REVIEW ARTICLE

Orthobiologics in Orthopedic Cases

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ABSTRACT

Orthobiologics are biological substances, which are obtained from naturally occurring substances in the body. Musculoskeletal injuries, broken bones, and torn muscles, tendons, and ligaments are helped by speedier healing. These contemporary biologics have undergone tremendous evolution and have a significant impact on orthopedic surgical practice. These biologics are available in diversified form such as bone grafts, autologous blood injection, platelet-rich plasma, and various stem cells therapy obtained from bone marrow, amnios, or fat tissue. Each of these biologic substances has some advantages and disadvantages, which would be further elaborated in this article. The purpose of this article is to provide an overview of the reasons for utilizing orthobiologics, the orthobiologics that are presently accessible, as well as their application in different orthopedic situations.

Key words: Orthobiologics, Musculoskeletal injuries,

INTRODUCTION

In orthopedics and sports medicine, biologics have become increasingly popular over the past 20 years. These agents aim to provide superior clinical outcomes by improving and hastening musculoskeletal tissue healing.[1]

Orthobiologics are synthetic and organic substances. They act by helping the recovery of musculoskeletal conditions. They also help in orthopedic surgery to hasten the bone and soft-tissue lesions recovery. These substances are used intraoperatively as well as outside the operation theater or both.

"Orthobiologics" therapies include a largely diversified group of substances that may be harvested from self, donor human, other species, or bioengineered synthetic sources and hold enormous potential to enhance tissue healing and restore tissue structure and function after injury or disease.[2]

This article aims to concisely outline the justification behind employing orthobiologics, the orthobiologics currently accessible, and their utilization in diverse orthopedic conditions.

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EVOLUTION OF ORTHOBIOLOGICS[3]

- First generation – hyaluronic acid-1997
- Second generation – platelet rich plasma-2006
- Third generation – bone marrow concentrate.

RATIONALE FOR USE OF ORTHOBIOLOGICS

Orthobiologics have widespread use in various orthopedic conditions with involvement of musculoskeletal, cartilage, and bone tissue.

Regeneration and repair ability as part of physiological process or in response to injury is higher in bone tissue. In some situations, such as adverse local conditions, a larger bone defect, systemic causes, or combinations of these factors may hamper the spontaneously repairing bone capacity.

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Hence, several surgical procedures are tried by orthopedic surgeons to augment bone regeneration as biological support in the form of a bone graft or substitute, either natural or synthetic.[3]

Chances of injuries in sports are increasing among the professional and recreational athletes. There are advanced diagnostic techniques available for these conditions. There is a need of quick return to preinjury level of sporting activities. Orthobiologics are used to fulfill the demands of patients by hastening the recovery of fractured bones, injured muscle injury, and injury of tendons and ligaments. These agents are relatively safe as derived from naturally found substances in the body.

The chronic conditions of musculotendinous tissue being more problematic and cause disruption of the internal structure of the tendon and degeneration of the cells and matrix.

MODE OF ACTION OF ORTHOBIOLOGICS

The therapeutic uses of orthobiologics are due to their ability to enhance possibility of healing the tissues which are lacking with intrinsic healing ability such as tendons, ligaments, bones, muscles, cartilage, and meniscus.[4]

Bone Marrow Concentrate[5]

It contains a potent mixture of hematopoietic cells, mesenchymal stem cells, platelets, and cytokines. It has anti-inflammatory, immunomodulatory, and chondrogenic properties, which act as the basis for its regenerative potential.

In the field of sports medicine, orthobiologics have brought about a change in treatment approach; from temporary symptomatic management to delay or disease prevention. This was hypothesized due to modifying cell signals within the biologic environment.

POTENTIAL ROLE IN TREATMENT OF VARIOUS ORTHOPEDIC CONDITIONS

In chronic musculoskeletal conditions – in this situation, tendons fail to mature into normal state and at times, such injuries result in

- Tendinosis
- Angiofibroblastic degeneration
- Tendinopathy of lateral epicondyle
- Injuries of rotator cuff
- Tendinopathy of patella
- injury of the Achilles tendon
- Plantar fasciitis.

In addition, ligament reconstruction and repair, as well as bone and cartilage degeneration such as osteoarthritis.

VARIOUS OTHER EFFICACIOUS TOOLS THAT ARE USED BY ORTHOPEDIC SURGEONS TO SOLVE THE CHRONIC CONDITION[4]

Bone Graft

- The gold standard process in bone grafting is self-bone graft from iliac crest called autologous (ICBG). Autologous bone grafting procedure has some complications
- Allogeneic bone graft: which is taken from other human donor.

Demineralized Bone Matrix

Bone graft replacements

- Calcium salts such as coral hydroxyapatite, calcium sulfate, phosphate, and tricalcium phosphate.

Cell therapy

- Bone marrow aspirate concentrate: Iliac crest is a most commonly used site for harvesting the mesenchymal stem cells, other progenitor cells, and associated cytokine/growth factors. This is approved by US-FDA
- Adipose-derived mesenchymal stem cells
- Platelet-rich-plasma: This is also known as platelet-enriched plasma, platelet-rich concentrate, and autologous platelet gel. This is obtained from the plasma of autologous blood which has platelet count above baseline
- Bone morphogenetic protein – it is a powerful osteoinductive substance
- Platelet-derived growth factor
- Parathyroid hormone
- Micro ribonucleic acids.

COMMON ORTHOPEDIC CONDITION AND ROLE OF ORTHOBIOLOGICS: ARTICULAR CARTILAGE DAMAGE[6]

The serious clinical and economic burden for the orthopedic community and the public health system is caused by articular cartilage damage. The orthopedic surgeons face this most challenging clinical problem in their day-to-day practice. These conditions are extremely difficult to repair, and an important complication is the progressive degenerative osteoarthritis of the joint. Trauma or degeneration cause

articular cartilage deterioration and can result in severe joint pain, impairment in function, and osteoarthritis.

CURRENT TREATMENT APPROACHES IN CARTILAGE REPAIR[6]

Surgical and non-surgical method of management

1. Non-pharmacological
    a. Exercise: Regular exercise is the most promising approach
    b. Weight reduction: This is a proven method to reduce thickness loss of cartilage and quality improvement.
2. Pharmacological management
    a. Oral supplements: Monotherapy of glucosamine and chondroitin sulfate or in combination are used commonly
    b. Injectable steroid: It has a strong local anti-inflammatory effect and provides pain relief. However, it is useful for acute onset pain in degenerative osteoarthritis. Long-term therapy of steroid is not safe
    c. Viscosupplements: Hyaluronic acid with high molecular weight in injectable form are used but have slower response than corticosteroid injections. It has benefits in the form of long-lasting pain relief, and less side effects. It increases endogenous production of hyaluronic acid by synovial cells and thereby joint lubrication, anti-inflammatory effect, and antioxidant
    d. Orthobiologics: Cartilage defects are treated by bone marrow aspiration concentrate and cell therapy such as platelet-rich plasma and Adipose derived mesenchymal stem cells. The original architecture and articulation of cartilage is achieved by osteochondral autografts and allografts.[6]

CONCLUSION

The use of biologics in orthopedic surgery is rapidly increasing. Biologics are use in the orthopedics from decades and evolved over decades. Orthobiologics help in the cure of musculoskeletal problems and are utilized in orthopedic Surgery. Orthobiologics has both sides of coin in the form of advantages such as generally safe treatment modality, useful in emergency conditions like sports injury by expedite early return to play, while the other side of coin is lack of clinical study data of new methods such as cell therapy. Orthobiologics should be used only in indicated cases and proper sterile precautions should be taken to prevent possible infections and other complications.

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