© J ORTHOP TRAUMA SURG REL RES
18(5) 2023
Opinion

Impact of resistance training on elderly people's bone health

DEEPTI PATHAK (1), HIMANI DHIMAN (2)
(1) Guru Nanak Dev University, Amritsar, India
(2) J C Bose University of Science and Technology, YMCA, Faridabad, India

Address for correspondence:
Deepti Pathak, Guru Nanak Dev University, Amritsar, India
deeptipathak2599@gmail.com

Statistics

Figures	00
Tables	00
References	08

Received: 06.05.2023; Manuscript No. jotsrr-23-100464;
Editor assigned: 08.05.2023, PreQC No. jotsrr-23-100464 (PQ);
Reviewed: 18.05.2022, QC No. jotsrr-23-100464 (Q);
Revised: 21.05.2023, Manuscript No. jotsrr-23-100464 (R);
Published: 25.05.2023,
DOI. 10.37532/1897-2276.2023.18(5).98

Abstract

Regenerative medicine is acknowledged as one of the world's most rapidly evolving fields of study. Researchers in reconstructive surgery have recently proposed employing stem cells and biomaterials to repair bone injuries. From individual cells to entire tissues and organs, biomechanical environments are crucial. Additionally helpful in the process of bone restoration, these settings. At the location of injury, mechanical signals regulate biological activity. These signals control how various cells develop, differentiate, and proliferate. Additionally, they are in charge of the development of connective tissue and the stabilisation of broken bones. Cells receive mechanical signals via internal or external sources.

The effective and active forces that affect stem cell fate, such as shear stress, tension, elasticity, stiffness, etc., are first introduced and reviewed in this article. Next, we examine the data derived from experimental research and clinical observations about the impact of mechanobiology on stem cell differentiation or bone healing. Additionally, we have compiled the results of current investigations in a number of tables.

Keywords: Knee injury, Knee osteoarthritis, Meta-analysis

INTRODUCTION

An essential branch of reconstructive surgery called tissue engineering offers prospective solutions to issues with the treatment of illnesses, accidents, and aging-related limits. There are several ways to treat bone abnormalities in modern medicine in order to restore bone tissue and improve the outcome of surgery. Due to the use of autograft tissue, these procedures provide benefits such a minimal risk of immunological rejection. These techniques, however, are ineffective for treating osteoporotic fractures or bone fractures in cancer patients, necessitating the adoption of more advanced techniques like tissue engineering. Implanting cells on a suitable scaffold is one of tissue engineering's guiding principles. This structure should have chemical, physical, and mechanical characteristics that are comparable to and close to the target's native texture. However, in order for tissue engineering techniques to be effective, the right cell and substance must be chosen that can easily regenerate new tissue determining the best conditions for in vitro tissue engineering structures To shorten healing times, tissue engineering researchers must get their products ready for *in vivo* implantation. Stem cell function can also be influenced by chemical substances including cytokines, growth factors, and cellular signaling as well as external elements like surface chemistry and topography. The behaviors and features of stem cells can be significantly influenced by mechanical stresses as well. According to research, external mechanical forces play a vital and crucial part in producing these ideal circumstances [1-3].

We are currently unable to properly control stem cell differentiation, which restricts the development of effective tissue engineering therapies despite the breakthroughs achieved in the understanding of stem cell behavior and capabilities. The ideal cell is simple to collect through a minimally invasive biopsy, expandable *in vitro*, immune-suppressed, and able to develop into numerous cell types with distinct roles. One of these perfect cells is the MSC, which is easily acquired from the stroma of adult bone marrow and has the capacity for multipotent differentiation, self-renewing ability, and immunosuppressive qualities. These cells are capable of differentiating into cells that make up the musculoskeletal system, including those that make up bone, cartilage, tendon and ligament cells, fat, smooth muscle, endothelium tissue, and nerve tissue. In addition, mesenchymal stem cells which considered morally superior to Embryonic Stem cells (ES)—have grown to be popular for use in reconstructive medical procedures.

The human body's cells and tissues are subject to a variety of external pressures that have an impact on their development, maintenance, and growth. When the bone is not loaded enough, such as during space travel or extended periods of bed rest, bone mass and density decline. On the other side, high-impact impact training raises bone density. Numerous investigations have revealed that certain cell types are extremely susceptible to mechanical impacts. Numerous studies have also demonstrated the function of tissue mechanics and the impact of various stresses on cellular disorders, physiology, stem cell differentiation, and growth.

The relationship between cellular contact and the mechanical characteristics of the substrate, two important elements influencing the development of mesenchymal stem cells, has received less attention. Cell-cell interaction is also significant because it prevents stem cells, particularly mesenchymal stem cells, from differentiating into fat, bone, and cartilage cells to a greater extent. Additionally, differentiation can be expanded by increasing the amount of cell-cell interaction between stem cells. Additionally, density influences how we react to mechanical stimuli. For instance, ossification genes are regulated by MSC cells transplanted at high densities regardless of substrate stiffness. According to a study, elastic matrices with a 20 kPa elastic modulus are more successful at promoting osteogenesis than those with a 2 kPa elastic modulus. Or the MSC monolayer is subjected to tensile tension, which promotes ossification and prevents lipolysis. Another study used MSCs to replicate pre-mineralized bone on a hard matrix (25 kPa-40 kPa), and the cells developed into the osteoblast phenotype [4-6].

Mechanobiology at the molecular level describes how molecular mechanical agents are used and how they bind together to activate a particular biological function. Mechanobiology at the cellular level is defined as the sensing, decoding, and response of cells to physical forces [7,8].

References:

1. *Park YS, Sung KS. Surgical reconstruction of chronic Achilles tendon ruptures using various methods. Orthopedics. 2012;35(2):e213-8.*
2. *Xu B, Yin Y, Zhu Y, et al. Comparison of bioabsorbable and metallic interference screws for graft fixation during ACL reconstruction: a meta-analysis of randomized controlled trials. Orthop. J. Sports Med. 2021;9(8).*
3. *Gabel S, Manoli A. Neglected rupture of the Achilles tendon. Foot & ankle international. 1994;15(9):512-7.*
4. *Jeng CL, Thawait GK, Kwon JY, et al. Relative strengths of the calf muscles based on MRI volume measurements. Foot & Ankle International. 2012;33(5):394-9.*
5. *Collins NJ, Misra D, Felson DT, et al. Measures of knee function. Arthritis care res. 2011;63 (S11):S208-28.*
6. *Alhaug OK, Berdal G, Husebye EE, et al. Flexor hallucis longus tendon transfer for chronic Achilles tendon rupture. A retrospective study. Foot and Ankle Surgery. 2019 Oct 1;25(5):630-5.*
7. *Shervegar S, Nagaraj P, Grover A, et al. Functional outcome following arthroscopic ACL reconstruction with rigid fix: a retrospective observational study. Arch. Bone Jt. Surg. 2015;3(4):264.*
8. *Wegrzyn J, Luciani JF, Philippot R, et al. Chronic Achilles tendon rupture reconstruction using a modified flexor hallucis longus transfer. International orthopaedics. 2010;34:1187-92.*