPFS continue to suffer from persistent pain and other symptoms many years after diagnosis [92,105,106]. In community samples, research suggests better long-term
outcomes [93,107,108]. These studies, however, primarily have used the ACR diagnostic criteria that may not be applicable to children. Thus, it generally is accepted that JPFS has a chronic course that can have detrimental effects for child health and psychosocial development. As an example, adolescents who have JPFS who do not receive treatment or are treated inadequately may withdraw from school and the social milieu, complicating their transition to adulthood.

**Juvenile primary fibromyalgia syndrome symptoms: etiology and maintenance**

Although the precise cause of JPFS is unknown, there is an emerging understanding that the development and maintenance of JPFS are related to
biologic and psychologic factors consistent with the biopsychosocial model of pain. JPFS seems to be an abnormality of pain processing characterized by disordered sleep physiology, enhanced pain perception with abnormal levels of substance P in spinal fluid, disordered mood, and dysregulation of hypothalamic-pituitary-adrenal and other neuroendocrine axes [109,110]. In addition, physiologic abnormalities are documented in children and adults who have fibromyalgia. For example, children who have JPFS have lower tender-point pain thresholds and greater pain sensitivity than seen in healthy children or in children who have chronic arthritis [97,111].

The maintenance of symptoms in JPFS is perpetuated by a variety of physical and psychologic factors. Children who have fibromyalgia often find themselves in a vicious cycle of pain, whereby symptoms build on one another and contribute to the onset and maintenance of new symptoms (Fig. 6). Factors likely to be included in this vicious cycle include fatigue, poor sleep, stress, anxiety, inactivity, and depressed mood. Other factors influencing symptom report and functional disability in JPFS include children’s coping mechanisms and family environment. Additionally, a recent study by Pamuk and Cakir [112] revealed that menstrual cycling affects symptom report in up to 50% of patients who have JPFS.

The majority of children who have JPFS evidence sleep disturbances and psychologic distress contributing to their level of functional disability. All

Fig. 6. Cycle of pain.
the children in Yunus and Masi’s [92] original sample reported waking unrefreshed, 91% reported general fatigue, and 67% reported poor sleep. In later studies, children who had JPFS evidenced a higher frequency of sleep difficulties than healthy children and children who had chronic arthritis, including increased sleep latency, more decreased sleep efficiency, more arousals, more intrusions on slow wave sleep, and more morning fatigue [97,113,114]. Psychosocial distress noted in JPFS includes depression and anxiety. Estimates of anxiety disorders or major depression in children who have JPFS reach 50% [92,108,115]. In addition, children who have JPFS report more anxious and depressive symptoms than children who have chronic arthritis or healthy controls [111]. Moreover, many children report that anxiety and stress play a significant role in the modulation of their pain [92]. Coping predicts health status in JPFS, with better health outcomes (eg, less pain, increased function, and decreased psychologic impairment) in children who evidence greater perceived coping efficacy and less catastrophizing [99].

Several studies have documented familial aggregation of fibromyalgia [93,113,115]. Parents of children who have JPFS also report personal histories of other chronic medical conditions, including rheumatic diseases and chronic pain conditions, such as low back pain, shoulder/neck pain, and migraine headaches [113,116]. In a study of the social context of pain in children who had JPFS, 79% of parents of children who had JPFS reported a history of at least one chronic pain condition, and 62% reported a history of two or more. In this and other studies, a more extensive pain or medical history in parents and poor parental pain coping (eg, catastrophizing) are associated with higher global impairment and physical disability in children [97,116]. The presence of fibromyalgia and other chronic pain conditions in families of children who have JPFS may indicate a genetic or biologic link in the development of JPFS; however, it also might suggest strong environmental influences or both biologic and environmental influences. Specifically, data suggest families of children who have JPFS and other pain syndromes function less effectively than other families and that parents may serve as pain models for their children [111,116,117]. Overall patterns of family interaction in JPFS and other pediatric pain syndromes include less cohesion, more conflict, decreased organization, and increased parental, particularly maternal, psychologic distress [111,118]. Moreover, the specific nature of family relationships may be predictive of child outcomes. Schanberg and colleagues [116] demonstrated that children in families described as more active-recreational and intellectual-cultural in orientation on the Family Environment Scale report less impairment from JPFS, whereas children in families self-described as more moral-religious and controlling in orientation reported more pain and lower levels of function. It is likely that family environments with high levels of physical disability, poor coping, and increased stress interact with a genetic or biologic predisposition to influence the expression of JPFS symptoms [110].
Treatment of juvenile primary fibromyalgia syndrome

To date, there have been no large-scale systematic, well-controlled studies of treatment of JPFS. Current treatment and management of JPFS generally follows the recent consensus statements of the American Pain Society and is consistent with what is advocated for adults who have fibromyalgia with modifications based on the children’s age, developmental level, and social environment (eg, less medication) [95,96]. The major goals of treatment are to restore function and to alleviate pain. As such, treatment should address sleep, depression, and anxiety. Treatment strategies include pharmacologic interventions, exercise-based interventions, and psychologic interventions. Drug therapies include nonsteroidal anti-inflammatory drugs (NSAIDs), tricyclic antidepressants, selective serotonin reuptake inhibitors (SSRIs), muscle relaxants, and, recently, anticonvulsants. Drug therapies largely are unsuccessful. In the adult literature, previous studies have shown these medications provide only modest and short-term benefits [119,120]. Two recent randomized controlled trials, however, showed treatment with pregabalin reduced pain and improved function in adults who had fibromyalgia [121,122]. As a result of these clinical trials, pregabalin just became the first drug approved by the United States Food and Drug Administration (FDA) to treat fibromyalgia in adults, with a study in children forthcoming. To date, there are almost no studies of medication efficacy in pediatric populations. In one study with a sample of 15 children who had JPFS, use of NSAIDs alone did not produce any improvement in symptoms [123]. In another study of older adolescents and adults, the combination of NSAIDs and tricyclic antidepressants was beneficial [119].

In JPFS, whether or not treating chronic pain, comorbid anxiety, or depression, practitioners should be cautious in their use of antidepressants, in particular SSRIs. In October 2004, the FDA issued a public health advisory regarding the use of SSRIs in children and adolescents related to the increased occurrence of suicidal thoughts in this age group [124] with a proposed medication guide [125]. Results of a recent large, randomized, controlled trial studying the efficacy of fluoxetine on cognitive behavioral therapy in a sample of 439 children who had depression ages 12 to 17 indicated that fluoxetine alone (60% response rate) was significantly inferior to the combination of drug and cognitive behavioral therapy (71% response rate) but better than cognitive behavioral therapy alone [126]. In addition, there was an increased rate of suicide attempts in fluoxetine groups (six versus one), although no suicides were reported. A more recent comparative study found, however, that higher SSRI prescription rates were associated with lower suicide rates [127]. There is little or no evidence supporting the use of other SSRIs (eg, sertraline) or atypical antidepressants (eg, mirtazapine, venlafaxine, and buproprion) in children and adolescents. Thus, fluoxetine should be the first antidepressant agent used; this and all other antidepressants should be used only with extreme caution, extensive parental education, and close, frequent monitoring for side effects. Psychiatric consultation is recommended.
In general, children who have JPFS seen at tertiary care centers are encouraged to pursue a multidisciplinary treatment regimen, including medication, parent and child education, graduated aggressive aerobic exercise, training in pain-coping skills, stress management, improved sleep hygiene, and psychotherapy. In a meta-analysis of treatment studies in adult fibromyalgia, the combination of pharmacologic methods with cognitive-behavioral therapy and exercise showed larger effect than pharmacologic interventions alone [128]. Unfortunately, multicomponent treatment regimens are difficult to coordinate, often expensive, not reimbursed fully by insurance companies, and accepted poorly by many families [105,129].

Regardless of other treatments, it is strongly recommended that children who have JPFS be encouraged to return to school and resume normal activities. Parents also should be encouraged to take an active role in promoting their children’s re-entry into school and other social environments [95,96].

As with all pain management, the goals of therapy should focus on promoting function rather than simply alleviating pain. Moreover, the therapeutic interventions should be time limited and goal oriented with the aim of fostering self-reliance. Families and children need education about the diagnosis and the interrelationships between mood, stress, poor sleep, pain, and lack of exercise in the maintenance of symptoms. Of prime importance is the establishment of a therapeutic relationship with reassurance that the pain and other symptoms experienced by children are real and not imagined [129]. This reassurance is important particularly with pain syndromes because families often are frustrated with the medical system as a result of previous misdiagnosis or lack of diagnosis of their children’s condition and perceived accusations that the children are experiencing psychogenic pain or are malingering [95].

Cognitive behavioral therapy

In cognitive behavioral therapy, approaches to pain management are designed to teach children and adolescents coping skills for controlling behavioral, cognitive, and physiologic responses to pain. Cognitive behavioral therapy involves educating children and parents about mechanisms by which pain messages are transmitted and perceived and the role of the individual in these processes. Children then are taught various pain-coping skills with guidance in applying the skills in difficult situations. Skills taught include decreasing cognitive responses to pain and relaxation strategies, such as progressive muscle relaxation, distraction, and guided imagery. Finally, children are encouraged to anticipate situations in which they are likely to experience increased pain or difficulty managing pain and to plan strategies for handling these challenges. Cognitive behavioral therapy teaches self-reliance and seeks to empower patients to be responsible for their own pain management. Cognitive behavioral therapy training has been done in individual or group formats consisting of 6 to 14 sessions. Small studies show the efficacy of cognitive behavioral therapy in adults.
and children who have fibromyalgia [128,130,131] and in patients who have multiple other pain conditions.

Two recent studies of JPFS demonstrated significant reductions in pain, symptoms of depression and anxiety, sleep disturbance, and functional disability after participation in a cognitive-behavioral intervention [132,133]. The study by Kashikar-Zuck and colleagues [132], was a randomized, controlled crossover trial evaluating a cognitive-behavioral intervention in 30 adolescent girls who had JPFS. In addition to the aforementioned improvements, adolescents receiving the cognitive-behavioral intervention endorsed improved ability to cope with pain—an important finding given the relationships between coping efficacy and improved health status in JPFS [99].

Aerobic exercise and physical therapy

Because children who have JPFS often are deconditioned and no longer participating in physical activities because of fatigue and pain, graduated aggressive aerobic exercise is another important component of treatment. Although the initiation of aerobic exercise often leads to increased pain intensity, gradual improvement follows over several weeks accompanied by a concomitant, paradoxic increase in energy level [129]. Aerobic exercise has the additional benefit of improving sleep and mood. Research shows that it is aerobic exercise, rather than stretching, strengthening, or manipulative techniques, that is associated with symptom improvement [134,135]. Exercise and physical therapy, implemented in either an individualized or group format, can be helpful in promoting function in children who have fibromyalgia [95]. Physical therapists should help children design and implement home exercise programs, enabling them to develop self-management skills and encouraging feelings of self-efficacy.

Sleep hygiene

Sleep hygiene promotes improved sleep patterns in children who have fibromyalgia and other pain conditions. To improve sleep hygiene, children are encouraged to avoid napping during the day and establish a bedtime routine with consistent sleep-wake cycles even during weekends and school holidays. This is important particularly because children who have fibromyalgia and other painful conditions often have disordered sleep cycles, staying awake much of the night and then sleeping during the day, resulting in more difficulty sleeping at night [95]. Improved sleep hygiene and increased aerobic activity, combined with low doses of tricyclic antidepressants, provides comprehensive treatment of sleep difficulties. Doses as low as 10 mg of amitriptyline may be efficacious. The chronic use of hypnotics should be avoided.

Research has demonstrated both, by history and on polysomnography, that children who have JPFS have sleep disturbances. These disturbances include nonrestorative sleep, increased sleep latency, shortened total sleep time, decreased sleep efficiency, and excessive movement activity during
sleep [113,114]. These findings, however, are not specific to JPFS. Children who have JPFS should be treated presumptively for sleep disturbance. Generally, sleep studies are recommended only when children present with a history consistent with sleep apnea, including snoring, morning headache, and daytime sleepiness, especially in children and adolescents who are obese.

Other forms of treatment

Other suggested forms of treatment of JPFS include support groups and complementary and alternative medicine strategies. Support groups can be helpful for children and their parents, providing social support and a sense that they are not alone in dealing with fibromyalgia. Groups should be age specific and supervised by appropriately trained health care professionals who have experience working with families of children who have fibromyalgia or chronic disease. Ideally, parent groups and child groups should be conducted separately. Support groups should not foster dysfunctional behaviors that could lead to increased pain complaints [95].

Increasingly, adults and children who have JPFS, frustrated by the limitations of current therapies, have sought alternative forms of treatment, including acupuncture, massage, and herbal remedies [95]. Although these treatments may be helpful for individual children who have fibromyalgia, there are few data supporting their effectiveness. Moreover, some of the treatment alternatives, such as acupuncture, are not suitable for children. Future studies are needed to determine the effectiveness and safety of these treatments for children and adults who have fibromyalgia [136].

Although this discussion addresses JPFS in children, the concepts discussed generally are true for all pain states. The biopsychosocial model of pain, taking into account influences from the environment, cognition, and disease-specific biologic abnormalities, holds true for all pain syndromes, with changes only in the relative contribution of variables. Likewise, treatment approaches are similar but need to be individualized for every child and health condition. The following discussion of pain in JIA highlights issues pertinent to disease-related pain, again within the context of the biopsychosocial model of pain.

Pain in children who have juvenile idiopathic arthritis

There is an increasing awareness by pediatric rheumatologists that pain is a clinically significant symptom for children diagnosed with JIA, requiring more attention and targeted interventions. JIA affects as many as 200,000 to 300,000 American children, making it the fifth most common childhood chronic disease [137–140]. It follows most commonly a fluctuating course characterized by unpredictable flares of disease symptoms, including pain, morning stiffness, fatigue, and sleep disturbance. Children also may
experience potentially painful complications, including joint deformities and
destruction, osteoporosis, and growth abnormalities that can lead to psy-
chologic distress and functional disability [141,142].

Prevalence of pain in juvenile idiopathic arthritis

Advances in measures of pediatric pain in the past 15 years have enabled
researchers to take a more systematic approach to the study of pain in chil-
dren who have JIA. The results of several studies show that pain is more
prevalent in JIA than previously recognized and may persist in some pa-
tients into adulthood [143]. For example, Sherry and colleagues [144] found
that 86% of 293 children who had arthritis reported pain during a routine
clinic visit. In addition, data from the Cincinnati Juvenile Arthritis Data-
bank, which examined 462 children who had arthritis, indicated that
60% of children reported joint pain at disease onset, 50% reported pain
at 1-year follow-up, and 40% continued to report pain 5 years later [145].
More recent research indicates that most children who have chronic arthri-
tis experience pain on an almost daily basis and that disease flares are fre-
quent. Using daily diary methodology, the authors demonstrated that
school-aged children who have chronic arthritis report pain an average of
73% of days, with the majority of children (76%) reporting pain on more
than 60% of days [146]. Across studies of pain in juvenile chronic arthritis,
children report average pain intensity in the mild to moderate range
[44,144,145,147–149]. There is, however, considerable variability in pain
ratings, with as many as 25% of the children reporting pain intensity in
the higher ranges [150]. Higher levels of pain in children who have chronic
arthritis and other juvenile rheumatic diseases are associated with poor
functional outcomes (eg, reductions in school attendance and social activi-
ties) [150–152], worse health-related quality of life [153–156], and more
illness-related negative attitudes [157].

Predictors of pain in children who have juvenile idiopathic arthritis

Although a relationship between increased disease activity and increased
pain exists [44,158,159], research consistently has demonstrated limited pre-
dictive value for disease status variables. Across studies, they typically pre-
dict only a small to medium proportion of the variance in children’s pain
ratings (eg, 8% to 28%), with higher pain ratings in children who have poly-
articular disease related to more severe disease as rated by physicians
[149,150,159,160]. Consequently, it has been necessary to delineate other in-
fluential factors in the pain experience of children who have JIA. The most
highly predictive models use a biopsychosocial approach conceptualizing
pain reporting as influenced by multiple factors, including disease variables,
demographic variables, psychologic variables, such as coping and mood,
and environmental factors. For example, results of a two-part study by
Thompson and colleagues and Varni and colleagues [149,151] demonstrated that scores on the Family Relationship Index of the Family Environment Scale, behavior and social subscales of the Child Behavior Checklist, and disease variables combined to predict 34% of the variance in children’s present pain intensity and 72% of variance in children’s ratings of their worst pain intensity. Similarly, in a sample of 56 children who had chronic arthritis, Ross and colleagues [161] reported that increased child anxiety, increased maternal distress, and increased family harmony were associated with higher child pain ratings averaged over a 1-month time period. The role of family harmony was surprising and contrary to study hypotheses. The investigators hypothesized that increased family harmony might lend itself to increased responsiveness to children’s pain behavior, serving to reinforce pain behavior and pain reporting in children.

The relationships between demographic variables and JIA-related pain remain unclear. There is some suggestion that age and gender may be influential. For example, Hagglund and colleagues [162] report a marginally significant effect for age, with older children reporting more severe pain on a 10-cm VAS. More recently, in a large sample of 301 children who had chronic arthritis, Malleson and colleagues [159] reported that increased age was a significant predictor of pain in the 8- to 15-year-old age range but not for older adolescents. In other studies, age has not been a statistically significant predictor [150,158,161,163–165]. With regard to gender, several studies found no difference between the reported pain levels of boys and girls [158,159,162,163]. When differences are noted, girls report more pain than their male counterparts [164,166].

Several studies have demonstrated the role of many psychosocial variables in children’s pain reporting, including emotional distress, mood, stress, and pain-coping strategies. In the authors’ study investigating the interrelationships of daily stress, daily mood, and disease expression, results of multilevel random effects models indicated that day-to-day fluctuations in mood and stressful events were related to daily symptoms in children who had polyarticular forms of juvenile chronic arthritis [66,67,167]. Specifically, worse mood and more stressful events were related significantly to increased daily pain, fatigue, and stiffness. The authors’ research and that of others indicates that increased psychologic distress (eg, stress, depression, and anxiety) is related to increased pain reporting and to poor functional outcomes, such as decreased participation in school and social activities [144,161,168,169]. In a study by Hoff and colleagues [168], depressive symptoms reported by children who had JIA at a baseline evaluation were predictive of later (ie, 6-month and 12-month) pain reports and reports of functional disability.

With regard to children’s coping with pain, the use of catastrophizing (ie, engaging in overly negative thinking about pain) and decreased pain-coping efficacy are shown to predict higher pain intensity across several pain measures and more painful body locations, even after controlling for demographic variables and medical status variables [150]. In a laboratory
setting, catastrophizing also predicted higher pain intensity, decreased pain tolerance, and increased pain-related discomfort in children undergoing experimental cold pressor pain [170]. A more recent study by Thastum and colleagues [171] further elucidated the impact of cognitive health beliefs (eg, views of self-efficacy) on pain in children who have JIA. Results suggested that cognitive health beliefs about control over one’s pain and the ability to function despite the presence of pain may be influential in the development of effective pain-coping strategies.

Finally, parent and family environmental variables are related to the pain reporting of children who have JIA. These variables include the nature of family relationships (eg, family harmony or conflict), increased parent psychologic distress, parental responses to child pain, and parent and family pain history [172,173]. For example in a sample of school-aged children who had chronic arthritis, the authors and colleagues [174] found that a more extensive parent and family history of pain (eg, a family history of chronic pain conditions, intensity levels of parental pain, or parental pain that interfered with activities) was related to increased child self-reported pain and to higher physicians’ ratings of children’s disease status. Moreover, within the context of hierarchic regression analyses, children’s catastrophizing mediated these relationships. In other words, parental and familial pain variables influenced the use of catastrophizing by children, which in turn influenced the children’s reporting of pain and disease activity.

Management of pain in children who have juvenile idiopathic arthritis

Consistent with the biopsychosocial model of pain, a useful algorithm for the approach to treating pain in JIA is first to treat the underlying disease aggressively and then to combine drug treatment with nonpharmacologic modalities to treat pain. As in JPFS, goals of treatment should be to alleviate pain and to improve or preserve function in children and adolescents.

Pharmacologic management

Although no clinical trials have addressed pain management in JIA directly, the treatment of pain has focused historically on controlling the underlying disease process with medications while providing symptomatic relief with NSAIDs, acetaminophen, heat or cold, splints, adaptive devices, physical therapy, and, rarely, opioids. The mainstay of drug treatment of JIA-related pain continues to be NSAIDs with acetaminophen for acutely painful events. Recently, the Cox-2 inhibitor, celecoxib, was approved by the FDA to treat pain in JIA. Disease-modifying agents, in particular methotrexate and anti–tumor necrosis factor medications, are indicated in children who have persistently active joints despite first-line treatment. Systemic steroids generally are avoided but may be useful short term to treat painful flares while other interventions are put in place. Intra-articular steroids are a safe option to manage inflammation in monoarticular or
pauciarticular arthritis and also may be useful to treat particularly symptomatic joints in children who have polyarticular arthritis. Sometimes, however, additional pain relief is needed, acutely at presentation before other medications are effective, during a flare, or chronically in severely affected children.

There is a growing body of evidence indicating that opioids, when used properly, can treat the pain often associated with JIA safely and efficaciously. They can be used to provide pain relief in acute situations and to maintain mobility in children who have longstanding disease. Opioids may have less long-term toxicity than corticosteroids, which are used commonly for symptom management. For children who have severe neck, hip, or lower extremity arthritis, the addition of opioid analgesia may make possible continued mobility, with all the associated health benefits. Despite these potential benefits, use of opioids by pediatric rheumatologists to treat JIA-related pain is rare. A recent survey of pediatric rheumatologists revealed that nearly 60% disagree with the use of opioids for pain management. This was true even in light of more than 75% of respondents reporting caring for patients who have significant arthritis-related pain despite adequate treatment [175]. In the aforementioned study, concerns about side effects influenced attitudes toward opioid use by pediatric rheumatologists. Although opioids are associated with side effects, including respiratory depression, sedation, nausea, constipation, and pruritus, these side effects are reversible and short term. They can be managed with proper monitoring, use of additional medications, dosage reduction, or opioid rotation. Additionally, complications, such as respiratory distress, can be avoided by starting at a low dose and titrating up. A pre-emptive bowel regimen, including a stool softener and stimulant, can prevent constipation [176].

For children requiring opioid therapy for adequate pain management, single-agent oxycodone preparations are preferable for short-acting medication, and methadone is preferred for long-term therapy. Methadone is available in a liquid form, so it can be titrated easily to effect in children. The analgesic half-life of methadone may be increased in children and adolescents, with many needing only 2 or 3 doses per day for adequate pain relief rather than the traditional dosing every 6 hours [177,178]. Additional pediatric dosing guidelines are provided in Table 2.

As in adults, adjuvant medications often are useful for managing chronic pain in children. These medications most commonly include tricyclic antidepressants for generalized chronic pain associated with sleep disturbance. The tricyclic antidepressants, for example amitriptyline and nortriptyline, are used in low doses given at night. SSRIs should be used only with extreme caution in children and adolescents to treat mood disorders that may be comorbid. As described previously, with recent FDA-mandated black box labeling for SSRIs, these medications should be used only with close follow-up and extensive parent education about the risks for increased potential for suicide attempts.
Surgical interventions

There is no general agreement about the role of surgery in treating pain and symptoms in children who have chronic arthritis, although some research suggests that children experience marked pain reduction after surgical intervention [179–181]. Surgical interventions can include synovectomies, soft-tissue release, and arthroplasty and generally are limited to children who have marked functional impairment, severe disabling pain, and deformity. Whenever possible, the age of children should be considered, and surgery should be delayed until the growth plate has closed [182]. Surgical interventions should be performed only in specialized clinics at tertiary care centers, with special care to the presence of arthritis of the cervical spine and temporomandibular joints if intubation is planned. Given the recent pharmacologic advances in treating children who have chronic arthritis, the future role of surgical interventions is unclear.

Nonpharmacologic interventions

Growing acceptance of the biopsychosocial model of pain has prompted the development and study of nonpharmacologic interventions for JIA-related pain. Research on nonpharmacologic interventions has included programs for improving physical conditioning and sleep hygiene, massage therapy, and, perhaps most importantly, cognitive behavioral therapy.

As described previously, cognitive behavioral therapy aims to manage pain by improving self-reliance and facilitating normal activities through the use of coping skills, decreasing cognitive responses to pain, and using

Table 2
Pediatric dosing guidelines for selected medications used to treat musculoskeletal pain

<table>
<thead>
<tr>
<th>Medication</th>
<th>Total daily dose</th>
<th>Frequency</th>
<th>Daily maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsteroidal anti-inflammatory drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salicylate</td>
<td>60–100 mg/kg</td>
<td>3 times/d</td>
<td>Serum level 20-30 mg/dL</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>30–40 mg/kg</td>
<td>3 times/d</td>
<td>2400 mg</td>
</tr>
<tr>
<td>Naproxen</td>
<td>10–20 mg</td>
<td>2 times/d</td>
<td>1000 mg</td>
</tr>
<tr>
<td>Tolectin</td>
<td>40 mg/kg</td>
<td>3 times/d</td>
<td>1600 mg</td>
</tr>
<tr>
<td>Nabumetone</td>
<td>30 mg/kg</td>
<td>1-2 times/d</td>
<td>2000 mg</td>
</tr>
<tr>
<td>E tol Ac SR</td>
<td>400–1000 mg (by age)</td>
<td>Daily</td>
<td>1000 mg</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>0.125 mg/kg</td>
<td>Daily</td>
<td>7.5 mg</td>
</tr>
<tr>
<td>Celecoxib</td>
<td>100 mg (≥12–≤25 kg)</td>
<td>2 times/d</td>
<td>200 mg</td>
</tr>
<tr>
<td></td>
<td>200 mg (&gt;25 kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analgesics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetaminophen</td>
<td>10–15 mg/kg/dose</td>
<td>Every 4 h</td>
<td>2–4 g</td>
</tr>
<tr>
<td>Hydrocodone</td>
<td>0.15 mg/kg</td>
<td>Every 3–6 h</td>
<td>Limited by side effects</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>0.05–0.2 mg/kg</td>
<td>Every 3–6 h</td>
<td>Limited by side effects</td>
</tr>
<tr>
<td>Tramadol</td>
<td>25–100 mg</td>
<td>Every 6–8 h</td>
<td>300 mg</td>
</tr>
<tr>
<td>Methadone</td>
<td>0.2–0.4 mg/kg</td>
<td>Every 6–12 h</td>
<td>Limited by side effects</td>
</tr>
<tr>
<td>Amitriptyline</td>
<td>10–30 mg</td>
<td>At bedtime</td>
<td>75 mg at bedtime</td>
</tr>
</tbody>
</table>
relaxation strategies including progressive muscle relaxation, distraction, and guided imagery. Two published studies have demonstrated improvements in self-reported pain ratings of children who have chronic arthritis after cognitive behavioral therapy immediately after treatment and at 6-month follow-up [183,184]. Both studies, however, are limited by small sample sizes, the abbreviated scope of the cognitive behavioral therapy intervention, and the lack of functional outcome variables. Although future studies of cognitive behavioral therapy are necessary to understand fully its role in the treatment of this population, research in many other disease populations supports its applicability. Moreover, the lack of side effects seen with pain medications and the generalizability of the skills make cognitive behavioral therapy an attractive adjunctive therapy.

As indicated, programs for improving physical conditioning and sleep hygiene in children who have JIA are advocated. Children who have chronic arthritis often are less physically active than their peers as a result of disease symptoms and have decreased aerobic capacity and endurance, decreased exercise time, and decreased peak workload as compared with healthy controls [185,186]. A series of studies provides preliminary support for the safety and benefit of conditioning programs in improving symptoms in children who have chronic arthritis, including joint counts, cardiovascular fitness, pain, and gait efficiency [187–191]. For example, Fisher and colleagues [190] show that resistance exercise led to decreased pain, disability, and medication use in a sample of six children who had chronic arthritis. Future studies are necessary to delineate the most appropriate exercise for children who have arthritis.

Improving sleep quality often is overlooked in the treatment of pain. A recent study described frequent night waking, parasomnias, sleep anxiety, sleep-disordered breathing, and daytime fatigue in children who had arthritis compared with controls [192]; disturbed sleep also was associated with increased pain in children who had JIA. Thus, even simple measures to improve sleep, including use of a waterbed and sleeping in warm pajamas (eg, sweat clothes), should be recommended to children who have JIA. Physical therapists also can suggest sleep positions that maximize children’s level of comfort depending on the unique combination of active joints. Relaxation techniques, such as progressive muscle relaxation or guided imagery, also can be useful in improving sleep hygiene, and these strategies often are taught within the context of cognitive behavioral therapy.

Finally, one study evaluated the effectiveness of massage therapy in decreasing pain in a sample of 20 children who had mild to moderate arthritis [193]. Children were assigned randomly to a massage therapy group or a control group using relaxation techniques. Immediately after treatment, children who received massage evidenced lower levels of anxiety and decreased salivary cortisol levels. They also reported less present pain, less pain during the past week, and fewer painful locations than children in the control group.
Summary

Chronic musculoskeletal pain, whether it is idiopathic or disease-related, is common in childhood. Pediatric rheumatologists and other pediatric health care providers must understand the epidemiology of musculoskeletal pain as part of childhood, diagnose pain syndromes in children and rule out rheumatic disease, and be willing to initiate treatment of pain in children and adolescents. Practitioners’ ability to carry out these tasks is enhanced by an awareness of the biopsychosocial model of pain, which integrates biologic, environmental, and cognitive behavioral mechanisms in describing the causes and maintenance of children’s pain. A growing body of research in rheumatic diseases, such as JIA, and idiopathic musculoskeletal pain syndromes, such as JPFS, highlights the importance of environmental and cognitive behavioral influences in the pain experience of children in addition to the contribution of disease activity. These influences include factors innate in the child, such as emotional distress, daily stress, coping, and mood, and familial factors, such as parental psychologic health, parental pain history, and the nature of family interactions. Addressing these issues, while providing aggressive traditional medical management, optimizes pain treatment and improves overall quality of life for children who have musculoskeletal pain.

References


