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To cite this article: Jessica Law, Robin Owen, Caroline Wakefield & Karen May (06 May 2025): Barriers experienced by visually impaired rugby players when undertaking concussion assessment: a qualitative investigation, Research in Sports Medicine, DOI: [10.1080/15438627.2025.2494031](https://doi.org/10.1080/15438627.2025.2494031)

To link to this article: <https://doi.org/10.1080/15438627.2025.2494031>



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Published online: 06 May 2025.



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Barriers experienced by visually impaired rugby players when undertaking concussion assessment: a qualitative investigation

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ABSTRACT

Previous work has conjectured that visually impaired athletes may face barriers when attempting concussion assessments because they can present with signs of concussion as part of their condition. The present study aimed to explore the qualitative experiences of visually impaired players undertaking the Sport Concussion Assessment Tool 5 (SCAT5). Four visually impaired Physical Disability Rugby League players completed the SCAT5 neurological assessment (i.e. read aloud and visual tracking sections) prior to attending an online focus group discussion. Thematic analysis was performed, revealing numerous barriers and consequent additional needs experienced by the athletes. The present results support the removal of the read aloud section from the SCAT5 and suggest that the SCAT6 may thus be a more appropriate assessment tool for visually impaired athletes. Clinicians using the SCAT6 may want to make adjustments to meet the additional needs of visually impaired athletes when completing the visual tracking section.

ARTICLE HISTORY

Received 21 October 2024
Accepted 11 April 2025



KEYWORDS

Concussion; Disability Sport; SCAT5; SCAT6

Introduction

Over one billion people worldwide are living with a disability and approximately 1.6 million people partake in disability sport in the UK (Weiler et al., 2016). The positive outcome of the 2012 Paralympic Games resulted in increasing opportunities for disability sport participation ranging from grass roots to elite levels with various sports developing disability teams and leagues (Derman et al., 2013). In 2018, the Rugby Football League (RFL) established the Physical Disability Rugby League (PDRL). It is a contact sport which had its first competitive season in 2019.

Sport-related concussion is defined as a “traumatic brain injury induced by impulsive biomechanical forces from a blow to the head, neck, or body with the impulsive force transmitted to the head resulting in rapid onset of short-lived impairment of neurological function that resolves spontaneously” (McCrory et al.,

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2017). On average, 13–17% of professional Rugby League players have sustained sport-related concussion at least once over three playing seasons (Longworth et al., 2021). However, visually impaired athletes, such as those in the PDRL, have an even greater risk of head collisions and concussion due to reduced ability to brace or block a blow to the head because of playing in a more upright position (Kissick & Webborn, 2018). A study conducted at the London 2012 Paralympic Games reported that 5-a-side football (played by visually impaired athletes), sustained the highest injury rate of the games (Willick et al., 2013). Consequently, research plays a key role in developing understanding, assessing, and managing suspected sport-related concussion in disability sport (Webborn et al., 2018; West et al., 2017; Willick et al., 2013). This has been highlighted and internationally supported in the first position statement of the Concussion in Para Sport (CIPS) (Weiler et al., 2021). On the contrary, it is widely documented that these protocols are lacking (Kissick & Webborn, 2018; Webborn et al., 2018).

One of the most common measures utilized to identify a sport-related concussion is the Sport Concussion Assessment Tool (SCAT) (Echemendia et al., 2017, 2023). Earlier iterations of this test, such as the SCAT3 did not contain a neurological assessment (Ventura, Balcer, et al., 2015; Ventura, Jancuska, et al., 2015). However, as examination of the visual system plays a key role in the diagnosis of sport-related concussion (Ventura, Balcer, et al., 2015; Ventura, Jancuska, et al., 2015), neurological testing was added to the SCAT5. Key elements of this included a read aloud assessment (i.e., reading a piece of text aloud) and visual tracking assessment (i.e., tracking an object with the eyes). This is useful given that sport-related concussion involves impairments in the vestibulo-ocular system commonly presenting as symptoms of visual instability. These oculomotor impairments may manifest as blurred vision, diplopia, impaired eye movements, difficulty in reading, dizziness, headaches, ocular pain, or poor visual-based concentration (Ventura, Balcer, et al., 2015; Ventura, Jancuska, et al., 2015). However, visually impaired athletes may present with concussion-like symptoms as part of their condition, which could result in misdiagnosis (Kissick & Webborn, 2018; Willick et al., 2013).

Despite the welcome addition of neurological testing to the SCAT5, it had been postulated that the “read aloud” assessment and “visual tracking” assessment could pose issues for visually impaired athletes (Kissick & Webborn, 2018). Indeed, many medical professionals working with the assessment and management of sport-related concussion in disability sport, have reported that concussion assessment was “difficult” and they relied on knowing their players rather than following any suggested protocols (West et al., 2017). Consequently, the most recent version of the SCAT (SCAT6) (Echemendia et al., 2023) contains revised neurological symptom evaluation which does not require the athlete to complete a read aloud assessment but does still require the completion of the visual tracking assessment.

The present study utilizes a qualitative approach to identify the specific barriers and additional needs experienced by visually impaired athletes when undertaking the read aloud and visual tracking assessment elements of the neurological section of the SCAT5. This would enable evaluation of the SCAT6’s removal of the read aloud but

continued use of visual tracking elements for the assessment of visually impaired athletes.

Method

Participants

Four visually impaired male players ($M_{Age} = 36 \pm 11.29$ years) currently competing in the domestic Physical Disability Rugby League (PDRL) in the United Kingdom participated after being identified via purposive sampling. All participants were: over 18 years old; volunteered to take part; gave informed consent in accordance with institutional ethical guidelines (ethics number: *SoME210121KM-JL*); currently competed in PDRL with classification of totally blind or partially blind, including any medically diagnosed conditions that cannot be corrected by conventional means (Arditi & Rosenthal, 1998).

Five visually impaired pathologies were present in the sample, as some participants presented with more than one impairment. These were: monocular blindness ($n = 2$); partially sighted ($n = 2$); colour blindness ($n = 1$); photophobia ($n = 1$); nystagmus ($n = 1$). All participants reported having previously completed the SCAT5 read aloud assessment, but only two reported having previously completed the visual tracking assessment. The four participants comprised approximately 40% of visually impaired players competing in the UK PDRL league at the time of data collection.

SCAT5 measure

The SCAT5 was printed in colour, in its original format on standard white A4 paper. The read aloud section comprised 57 words in total (47 in blue and 10 in red) in MS Word size 6 and Roboto font (unemboldened). The examiner directed the participant to the location on the page and asked them to attempt to read the paragraph aloud, to the best of their ability. For the visual tracking assessment, a standard BIC Crystal Original Medium (1.00 mm) Ballpoint Pen was used. The examiner held the pen at the midline of the participant's face (with the black lid at the top) then asked the participant to fixate on the object. The examiner then moved the object, left, right, up, and down. The participant was asked if they experienced diplopia (double vision) at any point during the assessment.

Study methodology and procedure

The study utilized an interpretivist perspective, comprising a social constructivist epistemology and relativist ontology (Smith & Sparkes, 2016). Consequently, the qualitative approach encouraged by these standpoints provides detailed insights into the experience of visually impaired PDRL players.

The study comprised an individual appointment to a 45-minute online focus group conducted on Microsoft Teams (Microsoft, USA), due to COVID-19. Online focus groups require three to five participants to capture sufficiently rich and detailed information about participant experiences (Lobe, 2017; Lobe et al., 2020). Furthermore, online focus group interviews with greater than three to five participants are difficult to conduct on

mobile devices with small screens, as it is difficult to see the other participants (Lobe, 2017; Lobe et al., 2020). This was key in designing the focus group size, for all participants to be on the screen and promote discussion.

Individual appointments and the focus group discussion were conducted by a female researcher (article's 1st author) who was a qualified Sport Rehabilitator and the Sport Rehabilitator for one of the teams in the PDRL at the time of the study. This served to facilitate the development of a rapport with participants, as well as ensuring a strong understanding of the concussion protocols in this sample group.

The study was advertised to participants via their clubs. Participants were requested to contact the researcher directly if they wished to participate. After being briefed on the study, providing informed consent, and being given an opportunity to ask questions, the written component of the SCAT5 neurological assessment (Echemendia et al., 2017) was posted to each participant's address. Following receipt of the SCAT5, each participant had an individual online meeting to perform the two aspects of the SCAT5 neurological assessment. To ensure consistency, the researcher read out the standardized SCAT5 instruction text to each participant and confirmed understanding prior to the assessment. Subsequently, they participated in an online focus group where a semi-structured interview schedule was used to facilitate in-depth information gathering via opportunities for discussion among participants, as well as providing both individual and collective experiences (Smith & Sparkes, 2016). Care was taken by the interviewer not to lead participants' responses during discussions by using open ended questions.

Data analysis

The focus group's video recording was transcribed verbatim (this transcript was not checked with participants). An exploratory thematic analysis was performed to identify the barriers experienced by visually impaired players in the PDRL when undertaking the read aloud and visual tracking components of the SCAT5 neurological assessment. The thematic analysis was conducted by the lead researcher (who also conducted the interviews) using the 6-step model of Braun and Clarke (2006).

Firstly, two researchers familiarized themselves with the data by reading and re-reading the focus group transcript. Secondly, initial analytic statements within the data were noted. Thirdly, these statements were used for initial coding and theme refinement. Fourthly and fifthly, codes were refined further and sorted into broader themes. Lastly, the result was a set of higher-order themes and subthemes for each of the two sections of the SCAT5 (read aloud and visual tracking assessments). Following critical discussion and questioning among the research team, a final set of overarching themes and subthemes were decided upon in relation to the two sections of the SCAT5.

Results

Three main themes were identified for the read aloud assessment: inability to complete the task due to text-related barriers, inability to complete the task due to page formatting-related barriers, and needs of the visually impaired athletes to overcome barriers. These themes contained a total of six subthemes (Table 1). Two main themes were identified

Table 1. Themes and subthemes for the read aloud assessment.

Themes	Subthemes
Inability to complete the task due to text-related barriers	Difficulty with small text size Difficulty with text colour
Inability to complete the task due to page formatting-related barriers	Difficulty with page layout Difficulty with white page colour
Needs of visually impaired athletes to overcome barriers	Desire to have larger text available Desire to have different coloured paper or overlay equipment available

Table 2. Themes and subthemes for the visual tracking assessment.

Themes	Subthemes
Inability to complete task due to equipment-related barriers	Difficulty with the colour of the equipment Difficulty with the size of the equipment
Needs of visually impaired athletes to overcome barriers	Desire to have equipment which contrasts to the environment Desire for the clinician to understand their condition-specific characteristics

after the visual tracking assessment: inability to complete the task due to equipment-related barriers and needs of visually impaired athletes to overcome barriers. These themes contained a total of four subthemes (Table 2).

Read aloud section

Theme 1: inability to complete the task due to text-related barriers

Subtheme 1: difficulty with small text size. This subtheme encapsulates the difficulty all participants experienced with the size of the standardized text on the SCAT5 printout (Roboto, unemboldened, size 6 in blue and red). Participants did not feel that the test was appropriate for them.

“For me the text was way too small, without any kind of equipment, there’s just no chance I could read it.” (Participant 3)

Subtheme 2: difficulty with text colour. This subtheme highlights the issues coloured text and its contrast with other colours can pose for the visually impaired. Again, participants felt that the assessment format introduced difficulties that were not appropriate for their condition.

“There is some blue text but other information highlighted in a different colour [red], that is a little bit of a problem being colour blind.” (Participant 5)

“My condition [nystagmus] means my eyes will jump from one colour to the other colour making it difficult to read.” (Participant 4)

Theme 2: inability to complete the task due to page formatting-related barriers

Subtheme 1: difficulty with page layout.

This mainly affected one participant with partial sight, who explained they could only focus on one section of the page, making awareness of different columns difficult.

“If it was a single, if it wasn’t on multiple columns that would make it easier.” (Participant 3)

Subtheme 2: difficulty with white page colour. The main issue discussed by participants was the colour of the paper, where the participants highlighted standard white A4 paper is not ideal for visually impaired individuals.

"Yellow paper tends to be the universal best option." (Participant 1)

Theme 3: needs of the visually impaired athletes to overcome barriers

Subtheme 1: desire to have larger text available. To facilitate correct completion of the assessment, it was suggested, by Participant 1, that standardized visual impairment guidelines should be adhered to.

"If we look into what the visual impairment standardization stuff is - the standard font is 18, it's also bold, black text." (Participant 1)

Subtheme 2: desire to have different coloured paper or overlay equipment available. To improve the inclusivity of the assessment it was suggested that it should be tailored individually to each person's needs.

"I think if you know your players individually and you know that I might need an overlay for certain things or whatever, then it will be very useful." (Participant 5)

Visual tracking assessment

Theme 1: inability to complete the task due to equipment-related barriers

Subtheme 1: difficulty with the colour of the equipment. This subtheme denotes the experience of the participants when undertaking the visual tracking assessment of the SCAT5 with a Bic crystal standard ballpoint pen. The main issue discussed was the colour of the pen and how difficult it was to see if it did not contrast enough with the surrounding environment.

"With the pen being clear, it was a bit difficult. .. you had a dark top on, but using a light environment. Yeah, problem was the light pen would contrast with you but not with the background." (Participant 3)

Subtheme 2: difficulty with the size of the equipment. Participants found it difficult to focus during the assessment due to the size of the equipment.

"It is quite small [which made it difficult to see]." (Participant 3)

Theme 2: needs of visually impaired athletes to overcome barriers

Subtheme 1: desire to have equipment which contrasts to the environment. To facilitate correct completion of the assessment, an object which is a block colour and contrasts with the environment, or is a light, has been suggested as potentially beneficial to their needs.

"Something that's a solid colour that will be like a completely different colour to the background." (Participant 5)

"The easiest thing for me to follow is a light." (Participant 3)

Subtheme 2: desire for the clinician to understand their condition-specific characteristics. This theme applied to those with monocular blindness. The main issue discussed was the starting position of the object to conduct the test. To improve the accuracy of the test, the clinician would need to know the individual and understand what is central vision for them to conduct the test effectively.

“Depending on what the individual’s condition is, you would work out what is central for them. You would know the individual.” (Participant 3)

Discussion

The present study explored the experiences of visually impaired athletes when undertaking the read aloud and visual tracking sections of the SCAT5 neurological assessment. The focus group identified barriers similar to those highlighted by organizations representing visually impaired people, such as the European Blind Union (2003) and the Royal National Institute for the Blind (2006).

With regards to the SCAT5 read aloud section, all participants regarded the small text size (Roboto font, size 6) as a barrier. Additionally, participants with colour blindness reported being unable to differentiate between red and blue text. This is further supported by the European Blind Union (2003), the Royal National Institute for the Blind (2006), and Fuchs et al. (2008) who recommend using font sizes between 12 and 22 for visually impaired reading material. It is paramount to understand the importance of tailoring the materials to the population group; it has been identified that bold text, large text size, and sans serif font are key factors in accommodating an individual with a visual impairment (Buultjens et al., 1999). With Roboto being a sans serif typeface, individualized SCAT5 printouts for visually impaired athletes would benefit from boldened size 14-font in color blind friendly colours, such as blue and orange instead of blue and red, when completing the SCAT5.

The second subtheme within the read aloud section was difficulty introduced by the page layout. While columns can allow for large quantities of text on one page, they can pose issues for visually impaired players. This is congruent with previous findings which highlighted that visually impaired individuals found it difficult to distinguish between different columns, resulting in sentences appearing unintelligible. Specifically, the Association of Directors of Social Services (2002) explain that visually impaired persons “often have narrow fields of focus” and recommended a simple and clear layout of any page, as complex structure would exacerbate this issue. Printing the read aloud section on a separate piece of paper, without a column format, could aid in overcoming this issue.

Paper colour was the third subtheme discussed for the read aloud section. In line with work by Jaccarino (2009), participants voice preference for coloured paper. Jaccarino (2009) determined that text should be on yellow or off-white paper to help with the reduction of glare produced by white paper. Where this is not possible, the use of a coloured overlay was also suggested by participants to mitigate the effect of the white paper. This is in line with previous research which demonstrated that coloured filters reduce visual stress by alleviating visual distortions and discomfort, resulting in improved text processing (Allen et al., 2008). Further investigation would be required into the colour of overlay as this may be dependent on different conditions. A printout on

yellow paper or providing an individual with their preferred overlay may be an appropriate solution to improve text processing and overcome these barriers.

All participants expressed difficulty with the size and colour of the equipment used for the visual tracking assessment. This amounted to participants struggling to focus on the pen, mainly due to its smaller size and colour not contrasting from the environment. It was suggested that a pen torch could be used instead. Such use of a pen torch has precedent (Yaphe & Pandher, 2003) and may be a suitable alternative to use during the SCAT6.

Participants voiced a desire for the clinician to understand their condition-specific characteristics. The visual tracking assessment protocol requires the clinician to hold the equipment in the central axis of the participant's face. However, this would only be appropriate for those with bilateral visual fields as monocular vision loss results in reduced visual field size, absence of binocular vergence and stereopsis (Gao et al., 2023). Clinicians need to determine the centre of the individual's monocular visual field prior to baseline testing, thus allowing a comparison following a suspected sport-related concussion.

Overall, the present study identified several barriers experienced by visually impaired athletes whilst undergoing sport-related concussion assessment using the SCAT5 assessment tool. The difficulty in barriers faced by each player in both sections were dependent on their individual visual impairment, suggesting a benefit for clinicians to adopt an individualized approach when assessing for concussion using a SCAT5 and the subsequent SCAT6 assessment tool. Despite this, all players found elements of the read aloud section of the SCAT5 unhelpful when being assessed for concussion.

The present study suggests that the removal of the read aloud section in the SCAT6 version is facilitative to accurate assessment of visually impaired athletes. However, it likewise highlighted barriers associated with the visual tracking assessment, which is still present within the SCAT6. Visually impaired players may benefit from clinicians' use of larger and light-based pointers during concussion assessment using the SCAT6.

Limitations

The applied emphasis of the current study may have resulted in a specialized but biased sample. Purposive sampling, voluntary participation, and a comparatively small sample size precluded exploration of barriers experienced by the wider visually impaired population. Therefore, the present study may lack breadth but allowed for in-depth discussion and understanding of perspectives within a sample of visually impaired athletes who are most likely to require concussion assessment. Future studies are encouraged to evaluate concussion assessments in a broader range of participants, such as non-athletes with visual impairments.

Additionally, only the read aloud and visual tracking tasks of the SCAT5's neurological section were performed by participants. All sections and tasks could be performed in future studies to have an even deeper understanding of visually impaired players' experience of concussion assessment. However, the read aloud and visual tracking tasks were deemed to be the most relevant, given that vision was essential to complete these tasks. Another limitation involved the read aloud and visual tracking tasks being performed online via video call (due to COVID-19), which resulted in participants'

surrounding home environment being different and potentially confounding (Perlmutter et al., 2013). However, the sample's previous experience with SCAT5 should mitigate this limitation. Additionally, with regards to online versus in-person focus groups, a wealth of recent research has demonstrated that high-quality qualitative data can be collected online (see Carter et al., 2021; Marques et al., 2021; Neville et al., 2016). Finally, the present study's focus group schedule primarily prioritized practical barriers involving the SCAT5. Thus, future studies should further explore players' lived experiences of concussion assessment (e.g., during matches). This information could then assist the development of comprehensive guidelines for sport-related concussion assessment in visually impaired athletes.

Conclusion

The present study explored visually impaired PDRL athletes' experiences when completing the SCAT5 concussion assessment. Individual differences in visual impairment contributed to the specific barriers reported within the read aloud section, which suggested that clinicians should adopt an individualized approach when using the SCAT5. Whilst the SCAT6 mitigates many of the barriers reported in the SCAT5 (i.e., via the removal of the read aloud section), potential barriers remain for visually impaired athletes in the visual tracking section. Specifically, the present results suggested that visually impaired athletes may benefit from clinicians' use of larger and/or light-based pointers during concussion assessment using the SCAT6. Overall, when compared with the SCAT5, the SCAT6 is currently a more appropriate assessment tool for sport-related concussions in visually impaired athletes.

Acknowledgements

We would like to give special thanks to the participants of the study, the PDRL and the Rugby Football League (RFL) as without their support, engagement and contribution the study would not have been possible.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

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