Position Paper

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Observation-Based Posture Assessment Practices

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Posture is a significant risk factor for musculoskeletal disorders in the workplace and has been included in many observation-based assessment methods[5], including Rapid Upper Limb Assessment (RULA)[4] and 3DMatch (a posture matching tool for estimating three dimensional cumulative loading on the low back).[2] However, it is often difficult to compare outputs from these methods because postures are not represented consistently within each method, in terms of the   to quantify working postures or how they are recorded. Given the importance of posture as a risk factor for injury in the workplace, posture categories used in many observation-based assessment methods should be standardized with respect to objective criteria (e.g., how many errors are made using the method, how long the method takes to use). Therefore, the purposes of this position paper are to recommend standardized posture categories, based on research evidence, that minimize observer error and help practitioners optimize observation-based posture recording and analysis practices.

Key Messages

- Observation-based posture assessment methods are widely used for quantifying risk factors during work, helping to inform job design decisions, and establishing safe work limits
- Many of these methods are not standardized in terms of the categories used to quantify working postures, or how postures are recorded
- Determining the optimal trade-off between the size of the observer error and the likelihood of making an error is an objective way of quantifying the optimal posture category size minimizing observer error and helping practitioners optimize observation-based posture recording and analysis practices

Recommendations for Standardized Posture Categories

Decisions about the size of posture categories in observation-based methods have been justified based on subjective criteria, including that non-neutral postures place workers at risk[3], and on muscle force and fatigue criteria[4]. Posture categories of 45° in size have been commonly used, as this angle is believed to be easily distinguishable by observers. Others have divided the range of motion into large, relatively equal sized categories. However, this does not address differences in ranges of motion at different joints (e.g., shoulder vs. wrist), or consider the number and size of errors observers make when selecting postures[6].

An objective way of determining the optimal posture category size for an observation-based posture assessment tool is to determine where the tradeoff is between the number of errors an observer makes and the size of the errors when errors are made. This approach has been used recently for the trunk, shoulder and elbow[6]. Selecting a posture category size larger than the optimal was shown to result in fewer posture errors, but these errors were larger in size. Conversely, selecting a posture category size smaller than the optimal resulted in reduced error size when an error was made, but increased the number of errors. Based on these findings, and those related to decision time for posture category selection[1], it is recommended that the following optimal posture category sizes (and numbers of categories) (Table 1) be used for the trunk, shoulder and elbow in observation-based posture assessment methods.

Segment/View	TRFL	TRLB	SHFL	SHAB	ELFL
Category size	30°	15°	30°	30°	30°
No. of categories	4	3	5	5	4

TRFL=trunk flexion/extension; TRLB=trunk lateral bend; SHFL=shoulder flexion/extension;
SHAB=shoulder adduction/abduction; ELFL=elbow flexion/extension; TRAR=trunk axial rotation.

Table 1. Optimal posture category sizes and number of categories: trunk (TR), shoulder (SH), and elbow (EL) postures (adapted from[6]).

Recommendations for Optimizing Posture Recording and Analysis Practices

The quality and accuracy of posture observations depends on recording and analysis practices. Observer training should be a primary consideration prior to recording and analyzing work postures using any method. The following recommendations provide a basic, practical guide for recording and analyzing work postures using observation-based approaches.

View: Tasks performed similarly by both sides of the body or that occur mostly in one direction, may only require a single camera view to capture an accurate sample of working postures. Asymmetrical tasks will likely require more views. For symmetrical tasks, views that are perpendicular to the main direction of movement provide valuable information. Some analysis methods allow for multiple views from one or more cameras to be analyzed[2], which can help when assessing asymmetrical tasks or tasks where a body segment is obscured by an object or by the worker's own body.

Lighting and Contrast: The amount of light and visual contrast between the worker and their environment can affect real-time and deferred posture observations, but will likely impact video-based approaches most. If a worker moves between environments, lighting conditions and contrast may change considerably; portable lighting (on a tripod or camera mounted) can be used to improve viewing conditions.

Camera Movement, Stability and Framing: Observation-based posture assessment methods such as RULA[4] or 3DMatch[2] require observers to select posture categories that correspond to the actual body postures seen in real-time[4] or via previously recorded video[2,4]. These approaches also allow observers to move around in order to obtain an optimal view. However, posture analysis accuracy can be affected by unstable camera views. A tripod can be used to ensure a stable camera view, but if the worker moves out of camera view, the operator will likely need to move as well. Using a monopod or solid surfaces within the work space to rest the camera can help reduce the impact of camera shake and improve image quality. Framing the body segments of interest fully in the camera view is helpful. When one is unable to get as close to a worker as needed to fill the frame, using the zoom function on the camera from a safe distance away is recommended.

Observation Duration: For repetitive work, observing only a few cycles of the task is likely necessary. Similarly, if you are evaluating the peak or heaviest instant of a task, only a few frames may need to be analyzed. For variable or non-repetitive tasks or when you are evaluating a worker's postures over an extended time, you should observe a representative sample of what they do. More variable tasks require more observations to obtain a representative sample of the worker's postures.

Conclusion

While many observation-based posture assessment methods exist, the lack of standardization makes it difficult to compare them. Determining the optimal trade-off between the size of the observer error and the likelihood of making an error is an objective way of quantifying the optimal posture category size. Using the optimal category sizes and/or method reported here, in addition to sound recording practices, will help to improve the consistency of findings from observation-based posture assessment tools, and help practitioners make accurate assessments of MSD risk in the workplace.

Implications for the Prevention of MSD

By using observation-based tools and recording and analysis practices which are supported by research evidence, practitioners can accurately identify and quantify MSD risk factors, such as posture, when addressing worker health and safety issues. Strategies can then be devised and implemented that are specifically aimed at reducing and preventing MSD associated with poor working postures.

References

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