Designation: F3579 – 24

Standard Practice for Considering and Deploying Exoskeletons for Return to Work[1]

This standard is issued under the fixed designation F3579; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The purpose of this practice is to discuss the potential benefits and risks of exoskeletons when used by workers during the Return to Work (RTW) process following an injury or illness, and to provide guidance to anyone considering their use during the modified/transitional duty period. The primary objectives of any exoskeleton used in a RTW capacity are to facilitate the natural healing process, prevent an exacerbation of an existing injury or illness, prevent further injuries or illnesses from developing, reduce the number of modified/transitional duty days, reduce the number of visits to healthcare providers for medical treatments, and assist the worker with return to full duty without restrictions. The exoskeleton must not aggravate the original injury or illness, nor cause a secondary injury or illness. Successful RTW constitutes an injured worker's ability to tolerate all of the demands of his/her job without reinjury, perform essential job functions, or return to work as per the decisions and directions of the worker's physician and employer. In some cases, workers may continue to use the exoskeletons after full duty RTW for risk reduction, injury prevention, or to continue to perform essential job functions. Exoskeleton usage that continues beyond full duty RTW for these purposes is beyond the scope of this particular standard practice.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F3323 Terminology for Exoskeletons and Exosuits

F3392 Practice for Exoskeleton Wearing, Care, and Maintenance Instructions

F3444M Practice for Training Exoskeleton Users

F3527 Guide for Assessing Risks Related to Implementation of Exoskeletons in Task-Specific Environments

3. Terminology

3.1 Refer to Terminology F3323-20.

4. Significance and Use

4.1 The current state of research provides limited evidence to directly support the use of exoskeletons by injured workers for Return to Work (RTW). However, there is research to support using certain exoskeletons to reduce strain and fatigue, as well as improve productivity and work quality. Reductions in strain and fatigue can reduce the risk for injury. To date, the best conclusion is that there is a potential opportunity for exoskeletons to help injured workers RTW, but precise outcomes may be unpredictable at this time. Professional management by a multidisciplinary team (see 5.8) of the following process is recommended. This practice is intended to serve as an example of a potential process that can be used when an exoskeleton is indicated for appropriate workers seeking to RTW. The first step is to consider the criteria in Section 5. If the criteria are met, use the procedure in Section 6 for managing the use of exoskeletons by injured workers for RTW.

5. Criteria to Consider Prior to Exoskeleton Deployment for RTW

5.1 Review and consider all the available scientific evidence on the use of exoskeletons to support rehabilitation and return to work. Since the research on exoskeletons is not easily generalizable, consider the available evidence on the specific

[1] This practice is under the jurisdiction of ASTM Committee F48 on Exoskeletons and Exosuits and is the direct responsibility of Subcommittee F48.02 on Human Factors and Ergonomics.

Current edition approved Feb. 15, 2024. Published March 2024. DOI: 10.1520/F3579-24.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

exoskeleton being considered, and how it may or may not benefit the specific worker, injury or illness, and job.

5.2 A worker is motivated to return to work following an injury or illness.

5.3 It is possible to identify an exoskeleton that can support the worker and that is compatible with the job to which the worker is seeking to return.

5.4 The injury or illness affects an area of the body that can be augmented, supported, assisted, off-loaded, or otherwise benefited by the exoskeleton being considered.

5.5 The worker is interested in and willing to wear an exoskeleton voluntarily, the exoskeleton is required to be used by the employer, or it is prescribed by a physician.

5.6 There are employer, physician, health, safety and ergonomics groups, workers compensation organizations, or claims management support, or combinations thereof, for the use of exoskeletons in the RTW process. The support of these individuals and groups is critical and may require outreach, communication, coordination, and specific education on exoskeletons and their potential to assist injured or ill workers with return to work. Educational resources and guidance may be needed for all stakeholders, however they are beyond the scope of this practice.

5.7 There is a budget for purchasing and managing the use of the exoskeleton.

5.8 There is a multidisciplinary RTW team including, but not limited to, physicians, rehabilitation professionals, claims adjusters, case managers, operations managers, human resource managers, workers compensation managers, ergonomics professionals, and exoskeleton managers involved in the case who have been educated on the use of exoskeletons and who support their use in the RTW process (see 5.6). Decisions should be made according to Evidence Based Practice (EBP). EBP involves integrating the best available evidence with professionals' clinical knowledge and expertise, while considering patients' unique needs and personal preferences.

5.9 The multidisciplinary RTW team should determine the objective criteria (if any) that workers will be required to meet in order to qualify for using an exoskeleton for RTW.

5.10 There is a plan for training the involved parties including the worker, his or her manager, support staff, and RTW team on the safe and proper use of the exoskeleton (Practice F3444M-20). This should include expectations for RTW and any considerations that apply because of the exoskeleton's use, such as increasing or decreasing, or both, use of the exoskeleton over the course of the modified/transitional duty period. The decision to increase or decrease, or both, exoskeleton use may depend on the client, user, or claim, or combinations thereof.

5.11 The physician involved provides medical clearance for the worker to use the exoskeleton, determines eligibility and appropriate restrictions with or without the use of the exoskeleton, provides treatment, and tracks patient progress toward goals.

5.12 The rehabilitation professionals involved are aware of the worker using the exoskeleton, provide appropriate treatment consistent with best practices and standards of care, and track patient progress toward goals.

5.13 An ergonomic assessment should be performed for the worker's job to determine that there are no other ways to reduce or eliminate the risk of injury,[3] and an ergonomics professional confirms that the worker performs a job that is appropriate for the use of an exoskeleton. For example, the worker performs overhead work that can be supported by a shoulder-assist exoskeleton, or a bending and lifting job that can be supported by a back-assist exoskeleton.

5.14 The exoskeleton manager confirms that the worker performs a job that is appropriate for the use of an exoskeleton, oversees exoskeleton training, and manages the use and care of the exoskeleton (Practice F3392-20).

5.15 There is a graduated RTW plan for progressing the worker from modified/transitional duty to full duty.

5.16 See Fig. 1 for a summary of Section 5.

6. Procedure for Deploying Exoskeletons for Return to Work

6.1 This is the recommended procedure for deploying exoskeletons for RTW.

6.2 A worker has an injury or illness that impacts an area of the body that can benefit from an exoskeleton. The injured worker wants to RTW to his/her original job or a transitional duty job, or both. The job has risk factors that can be safely addressed and reduced by an exoskeleton.

6.3 A multidisciplinary RTW team should oversee injury or illness claims and the RTW process. They should be familiar with and receive training on exoskeletons, their intended uses, their potential benefits, and their potential pitfalls.

6.4 The involved parties shall identify a potential claim, case, or client, or combinations thereof, for potential use of an exoskeleton device to assist with RTW. This can be done during regularly scheduled claims meetings.

6.5 The involved parties should agree on the appropriateness of using an exoskeleton to support RTW for a specific worker, injury/illness, healing status, and job. Ideally, the injured worker should attend this meeting so that he/she is involved in the discussions and decision-making.

6.6 The involved parties should determine if the worker meets their objective criteria (if any) for using an exoskeleton for RTW.

6.7 If the worker meets objective criteria for exoskeleton use for RTW and an exoskeleton is determined to be appropriate, the exoskeleton manager involved should identify the specific exoskeleton/s, and reviews with the parties for approval. The parties should determine if the worker will be required to use the exoskeleton or if its use will be voluntary.

[3] See NIOSH's Hierarchy of Controls available at https://www.cdc.gov/niosh/topics/hierarchy/default.html.