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Physical Activity and Function in Adolescents With Chronic Pain: A Controlled Study Using Actigraphy

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Abstract: **Physical functioning is often impaired in adolescents with chronic pain, which has largely been demonstrated through subjective self-report measures. Actigraphy uses motion monitoring as an objective means for assessing one dimension of physical functioning; physical activity level. This study used subjective and objective measures to assess multiple dimensions of physical functioning in a clinical sample of adolescents with chronic pain (n = 78) and a comparison group of healthy adolescents (n = 59). Individual and pain characteristics were also examined as predictors of actigraphy variables within the chronic pain sample. Results indicated that adolescents with chronic pain demonstrate significant impairment in subjective measures of physical functioning and evidence lower levels of physical activity. Actigraphic measures of physical activity were moderately correlated with self-report measures of physical functioning. Individual characteristics, including adolescent age, sex, and Body Mass Index percentile, were associated with physical activity levels among adolescents with chronic pain. Physical activity represents a distinct dimension of physical functioning. Assessing physical activity may provide additional description of physical functioning among adolescents with chronic pain, and may help identify targets for intervention in this population.**

Perspective: ***This study demonstrates that adolescents with chronic pain have lower physical activity levels, as measured objectively via actigraphy, as well as poorer subjective reports of physical functioning, compared to healthy adolescents. Actigraphic measurement of physical activity provides objective source data about one dimension of physical functioning.***

Key words: *Chronic pain, adolescents, physical functioning, physical activity.*

Impairments in physical functioning are common in adolescents with chronic pain, and many youths report withdrawal from physical activities such as team sports, gym, walking, and running.[11,14] Physical functioning is a multidimensional domain encompassing a number of constructs such as physical fitness, physical activity, functional capacity, and subjective disability, which are related but distinct aspects of functioning. Physical functioning has been identified as an important outcome domain to assess in clinical trials of pain interventions.[13] In addition to being an important clinical feature of chronic pain, participation in regular physical activity has broad long-term implications for adolescent health.[22,30] Most prior research examining physical functioning has relied on subjective reports on measures of functional disability, activity limitations, and physical health-related quality of life.

Actigraphy offers an objective means for assessing physical activity, which may be useful to assess in adolescents with chronic pain for a number of reasons. First, as has been noted by Kashikar-Zuck et al,[10] there are a number of sources of bias (eg, negative affect) that could potentially impact the reliability and accuracy of adolescent reports on self-report measures of physical functioning. Second, a better understanding of how subjective and objective measures of physical functioning relate is necessary, as changes in self-report measures are not necessarily reflective of changes in objectively measured physical function.[27] Third, not all adolescents with chronic pain demonstrate reductions in physical activity[10] and a better understanding of factors that are associated with lower and higher levels of physical activity

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may help identify youth who are at higher risk for negative health outcomes, as well as identify potential targets for intervention. Thus, actigraphic measures may provide useful additional information about physical functioning in this population of youth.

To our knowledge, only 2 previous studies have examined actigraphic measures of daytime physical activity in adolescents with chronic pain. One study examined a small sample (n = 20) with mixed chronic pain problems (headache, abdominal, or musculoskeletal pain) and showed lower levels of daytime physical activity compared to healthy adolescents.[12] In this study, physical activity was higher in younger adolescents, and was associated with self-reports of activity limitations and depressive symptoms. In a larger sample of adolescents (n = 104) with juvenile primary fibromyalgia syndrome, higher levels of physical activity were observed in some adolescents, which was associated with significantly lower reports of pain intensity, depressive symptoms, and functional disability.[10] The current study extends findings from these previous studies by examining physical functioning in a relatively large sample of adolescents with chronic pain (n = 78) and healthy adolescents (n = 59). Specifically, we address a gap in knowledge of measurement of physical function and physical activity. Inclusion of a healthy comparison sample will increase understanding of the degree of difficulty in physical functioning that is experienced by adolescents with chronic pain.

The first aim of the current study was to describe objectively measured physical activity (collected via actigraphy), and subjective measures of physical functioning in adolescents with a variety of chronic pain conditions compared to a comparison group of healthy adolescents. It was hypothesized that adolescents with chronic pain would demonstrate lower levels of physical activity and subjective physical functioning compared to adolescents without chronic pain. The second aim was to examine associations between actigraphic measures of daytime physical activity and subjective reports of physical functioning. It was hypothesized that physical activity and subjective measures of disability would emerge as distinct constructs. The final aim was to explore potential contributors to physical activity among adolescents with chronic pain, including age, sex, BMI, and pain characteristics.

Methods

The Institutional Review Board at the academic medical center where the study was conducted approved this study. Written informed consent was obtained from parents, and written assent was obtained from adolescents prior to participation in this study.

Participants

Participants were 137 adolescents, ages 11 to 17, and their parents. The sample included 78 adolescents with chronic pain and 59 children in a healthy comparison group. Chronic pain participants were drawn from 2 convenience clinical studies. The majority of participants were female (71.5%). For both studies, adolescents with chronic pain were recruited through specialty care physician referral from a multidisciplinary pediatric pain clinic, pediatric neurology clinic, and pediatric gastroenterology clinic at an academic health center children's hospital in the northwestern United States. Referring physicians provided study flyers to potentially eligible participants, posted flyers in their clinic areas, and provided lists of potentially eligible patients who were then mailed study flyers.

Inclusion criteria consisted of: 1) ages 11 to 17 years; 2) chronic idiopathic pain including headache, abdominal pain, or musculoskeletal pain present over the previous 3 months; and 3) pain occurs at least once per week. Healthy adolescents were recruited through advertisements and flyers in the community, including posting flyers in the children's hospital lobby and waiting areas and advertisements on the health center's research website. Inclusion criteria consisted of: 1) ages 11 to 17 years; and 2) did not meet the criteria for chronic pain used in the chronic pain group. Participants in both groups were excluded if the child: 1) had a serious comorbid chronic condition (eg, diabetes, cancer); 2) was non-English speaking; or 3) had developmental delays or cognitive impairment. For the chronic pain group, 15.1% of youth screened were ineligible, and an additional 15.1% declined to participate. For the healthy group, 38.3% of youth screened were ineligible, and an additional 5.6% declined to participate. Two participants in the chronic pain group and 1 participant in the healthy group had missing data and were not included in analyses.

Procedures

After the initial screening by a member of the research team and following enrollment, adolescents and parents completed retrospective questionnaire measures of pain characteristics, activity limitations, and physical health-related quality of life. Adolescents underwent 7 to 10 consecutive days of monitoring by actigraphy. Participants were provided with study materials during a routine outpatient visit or by mail. All participants were instructed to wear the wrist-mounted actigraphy device 24 hours per day during the monitoring period and to identify bedtime and wake time by pressing a button on the watch. The importance of wearing the device continuously was stressed to participants, and they were instructed to put the device back on immediately upon taking it off (eg, to take a shower). Participants were asked to complete questionnaires independently at home at their convenience during the week that they wore the actigraphy device. Actigraphy devices and questionnaires were returned by business reply mail. Gift cards to local stores were given to the participants as compensation for their time.

Measures

Sociodemographics

Parents reported on their adolescent's age, sex, ethnicity, and racial background, as well as on family income via a sociodemographic questionnaire.