

Regenerative Medicine and Ergonomics: Building Bridges

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Relationship between ergonomics and regenerative medicine is non-obvious but important correlations exist between these two areas. By definition, ergonomics is the study of relationship between people, their activities, their equipment and their environment. Thus, functioning (and malfunctioning) of our body is an essential aspect of ergonomics and this underlines the importance of regenerative medicine. Regenerative medicine will increasingly become an integral part of ergonomics as we move toward developing a workforce with a diverse capability: physical, sensorial and cognitive.

Faulty work practices and environments often lead to musculoskeletal disorders and diseases (MSD) which has escalated significantly over the last decade to present a critical socioeconomic problem [1]. Pathologically, MSDs represents a complex molecular and cellular microenvironment with an inflammatory condition leading to deterioration of tissue structure and function. Use of repetitive mechanical force, static loading and extreme positions induce changes in the tissues which are transduced to the cellular and molecular level. Understanding these features is critical for practicing effective treatment strategies and for recommending better work environment. Thus, regenerative medicine will play a major role both from a fundamental understanding of MSDs and for development of therapeutic strategies.

Since no single factor can be attributed to the MSDs, current treatment modalities for MSDs often involve a combination of drug therapy, physical exercises and surgical procedures. The usefulness of these strategies are constrained due to the lack of unified mechanism to combat the root causes of MSDs. Stem cell based regenerative medicine offers tremendous hope for treatment of MSDs due to the multifunctional characteristics of stem cells. Stem cells are characterized by ability to self-renew and to differentiate along multiple lineage pathways. To be clinically useful for regenerative and rehabilitative applications, cell therapy approaches with stem cells must meet certain criteria [1].

- (a) Cells should be harvested through minimally invasive procedure;
- (b) Expansion and production of stem cells in abundant quantity;
- (c) Safe and effective transplantation into either an autologous or allogeneic host.

Adult stem cells, popularly known as mesenchymal stem cells

(MSCs) have been used for treatment of several musculoskeletal tissues including cartilage, bone, and muscle. MSCs have gained significant attention for treatment of MSDs due to their ability to differentiate into multiple lineages, relatively simple isolation and expansion and lack of ethical concerns. In addition, MSCs can produce myriad of trophic factors to initiate the healing cascades for MSDs. Studies with MSCs have been performed with *in-vitro* and *in-vivo* models to demonstrate the efficacy of these cells in regenerating cartilage, bone and muscles tissues. Success of these studies has advanced the use of MSCs in clinical trials. Osiris Therapeutics Inc. (Columbia, MD) currently has MSC products in their pipeline undergoing through different phases of the clinical trial [2]. Chondrogen™ is a MSC based therapeutics which is currently being evaluated in clinical trials for regeneration of the meniscus and prevention of osteoarthritis in the knee. In this trial, patients received an injection of stem cells or placebo in their knees 1 week after surgery, along with standard postsurgical treatment. Results show significant improvement in pain at 6 weeks, 6 months, and 12 months in patients receiving stem cells compared to placebo. This shows MSC based therapies are gaining importance for MSD treatments. Other stem cells (and cells) e.g. embryonic stem cells (ESCs), induced pluripotent stem cells (iPSCs) are also investigated for treatment of MSDs [2,3].

The preclinical and clinical progress of stem cell therapy has proved the potential of this approach for treatment of MSDs. Feasibility and practicality of using stem cells in a rehabilitation clinical setting (without any surgical procedure) will improve the quality of life for patients with MSDs. We can envision that dysfunction of musculoskeletal tissues and organ can be reverted by application of stem cells with a more predictive outcome. Stem cell based therapeutics represent the next generation of treatment modalities for improving tissue function. In general, regenerative medicine will play a more decisive role in ergonomics and will provide guidelines to develop ergonomically relevant strategies. Building this connection will represent an effective and important interdisciplinary approach in ergonomics.

References

1. <http://stats.bls.gov/news.release/pdf/osh2.pdf>
2. Guan X, Furth ME, Childers MK (2011) Stem Cell Use in Musculoskeletal Disorders. PM R 3: S95-S99.
3. <http://www.osiristx.com/therapeutics.php>

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