Approach to activity, biomechanical loads and flare-ups of back pain

Individual views of patients and their clinicians increasingly play an important role in research. That is especially true for beliefs about the association between physical activity, biomechanical loads and new episodes of back pain. Layperson and clinician views might stimulate research questions and new concepts for improving pain management. Within this context, healthcare providers should be aware of at least 10 facts on pain behavior in patients with back pain:

1. **Activity-related pain behavior is highly variable among patients with back pain.**
   Patients' approaches to physical activities when experiencing pain vary widely. Common approaches include: 1) escape or avoidance of an activity, even at low levels of pain, 2) enduring an activity while tolerating low to moderate levels of pain, 3) persisting with an activity to the point that pain is significantly aggravated (i.e. severe flare-ups of pain), and 4) persisting with an activity until a severe flare-up of pain forces to interrupt or stop this activity, also known as overactivity [7, 18, 26]. Approaches to activity are not always mutually exclusive; individuals can avoid certain activities or movements but persist with other activities to the point of a severe flare-up [3, 4, 27].

2. **Patients showing elevated avoidance behavior feel highly disabled by their pain.**
   The literature provides robust evidence that, in patients with low back pain, avoidance of activities that are thought to increase the experienced level of pain yields a number of detrimental consequences, i.e. that it involves the risk of increasing fear of certain activities or the risk of pain disability in daily life [1].

3. **Flare-ups of pain are common among patients with chronic back pain.**
   Chronic back pain is not of constant and stable intensity but can vary over time with signs of "flare-ups", where pain is much worse than usual for days, weeks, or months [40]. More recently, a multiphase process, including consumers' views and expert consensus extended this definition of a pain flare-up to a worsening of the condition, that is difficult to tolerate and impacts usual activities and/or emotions [13].

4. **Physical activities associated with high or sustained biomechanical load are perceived as common triggers of flare-ups.**
   Patients with chronic back pain [1,12], as well as clinicians [42], perceive physical activities that are associated with high or sustained biomechanical loads (i.e. lifting heavy loads, bending, sustaining longer periods of time in static postures) as the most important precursors of a new acute onset of pain [36, 41] or a flare-up of chronic pain. Objectively assessed static postures (upright or forward bent sitting or standing) in daily life are positively related with pain intensity and pain-related fatigue in patients with chronic back pain [37]. Moreover, results from systematic reviews and meta-analyses give support for the association of biomechanical stressors such as lifting [11], bending [45], and new episodes of back pain, with some studies shown a dose-response [30].

5. **Research suggests a time delay between engaging in physical activity and a flare-up of pain.** An individual's perception of an association of biomechanical triggers and a flare-up of pain can be hampered by a delay that exists between biomechanical loadings and an exacerbation of pain. Preliminary studies have shown that dysfunctional physical activities can be followed by a flare-up of pain with a delay of 30 minutes up to hours [20, 32, 36].

6. **Pain persistence and overactivity are common behavioral responses to LBP.** Besides avoidance, persistence in an activity despite severe levels of pain is a common behavioral response to musculoskeletal and back pain [1, 9, 14, 17, 19, 22, 25, 27, 29, 31, 33, 34, 39]. Most studies assessed self-reported frequency of persistence behavior, using questionnaires, such as the Avoidance-Endurance Questionnaire AEQ [25], the 9-item Avoidance-Endurance Fast Screen (AEFS) [47], or the Patterns of Activity Measure-Pain POAM-P [8]. Different terms such as pain persistence [17, 25, 27, 39], overdoing [9, 34], task persistence [31] or pain-related endurance [25, 27] have been used to denote persisting with activities in spite of severe pain. In contrast, the terms overactivity [3, 7] or excessive persistence [31] refer to a process of pain persistence that was only halted by an intolerable intensity of pain and a subsequent phase of functional incapacity [28]. The Overactivity in Persistent Pain Assessment (OPPA) is a self-report measure to assess not only persistence despite pain but also the subsequent phase of physical inactivity [46].

7. **While adaptivity of pure frequency of pain persistence is inconclusive, habitual overactivity has been associated with worse outcomes.** The term pain persistence behavior that merely refers to the frequency or severity of occurrence displays low or zero linear correlations with pain intensity and inconsistent results with positive or negative relations to pain disability.[1,14,25,33] Negative associations with low to moderate effect sizes were shown for pain persistence and psychological distress, such as depression, anxiety, pain catastrophizing or fear of movement.[1,25,33,39] In contrast, measures that include aspects of the process of overactivity, which is followed by an interruption of an activity due to intolerable pain revealed positive associations with disability or psychological distress.[7,10,31,46]

8. **Research has revealed valuable insights into complex patterns of cognitive-affective and behavioral responses to pain.** Inspecting more complex individual patterns of cognitive, affective and behavioral pain responses instead of the frequency of pain persistence, provide more insight into physical and psychological adaption. For example, patients showing a pattern of distress-endurance pain responses (DER) with negative mood, elevated thought suppression and pain persistence behavior reported significantly higher pain intensity, disability and poorer psychological functioning than those patients with an adaptive response pattern (AR, i.e. with low persistence, low thought suppression and low negative mood) [22, 27, 43]. Despite higher pain and disability, DER patients have been shown to display a significantly higher number of static postures, assessed objectively with a tri-axial accelerometer advice, compared to AR patients [24, 37]. Conversely, patients with an eustress-endurance pattern (EER) with high pain persistence behavior, positive mood despite pain and elevated cognitive distraction from pain displayed higher pain intensity scores than AR patients, but comparably low disability and positive psychological function. Pain cognitions and affective responses seem to determine whether pain persistence is positive or negatively related

to disability and poor psychological functioning. The existence of two different pain persistence groups (similar to DER and EER) besides patients with a fear-avoidance (FAR, high fear of pain or injury, high avoidance behavior) or an adaptive pattern are described in a number of studies [8, 17, 29, 34, 37, 38, 47, 48].

9. **Neurobehavioral consequences of different approaches to physical activity requires further research.**
   The Avoidance-Endurance model (AEM) of pain conceptualizes possible neurobehavioral mechanisms suggesting that, due to extreme pain persistence behavior, these patients are prone to physical overuse/overload and the induction of early muscle fatigue, reduced blood/ oxygen supply, small and repetitive damages of soft tissues, such as muscles, ligaments, and tendons [26, 28]. Conversely, patients with an elevated FAR pattern run the risk of physical de-conditioning, including negative changes in muscular, motor, cardio-respiratory and metabolic aspects of physical fitness [44]. Research that addresses adaptations in the motor control system due to pain persistence and overactivity is currently at the stage of hypotheses, however a number of physiological mechanisms have been outlined suggesting promising perspectives for future studies [28].

10. **Flexible and self-determined pacing behavior might be an adaptive response to pain but more research is needed.**
    Activity pacing refers to regulating activity levels and/or rate in the service of an adaptive goal [35]. Activity pacing is a key self-management strategy taught in pain management programs across the globe where individuals are taught to break up and reschedule pain provoking activities by taking short rest breaks or alternating activities/postures [6]. Outcome studies evaluating the effectiveness of pacing as an intervention are however sparse with inconsistent findings observed.[21] Qualitative data has highlighted the potential value of activity pacing as a treatment strategy[4] and activity patterns consistent with the effective use of activity pacing strategies have been associated with better outcomes in some studies. For example, patients with an adaptive pain response pattern (suggestive of an effective pacing pattern [26]) showed the lowest pain intensity and disability scores [27, 29, 43] and lower depression than patients with an avoidance or persistence pattern [9, 27, 29]. In contrast, research on the linear association between frequency of pacing behavior and pain, disability or psychological function have yielded highly inconsistent results [1, 9, 10, 14, 15, 16, 31]. Further research on the effectiveness of activity pacing as a treatment strategy and exploring activity patterns consistent with the effective use of pacing strategies is warranted.

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