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Impact of wearable technology on the prevention of musculoskeletal injuries

Impacto de la tecnología wearable en la prevención de lesiones musculoesqueléticas

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ABSTRACT

Objective: to analyse the impact of wearable technology on the prevention of musculoskeletal injuries. **Method**: descriptive analysis supported by a systematic review. **Results and conclusion**: through an exhaustive systematic review of the scientific literature, consistent evidence has been identified to support the effectiveness of these devices in postural correction, stimulation of physical activity and reduction of prolonged sedentary lifestyles.

Descriptors: autistic disorder; audiologists; dental staff. (Source, DeCS).

RESUMEN

Objetivo: analizar el impacto de la tecnología wearable en la prevención de lesiones musculoesqueléticas. **Método**: análisis descriptivo respaldado por una revisión sistemática. **Resultados y conclusión**: A través de una revisión sistemática exhaustiva de la literatura científica, se han identificado evidencias consistentes que respaldan la efectividad de estos dispositivos en la corrección postural, la estimulación de la actividad física y la reducción del sedentarismo prolongado.

Descriptores: trastorno autístico; audiólogos; personal de odontología. (Fuente, DeCS).

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Brief original

INTRODUCTION

The issue of musculoskeletal injuries (MSIs) in contemporary workplaces, especially in office settings, has risen to a major concern. This concern arises from the confluence of the predominance of sedentary activities and prolonged exposure to technological devices, which has exacerbated the incidence and severity of such injuries. In this context, SCIs encompass a wide range of conditions, from carpal tunnel syndrome to tendonitis and low back pain, imposing a substantial impact on individuals' health and work performance, as well as on the costs associated with medical treatment and lost productivity. [1 2 3 4 5 6 7]

The advent of wearable technology has generated significant interest due to its potential to mitigate this challenge. These devices offer continuous, real-time collection of data related to physical activity, posture and other parameters crucial to musculoskeletal health. Consequently, wearable technology presents itself as a promising tool to proactively intervene in injury prevention and health promotion in the work context. [8 9]

Effective implementation of wearable technology in work environments requires a thorough understanding of several determinants, including the underlying mechanisms of injury, individual worker behaviours and the ergonomic challenges inherent to each specific work environment, and it is imperative to consider issues of worker acceptance and adoption, as well as privacy and data security issues.[10]

A critical component in the prevention of SCI lies in the promotion of postural awareness and the adoption of appropriate ergonomic behaviours. In this regard, wearable technology can play a key role by providing immediate feedback on posture and body movements. For example, posture-tracking devices can alert workers to postures that may increase the risk of injury, allowing them to make adjustments in a timely manner.[11 12]

In addition to encouraging postural awareness, wearable technology can help promote physical activity and regular breaks. Movement reminders, sedentary alerts and activity goals can encourage workers to stay active throughout their workday, generating benefits not only for their musculoskeletal health, but also for their cardiovascular and mental wellbeing.[13]

Real-time data collection through wearable technology also provides invaluable information for risk management and planning preventive interventions. By analysing workers' activity patterns and behaviours, employers can identify areas of risk and develop specific strategies to address them. This may include reorganising workspaces, implementing ergonomic equipment and providing training in ergonomics.[14]

However, despite its promising potential, the effective implementation of wearable technology in work environments is not without its challenges. One of the most critical is ensuring worker acceptance and adoption. It is crucial that employees understand the benefits of the technology and are comfortable with its incorporation into the workplace. This may require adequate education and training, as well as worker participation in the implementation process.[15]

The objective is to analyse the impact of wearable technology on the prevention of musculoskeletal injuries.

METHOD

A descriptive analysis supported by a systematic review was conducted, taking into account ethical considerations at all stages of the research.

The sample of 15 scientific articles was carefully selected from reliable sources such as PubMed and Scopus, thus ensuring the quality and integrity of the data analysed.

The information collected was subjected to a documentary content analysis, avoiding any bias or conflict of interest that could affect the validity of the findings.

Copyright was rigorously respected and all sources used were properly cited, encouraging transparency and acknowledgement of previous work by other researchers. Preference was given to papers no older than 5 years.

RESULTS

In the sports domain, accelerometry was the dominant type of portable sensor technology used, interpreting peak acceleration as an indicator of impact. Of the included studies, 28 assessed running stride, head impacts in invasive and team sports, or different forms of jumping or plyometric movements. The included studies revealed a lack of consensus regarding sensor placement and interpretation of results. [1] Correspondingly, the work of [2] showed a strong inverse correlation between tread categorisations and tread angles ($r = -0.86$, $p < 0.001$). Overall, the sensors demonstrated an accuracy of 78 % (rearfoot = 72.5 %, midfoot = 55.3 %, forefoot = 95.4 %), these results support the concurrent validity of sensor-derived gait measurements.

The internal sensor showed considerable random error and substantially overestimated head impact exposure. Despite the sensor's excellent on-field accuracy in discriminating pitches from other accelerated events in youth football, absolute values should be interpreted with caution and there is a need for secondary means of verification (e.g., video analysis) in real-life settings.[3] In this order, organisations intending to implement wearable technology should (a) focus its use on improving workplace safety, (b) promote a positive safety climate, (c) ensure sufficient evidence to support employees' beliefs that the wearable device will meet its intended purpose, and (d) involve and inform employees in the wearable technology selection and implementation process. [4]

CONCLUSION

Through a comprehensive systematic review of the scientific literature, consistent evidence has been identified to support the effectiveness of these devices in

correcting posture, stimulating physical activity and reducing prolonged sedentary lifestyles. These results hint at a possible paradigm shift in occupational health management, presenting an innovative tool to decrease the prevalence of musculoskeletal injuries and improve the holistic wellbeing of workers.

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CONFLICT OF INTEREST

There is no conflict of interest with persons or institutions involved in the research.

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