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Perspectives of people living with Axial Spondyloarthritis on virtual reality rehabilitation: A qualitative interview study

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Abstract

Background

Axial spondyloarthritis (axSpA) is a chronic inflammatory disease associated with pain, stiffness, fatigue, and reduced mobility. Exercise is recommended as part of axSpA self-management, but engagement during flares can be difficult because of pain, symptom exacerbation concerns and fear of movement. Virtual reality (VR) may offer an interactive and distracting way to support movement; however, its acceptability among people with axSpA remains unclear. This study explored patients' perspectives of VR exercise as a potential rehabilitation intervention during flares.

Methods

Fifteen adults diagnosed with axSpA took part in semi-structured online interviews conducted using Microsoft Teams. Participants were recruited through UK rheumatology charities and had experienced at least one flare in the previous six months. Before the interviews, participants completed demographic questions and the Tampa Scale for Kinesiophobia (TSK). Interviews explored flare experiences, mobility, fear of movement and views on using VR exercise during flares. Interviews were transcribed and analysed using thematic analysis.

Results

All participants reported high kinesiophobia, with TSK scores ranging from 39 to 50. Four VR-focused themes were generated: 1. Acceptance of VR as a potential management tool during flare, 2. Symptom-related concerns about using VR during flares, 3. Safety and home-based use, and 4. Gamified activity preferences. Participants were generally open to trying VR and viewed it as a possible non-pharmacological support for pain distraction and maintaining activity. Concerns included headset weight, fatigue, session duration, standing tolerance, balance, disorientation and risk of injury at home. Participants requested an introductory training session. Purposeful and sport-like activities were preferred over simulated daily tasks.

Conclusions

Participants expressed openness towards VR exercise to support physical activity and pain management during flares. Patient concerns regarding headset comfort, fatigue, balance, home safety, session duration, and game preferences should be considered when designing future studies using VR during flare in axSpA population.

Background

Axial spondyloarthritis (axSpA) is a chronic inflammatory arthritis that primarily affects the spine and sacroiliac joints. The condition is characterised by episodes of flares and remission, with fluctuations in disease activity that can significantly affect patients' quality of life (1, 2). People living with axSpA can experience inflammatory back pain, stiffness, fatigue, impaired physical function, sleep disturbance, and psychological challenges, which all affect quality of life (1, 3). AxSpA includes two types: 1. radiographic (r-axSpA) disease, where there are visible structural changes in the SI and spine via X-ray. When it progresses to bone formation and deformities, it is called ankylosing spondylitis (AS), and 2. non-radiographic (nr-axSpA) disease where the X-rays don't show any changes (2).

Flares are difficult to define because patients and physicians often have different perceptions of flare (4). Patients define flares as a worsening of their overall health, often combining both inflammatory and non-inflammatory symptoms, such as worsening pain, fatigue, stiffness, mobility, emotional wellbeing, and ability to cope. Physicians focus primarily on the level of disease activity. Godfrin et al. (4) defined flare by the increase in disease activity measured by a rise of ≥ 1.3 units in Ankylosing Spondylitis Disease Activity Score with C-reactive Protein (ASDAS-CRP), ≥ 0.8 units in Ankylosing Spondylitis Disease Activity Score with Erythrocyte Sedimentation Rate (ASDAS-ESR), or ≥ 2.1 units in Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) scores. Moreover, the Outcome Measures in Rheumatology Clinical Trials (OMERACT) group defined flares as "a cluster of symptoms with sufficient duration and intensity that the patient cannot manage alone, necessitating the initiation, change, or increase in therapy" (3, 5, 6). However, due to the psychological strain that comes with the unpredictability of increased pain, fatigue and worsening of disease (7), understanding patient experiences during flares is important for designing effective interventions that aim to reduce the impact of flares and their long-term outcomes (8).

Previous studies have described the frequency and duration of flares in axSpA and their association with activity limitation (9). Jacquemin et al. (9) used activity trackers to measure step counts over three months to explore the frequency of disease flares in RA and axSpA patients and their association with physical activity levels. Results revealed that shorter, more intense flares were associated with greater activity limitations, while longer, less intense flares had less effect on step counts. Additionally, Barnett, Ng and Sengupta (3) created a flare profile for axSpA patients by analysing ten variables tracked over two years using a smartphone app to monitor daily symptoms and behaviours. The study categorised patients into flare and non-flare profiles, showing significant relationships between flare status and outcomes including pain, stress, fatigue, self-management, and exercise. These studies show that flares can limit physical activity and daily function in people with axSpA. However, while the characteristics of flares are becoming better understood, less is known about interventions that could help people maintain movement and physical activity during these episodes. High levels of inflammation during flare can lead to mobility impairment, which is associated with increased structural damage and bone formation, and may contribute to long-term functional limitations if not adequately managed (10, 11). Alongside pharmacological treatment, physical activity is recommended as an important non-pharmacological component of axSpA management because of its benefits for disease activity, pain,

stiffness, physical function and mobility. It may also help with wider health risks relevant to this population, such as cardiovascular disease, osteoporosis, vertebral fractures and risk of falls (12).

Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (13). However, maintaining regular physical activity during flares remains challenging. People with axSpA experience multiple barriers to physical activity, including fear of disease progression, pain, fatigue, lack of time, and limited access to exercise facilities (14, 15). During flares, fear of movement, or kinesiophobia, can further limit engagement in physical activity because of concerns about symptom exacerbation or potential injury, creating a significant barrier to the effective use of exercise as a self-management strategy (16, 17). Living with kinesiophobia can create a cycle where pain and flare symptoms reduce activity, causing limited mobility, increased stiffness and reduced function. However, there remains limited understanding of how flare affects mobility, fear of movement, and willingness to perform physical activity from the patient perspective.

Using accessible and user-friendly technology to support physical activity may be a beneficial strategy to improve mobility and function in the axSpA population (18). Virtual reality (VR) is an innovative technology that is currently being used in clinical settings, including musculoskeletal pain rehabilitation (19). VR may offer an approach to support physical activity and pain management during axSpA flares. VR technology uses a computer interface to create real-time interaction through stimulation of visual and auditory systems. This computer-based three-dimensional technology allows users to experience a simulated world, with the level of immersion depending on the degree of sensory stimulation and interaction with the virtual environment. VR can be immersive, non-immersive, augmented, or mixed. Immersive VR allows the user to become more fully immersed in the virtual environment through a head-mounted display, while non-immersive VR allows the user to view and interact with computer-generated images on a screen. Both approaches may also use supplementary tools, such as handheld devices and vibrotactile platforms, to allow users to interact with the virtual environment, sometimes through an avatar (20).

Motivating patients with pain and fear of movement to move can be challenging (21). VR-based exercise has been explored in chronic musculoskeletal pain rehabilitation, including in patients with chronic low back pain and fear of movement (19, 21). VR systems have capabilities in managing chronic pain and improving physical function through distraction and engagment with virtual games (21–23). Virtual reality (VR) can provide immersive and interactive environments that may redirect attention away from pain and make exercise feel more engaging (22, 24). In addition to immersion and distraction, the gamified nature of VR may be relevant for rehabilitation engagement. Game-based features, such as goals, feedback, challenge, progression and enjoyment, may help make movement feel more purposeful and less like a clinical exercise task (19, 24). Therefore, VR can offer a tool to support movement motivation during flare.

The feasibility of using VR exercise for people with axSpA remains understudied. One mixed-methods feasibility study involving eight patients with axSpA and nine healthcare professionals explored VR-

guided exercise therapy in home and physiotherapy settings. The study reported positive user experience, but also highlighted usability issues, limited patient feedback and uncertainty around home-based implementation which indicate the need for further patient-perspective research before designing VR exercise interventions for people with axSpA. The current study explored patients' perspectives on using VR exercise during axSpA flares, when pain, fatigue, mobility limitations and fear of movement may create additional barriers to physical activity.

Understanding whether people with axSpA prefer gamified or functional task-based VR activities is important before developing future VR rehabilitation studies. Recognising patient perspectives is particularly relevant before considering VR rehabilitation for flare management. Acceptability is a key consideration to evaluate or design an intervention prior to experiencing it on patient populations (25). Therefore, this qualitative study aimed to explore axSpA patients' perceptions of the feasibility and acceptability of using VR exercise as a rehabilitation intervention during flares.

Methods

Design and setting

This qualitative interview study explored patient perspectives on VR exercise as a potential rehabilitation intervention for people with axSpA and evaluated interest in, and acceptance of, VR to support physical activity and pain distraction during flares.

The interview schedule also explored flare characteristics, mobility limitations, and fear of movement during flares. A pragmatist approach was adopted for this study, with the aim of generating practical knowledge from participants' experiences to inform the design and implementation of a future VR feasibility study (26).

Semi-structured online interviews (Microsoft Teams) were employed to facilitate participant description of their experience (27). The interviews were conducted by the lead author, a female physiotherapist with an MSc degree, who was conducting this study as part of her PhD research. The lead author had no prior clinical or personal relationship with any of the participants. Participants were informed that the study formed part of the lead author's PhD research exploring axSpA flares and the potential use of VR-based rehabilitation. The interview guide and analysis were developed with supervisory support from the wider research team.

Participants and recruitment

Following University of Bath Research Ethics Committee approval (Reference: 5013–7150). All participants provided informed consent prior to participating in the study.

Participants were recruited through UK rheumatology charities and patient organisations, including the Bath Institute for Rheumatic Diseases (BIRD) and the National Axial Spondyloarthritis Society (NASS). To be eligible, participants had to be adults aged 18 years or older, with a confirmed diagnosis of axSpA, at least one flare in the previous six months, and to have access to a private space for the online interview.

An information sheet explaining the rationale for the research was shared with participants who expressed interest in participating in the research. Interested participants completed an online registration form, provided permission to be contacted, and booked a suitable interview slot. Before the interview, participants received Microsoft Teams instructions, completed consent, and completed a demographic questionnaire and the Tampa Scale for Kinesiophobia (TSK).

The TSK was used to assess fear of movement, it is a validated 17-item self-report questionnaire that measures fear of movement and fear of (re)injury. Participants rate each item on a 4-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"), producing a total score between 17 and 68, with higher scores indicating greater levels of kinesiophobia. A score of 37 or above is commonly used to indicate high levels of kinesiophobia (28).

Fifteen eligible participants with axSpA were interviewed (11 Female, 4 Male), with a mean age of 41.36 years (Table 1). Participants represented different axSpA disease stages and included people with and without previous experience of VR. All participants who registered and booked an interview completed the interview; no participants withdrew after booking. Number of people who viewed the advert or chose not to register was not known.

Table 1
Participant characteristics

Participants	**Total, N = 15**
Age in years, mean (SD)	41.36 (7.18)
Gender, female/male	11/4
Diagnosis, nr-axSpA/r-axSpA/AS, n	7/3/5
Employment status, employed/unemployed	9/6
Used VR before, yes/no	7/8
Have exercise routine, yes/no	9/6
Experience limitation in daily activities, yes/no	15/0
Sleep quality, poor/fair/good	8/5/2
Time since diagnosis in years, mean	3.42
TSK score range	39–50

AS, ankylosing spondylitis; nr-axSpA, non-radiographic axial spondyloarthritis; r-axSpA, radiographic axial spondyloarthritis; TSK, Tampa Scale for Kinesiophobia; VR, virtual reality

Data collection

Semi-structured interviews were conducted to allow individuals to express greater meaning in their experiences and to provide flexibility in communicating their feelings and opinions (29). The individual online interviews lasted approximately 50 to 60 minutes. Only the lead researcher and participants were present during each interview. The researcher attended an online interview from the University of Bath, and participants were asked to join from a quiet and private room in a location of their choice. Questions first explored participants' understanding and experiences of flares, pain, fatigue, mobility, and fear of movement. Participants were then shown a short presentation introducing the concept of VR exercise and the proposed VR rehabilitation idea. A set of VR-focused questions was included to gather participants' views on the potential use of VR rehabilitation during axSpA flares. The questions explored previous VR experience, comfort with headset use, preferred types of VR-based activities, perceived concerns, safety considerations, and willingness to engage with VR exercise during a flare. Participants were also asked about their preference between immersive and non-immersive VR activities. In addition, the questions explored the feasibility of attending multiple study visits and using a VR headset at home. These questions were intended to support the development of a future VR rehabilitation study that is informed by patient experience, preferences, and practical considerations during flare periods. The interview questions are presented in Table 2. Additional prompts were used where needed to encourage clarification or elaboration. To assess question clarity, interview flow and approximate interview duration, the interview was piloted with a non-axSpA volunteer who was not included in the final sample. Each participant completed one online interview only, and repeat interviews were not conducted. Where audio data was recorded without any video data, Microsoft Teams transcription was used to generate transcription during the interview. Transcripts were checked and anonymised before analysis, and the researcher made notes during the interviews to support contextual understanding. Individual transcripts were not returned to participants for correction; however, a summary of the main findings was shared with participants after completion of the analysis. Data saturation was not formally assessed; however, data collection ended when the planned sample size was reached and the interviews provided sufficient depth and recurrence across the VR-focused topics to address the study aim. Reporting was informed by the Consolidated Criteria for Reporting Qualitative Research (COREQ) (30).

Table 2
VR-focused interview questions

Questions
Have you used virtual reality headsets before?
How comfortable do you feel wearing a VR headset for extended periods during activities or exercises?
Do you prefer performing the exercise with a VR headset or in front of a screen with an interactive game?
If you were to participate in this study, would you prefer gentle VR-based physical activities, such as picking up objects or putting on socks, or more challenging activities, such as tennis, boxing, golf, squatting, or exercising?
Are you willing to participate in a study that involves three or four visits to the University of Bath for data collection?
Is there a specific day during your flare that is most convenient for you to attend a study?
Do you think you could play a VR exercise game daily during your flare if you had the headset at home?

Data analysis and trustworthiness

Due to the exploratory nature of the study, interview transcripts were analysed using thematic analysis to allow identification and interpretation of patterns within qualitative data (31). The analysis was mainly semantic, focusing on participants' direct descriptions of their experiences and views.

The analysis was conducted by the lead researcher, who read and re-read the transcripts, highlighted relevant extracts, generated initial codes, and collated related codes into candidate themes to identify broader patterns in participants' accounts of axSpA flares and their views on VR-based management. Themes were derived from the interview data rather than being decided in advance, although the analysis was guided by the study aim, research question, and VR-focused interview topics. Candidate themes were defined in relation to the purpose of the study and then reviewed with the manuscript team. Microsoft Word was used to organise transcripts, coding notes, and highlighted extracts. Key extracts were highlighted to support the overall interpretation and to ensure the findings remained closely linked to the study aim, research question, and objectives.

Participant anonymity was ensured by using unique identifiers when saving the transcripts and questionnaire data (32). Ethical guidelines and institutional regulations for research involving human participants were followed to ensure participants were protected throughout the study.

To support the processes and principles of trustworthiness, a summary of the main findings was sent to participants, respecting their contribution and promoting transparency (33). To identify consistency

between the data and findings, quotes from the interviews are provided in the results section to support identified themes and illustrate how the findings were grounded in participants' responses (31).

Results

TSK scores and movement concerns during flares

Participants completed the TSK with reference to their movement concerns during flare episodes. All participants reported high levels of kinesiophobia, with TSK scores ranging from 39 to 50.

Participants described being more cautious during flares and often thought carefully before moving. They described concerns about making the flare worse, increasing pain, or losing the ability to manage daily activities. One participant explained:

"I'm certainly more cautious because, you really don't want to do anything to make it feel any worse" (P5).

This fear and caution provided an important context for how participants viewed VR. Participants were not only considering whether VR was interesting or enjoyable, but whether it could be used safely when pain, stiffness, fatigue, and fear of movement were high. Four VR-focused themes were generated from this analysis: acceptance of VR as a potential management tool during flare, symptom-related concerns about using VR during flares, safety and home-based use, and gamified activity preferences. A summary of these themes and their implications for future VR studies is presented in Table 3.

Table 3
Summary of VR-focused themes

Theme	Main meaning	Consideration for future VR studies
Acceptance of VR as a potential management tool during flare	Participants were open to trying VR and saw it as a possible non-pharmacological support for pain distraction and staying active during flares.	Use VR as a supportive adjunct to flare self-management, not as a replacement for usual care.
Symptom-related concerns about using VR during flares	Pain, stiffness, fatigue, headset weight, neck discomfort, and session duration could affect ability to use VR.	Future VR management sessions should be short, adaptable, and include seated or low-intensity options.
Safety and home-based use	Participants liked home-based VR but raised concerns about unfamiliarity, balance, disorientation, and injury risk.	Include introductory training, safety guidance, clear space requirements, and monitoring.
Gamified activity preferences	Participants preferred purposeful, sport-like activities and immersive games rather than simulated daily tasks.	Offer enjoyable activity choices such as tennis or golf, with adjustable levels.

Theme 1: Acceptance of VR as a potential management tool during flare

Most participants expressed willingness to try VR during or after flares. Their openness was linked to the possibility that VR could provide a different form of exercise, distraction, and symptom-management support. Participants did not describe VR only as a technology; they described it as a potentially engaging way to move when normal activity is difficult.

One participant described the motivational role of a game-like activity:

"The idea of playing something fun and stimulating, like a game, would make me want to keep coming back to it" (P7).

Participants also valued the idea that VR could redirect attention away from pain. Distraction is important because several participants described flares as periods where pain and fatigue became dominant and difficult to ignore. The immersive element of VR was therefore seen as potentially useful because it may make movement feel less like a medical task and more like an activity.

One participant linked this value to the wider emotional burden of persistent pain:

"If you live in pain, you will always have mental health issues because it affects your thoughts every day, so I would definitely appreciate some fun distraction" (P13).

Another participant described VR gaming as an appealing form of distraction during a flare:

"I'm excited about this. I really like the idea of it. Playing a game every day during a flare should be fun and would drive my mind away from the pain" (P15).

Previous gaming experiences also shaped some participants' openness to immersive or screen-based formats:

"I do play some Xbox and Switch games, so I'm used to being on a TV screen, so probably either would work for me to immerse myself in a different setting" (P4).

Theme 2: Symptom-related concerns about using VR during flares

Although participants were generally open to VR, they also described practical limitations related to flare symptoms. Headset weight, neck pain, back pain, fatigue, and the ability to stand for long periods were the most common concerns. These concerns were especially relevant because axSpA commonly affects the spine and some participants experience neck symptoms during flares.

The length of session was a concern raised by some participants, P10 explained that short sessions may be acceptable, but longer sessions could be difficult:

“I think 30 minutes is fine, but an hour might be pushing it. For some people with neck issues, this might be a concern” (P10).

Participants suggested that VR exercise should be adaptable rather than fixed. Some wanted the option to use VR while sitting, especially during more severe flare days.

“I think I could probably put it on and if I was sitting down probably” (P01)

Theme 3: Safety and home-based use

Home use was generally acceptable and was seen as convenient because flares are unpredictable and attending a therapy session or travelling to an exercise facility during a flare may be difficult. Participants suggested that having the headset at home could make it easier to build VR into a daily flare routine. One participant stated:

“Having the VR headset at home would allow me to stick to a daily routine, especially during a flare” (P11).

Some participants also described home-based VR as a way to support routine and adherence, particularly when travelling to exercise facilities was difficult:

“Because I think that one of the main things is being motivated enough to do the exercises. I think it’s hard to fit it into a routine, but then if you’re putting on this headset, it becomes a ritual that you perform every day, and it becomes part of your everyday routine” (P14).

Another participant highlighted the practical value of being able to exercise from home:

“Sometimes it’s difficult to have time to go to the gym, to go out. With our modern life, it’s hard to find time for everything. So, if you can do it from home, I can see the potential” (P5).

However, home use also created safety concerns. Participants worried about not seeing objects in the real environment, losing balance, feeling disorientated, or bumping into something. These concerns were stronger among those who had limited experience of VR. One participant said:

“I would like to give it a go, but during a flare, particularly with fatigue, I might not feel stable wearing a headset and doing activities for long time. I’d worry about bumping into something or losing balance” (P8).

Participants felt that confidence could be improved through an introductory session, preferably at the university, before using the headset at home. Training was seen as important for understanding how to wear the headset, how to interact with the game, and how to set up a safe space.

“For those new to VR, a quick training session at the university could be helpful to get comfortable before taking it home” (P5).

Theme 4: Gamified activity preferences

Participants preferred VR activities that felt purposeful, playful, or sport-like. They were less interested in simulated daily activities such as picking up objects or putting on socks. Sport-like games were viewed as more enjoyable and more distracting from pain.

One participant explained:

"I think it's better to have something interactive, like tennis or golf, as it's more distracting from the pain compared to daily tasks" (P8).

A preference for sport-like activity was also expressed more directly by another participant:

"I think I'd prefer some sort of sport activity. More engaging" (P13).

For some participants, enjoyment and stimulation were central to whether they would continue using VR:

"I think the key there would be that it is fun and stimulating, because I would want to keep coming back to it" (P9).

The preference for purposeful activities suggests that VR rehabilitation may be more acceptable if it is designed around enjoyment and choice, rather than presenting exercise only as a clinical task. Some participants described themselves as active outside flares but unable to maintain their usual activity during flares.

Discussion

This study explored the perceptions of people living with axSpA regarding the feasibility and acceptability of VR exercise during flares. Four VR-focused themes were identified from participants' discussions of virtual reality: acceptance of VR as a potential management tool during flare; symptom-related concerns about using VR during flares; safety and home-based use; and gamified activity preferences. Participants were generally willing to try VR and viewed it as a possible non-pharmacological support for pain distraction and physical activity during flares. However, this acceptability was shaped by several practical considerations, including physical limitations during flares, session duration, headset weight, safety concerns in the home environment, and unfamiliarity with VR technology.

Acceptability is important for understanding patients' attitude towards an intervention, including their positive views, expected burden, perceived effectiveness, and opportunity costs. When acceptability is assessed before experiencing the intervention, patients and healthcare providers can only judge the intervention based on the information given to them (25). In this study, acceptability of VR was balanced against concerns related to symptoms and safety, highlighting the need to modify and tailor VR applications based on patients' concerns. However, participants' views may also have been influenced by the short VR presentation shown during the interview. As many participants had no previous experience with VR, their perceptions were based on information about the technology, including its

definition, different types, and examples of applications, rather than direct experience. Future studies should evaluate participants' perceptions after hands-on experience with VR to determine whether these views change following direct interaction with the technology.

In this sample, all participants scored above the threshold for high kinesiophobia, and the interview data showed that participants often became more cautious and protective during flares. However, the combination of high TSK scores and participants' descriptions of increased caution and movement avoidance during flares may reflect the current sample and should not be interpreted as evidence that all people with axSpA experience high kinesiophobia. These findings align with the fear-avoidance model (FAM), whereby pain can lead to negative thoughts and catastrophising, resulting in fear that may contribute to avoidance of movement and reduced physical activity, potentially reinforcing functional limitations and creating a cycle in which pain leads to further avoidance of movement (34). This supports previous work showing that fear of movement and pain-related beliefs can affect physical function and activity in people with axSpA (16, 17). This study adds to this evidence by showing that, despite high levels of kinesiophobia across the sample, participants expressed readiness to try VR as a potential approach for pain management and supporting movement. VR may help interrupt the fear-avoidance cycle through its distraction effect, redirecting attention away from pain while encouraging movement and reducing avoidance of activity (35). Therefore, the potential role of VR may not only be to increase exercise volume, but also to support movement initiation during flares when fear and symptoms increase.

Participants' interest and positive perspectives towards immersive distraction are consistent with previous VR pain literature, where VR has been used to reduce pain attention and support rehabilitation through engaging virtual environments (19, 21, 22, 24). VR can be useful during flares by combining distraction, feedback, and graded movement, allowing healthcare providers to address axSpA-specific considerations by tailoring VR activity to accommodate physical and cognitive limitations (21). A systematic review conducted by Goudman et al. in (36) showed significant acute and chronic pain relief and functional improvement when using VR applications, suggesting a promising role for this intervention in pain management. Considering patients' opinions in this study, integrating VR into axSpA rehabilitation may have potential for improving pain management and mobility using the distraction effect, especially when fear of movement and flare symptoms are high.

Patients showed interest in using VR at home during flares but expressed concerns about safety and unfamiliarity with the system. Home-based VR use has been tested in chronic musculoskeletal pain and was reported as feasible and valued by patients (37). However, in the axSpA population, one mixed-methods study showed that patients preferred using VR in a physiotherapy setting rather than at home. The study also reported low demand for the pilot VR program because of difficulty in use and lack of patient feedback (38). These findings, together with the concerns raised in the current study, suggest that home-based VR may require careful introduction before use. An introductory familiarisation session may help address safety and unfamiliarity concerns by training participants to use and control the VR system safely at home. Additionally, cybersickness symptoms, precautions and management should be

introduced and discussed with patients (39). Addressing these concerns may provide patients with a better opportunity to use VR as a supportive approach for pain distraction and movement during flares.

Passalent (18) et al. conducted a qualitative study to understand barriers to physical activity in people with axSpA. The study participants suggested that user-friendly technologies may be useful as a possible strategy to support physical activity engagement (18). The findings of the current study suggest that VR may be one possible accessible and engaging technology for this population, especially if it can help reduce barriers such as fear of pain, time limitations, and difficulty accessing exercise facilities during flare. VR may be particularly relevant for home-based use, if patients receive appropriate training and guidance on how to use the technology safely. Home-based VR was acceptable to many participants and may be useful because flares are unpredictable, enabling use when symptoms occur without travelling to a clinic during a flare.

The preference for sport-like and purposeful VR activities is also important. Participants did not want VR to feel like a list of daily tasks. They wanted activities such as tennis or golf, which they considered more enjoyable and more distracting. A preference for sport-like VR activities is consistent with VR exercise literature suggesting that enjoyment, motivation and engagement are important mechanisms through which VR may support exercise participation (24). Perception of our participants aligns with qualitative work in axSpA showing that enjoyment, motivation, and meaningful activity are important for physical activity engagement (15). As such, our findings suggest that VR applications for an axSpA population should consider offering software engaging games with difficulty levels ranging from very easy to hard. Additional features should enable playing from a sitting position to adapt different levels of symptoms severity and allowing pausing to facilitate breaks during the training session. Offering these solutions can help axSpA patients maintain an exercise routine that fits their comfort level, especially during flares. These points should be included in future feasibility studies before testing VR effectiveness.

Strengths and limitations

Prior to this study, there had not been any exploration of VR flare management perspectives from people living with axSpA and experiencing flares The semi-structured interviews allowed participants to discuss both interest and concerns, giving insight into how a future VR feasibility study should be designed. Additionally, including TSK provides a quantitative assessment of fear of movement, complementing qualitative findings and enhancing the strength of the analysis (40).

The study was limited by the sample size that may restrict the generalisability to the broader axSpA population (41). Additionally, the dependency on self-reported data may introduce recall bias (42). Recruiting participants through patient charities or support groups may have led to a selection bias, resulting in a sample that is more engaged, informed, or motivated than the broader patient population (41). This study explored acceptability of VR after participants were shown a short presentation about the technology, rather than acceptability following direct use of the intervention. Acceptability may differ

after participants have experienced the headset and VR activity during an actual flare, as acceptability can vary depending on whether it is assessed before or after exposure to an intervention (25).

Implications for future research

Future feasibility studies should test VR exercise during or shortly after flare episodes and assess recruitment, adherence, symptom response, safety, and acceptability after actual use. Patient feedback from this study suggests that VR programs should include: an introductory training session, clear safety instructions, home setup guidance, short sessions, seated options, symptom-based progression, and a choice of sport game activities. Future studies should also consider measuring pain, fatigue, kinesiophobia, motion sickness, usability, and acceptability after VR use. These outcomes would help determine whether VR is only interesting to participants or whether it can support movement and pain management during flares.

Conclusions

People living with axSpA expressed openness and curiosity towards VR exercise as a potential way to support physical activity and pain distraction during flares. Participants valued the potential for immersive distraction and enjoyable activity, particularly through engaging in sport VR games. However, they also identified important concerns related to headset comfort, fatigue, neck symptoms, balance, safety, and unfamiliarity with VR technology. Future VR rehabilitation studies for axSpA should be designed around these patient concerns and should include adaptable, safe, and clearly guided home-based options.

Abbreviations

AS
Ankylosing spondylitis
axSpA
Axial spondyloarthritis
BASDAI
Bath Ankylosing Spondylitis Disease Activity Index
BIRD
Bath Institute for Rheumatic Diseases
nr-axSpA
Non-radiographic axial spondyloarthritis
PA
Physical activity
r-axSpA
Radiographic axial spondyloarthritis
TSK
Tampa Scale for Kinesiophobia

VR
Virtual reality

Declarations

Ethics approval.

Ethical approval was obtained from the University of Bath Research Ethics Committee (reference number: 5013-7150). The study was conducted in accordance with the Declaration of Helsinki.

Consent to participate.

All participants provided informed consent prior to participating in the study.

Consent for publication

Informed consent was obtained from all participants before their participation in the study. The manuscript does not include identifiable individual person's data.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because interview transcripts may contain information that could compromise participant confidentiality, but anonymised data may be available from the corresponding author on reasonable request and subject to ethical approval and data sharing agreements.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

AK designed the study, recruited participants, collected the data, analysed and interpreted the interview data, and drafted the manuscript. LW, DC, RS, ES, CC and PR contributed to study design, interpretation of findings, and critical revision of the manuscript. All authors read and approved of the final manuscript.

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