Short Communication

Magnesium Screws and Plates for Bone Augmentation: a New Concept in Dental Surgery

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Abstract

Objectives: This short review gives an overview of magnesium as a potential material for temporary metal screws and plates for maxillofacial applications.

Materials and Methods: PubMed was searched for magnesium as a biomaterial. Only in vivo studies and reviews were included.

Results: Until now, titanium screws and plates have been a golden standard in fixing augmented bone and bone grafts. However, a second operation for screw removal causes further damage to the tissues, increases infection risk, and increases patient suffering and costs. Magnesium is a biocompatible metal that resorbs in tissues without causing tissue damage, and it has better mechanical properties than titanium. Magnesium alloys are commercially available for orthopedic and cardiovascular uses, but not for maxillofacial applications.

Conclusion: Magnesium alloys have better properties than titanium and are beneficial in fixing bone grafts. Further development and implication of magnesium in the maxillofacial field would be beneficial for patients undergoing dental surgery.

INTRODUCTION

Metal screws and plates that fix the bone and then dissolve upon healing is a new concept in dentistry. Until now, titanium has been the metal of choice for fixing augmented bone. Although titanium plates, screws, and nets provide good stability for tissues during the healing phase, these materials have to be removed before further treatment with dental implants [1,2]. The second operation on screw and plate removal leads to new tissue damage, increased infection risks, and high patient costs and suffering.

The concept of biodegradation is already known in medical practice resorbable sutures are successfully used in surgery. Polymers and metals are bioresorbable materials that are suitable for bone augmentation. Polymers have low impact strength; low wear resistance, low capacity to absorb high-strain energy compared to metals Moravej and [3], and might provoke foreign body reactions [4]. The idea behind magnesium screws is to combine the degradability similar to polymers with good mechanical properties similar to or better than titanium.

Historically, the first metals to be used for medical applications were Ag-, Fe-, Au-, and Pt-based alloys in the late 18th century [5]. The discovery of elemental magnesium by Sir Humphrey Davy in 1808 led to the design of metallic biodegradable implants. The first implantation of magnesium wires as ligatures to stop bleeding vessels of human patients was performed [6]. Today, magnesium has been rediscovered in the medical field due to its fantastic properties.

MATERIALS AND METHODS

The PubMed database was searched for magnesium as a biomaterial. The search words were “magnesium biomaterial,” “magnesium in vivo,” “magnesium biodegradable,” and “magnesium implants.” Only in vivo studies and reviews from 2005 were selected. The aim was to get insight into magnesium’s properties, problems, and medical application areas. In total, 12 articles met the search criteria.

RESULTS

Properties of magnesium

It is crucial for metal alloys that are to be used for surgical applications be biocompatible and provide enough strength to the tissues. Magnesium is considered a suitable material for medical uses for a number of reasons. First, it is highly biocompatible [7]. Secondly, magnesium occurs naturally in our bodies: 50–60% of this element is found in bone, and we get about 380–850 mg of magnesium daily from [8]. Foods rich in magnesium include cabbage, spinach, nuts, and grains. Magnesium deficiency can lead to serious problems, such as migraines and cardiovascular disorders [8]. Excess magnesium is removed by the kidneys.
Two magnesium alloys are commercially available today for cardiovascular and orthopedic applications, WE43 and MgYREZr, respectively. However, no screws or plates are available for dentistry. MgYREzr is a modification of WE43, which, apart from magnesium, yttrium, and rare earth elements, also contains zirconium. The degradation time for MgYREzr is around 24 months [18]. These screws have shown positive results in the pilot study on 13 [2]. However, a limitation of this study is the relatively low statistical power.

REFERENCES


