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Osseointegration of dental implants in patients with oral bisphosphonate intake: a review

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ABSTRACT

Introduction: Bisphosphonates are widely used for various bone diseases including osteoporosis and bone tumors. One of the complications associated with these pharmaceutical agents is bisphosphonate-related osteonecrosis of the jaw. This condition may be triggered by placement of dental implants. In turn, osteonecrosis of the jaw may cause failure in osseointegration of implants. Moreover, bisphosphonates can influence osseointegration of dental implants by alteration of bone turnover. The aim of this study was to review the published articles on osseointegration of dental implants in patients taking oral bisphosphonates.

Material and Methods: PubMed/Medline database was searched for published articles until 31 January 2014 using "osseointegration" and "bisphosphonate" as keywords. Inclusion criteria were human studies including case series, retrospective studies and prospective studies on the subject. Exclusion criteria were case reports, intravenous bisphosphonate intake, and placement of implants in other parts of the body rather than jaws.

Results: A total of 66 articles were evaluated at abstract level. Eventually 4 articles were chosen including nearly 1470 patients taking oral bisphosphonates. Failure in osseointegration of dental implants or its loss was observed in 23 patients. This shows failure in integration between bone and implant in approximately 1 out of 64 patients taking oral bisphosphonates. Accordingly impaired osseointegration was observed in 1.44% of patients with bisphosphonate intake.

Conclusion: Although failure in osseointegration of dental implants in patients with bisphosphonate intake is unlikely, the risk of failure should be considered in treatment planning for these patients and utmost care should be employed to prevent possible complications.

Keywords: Bisphosphonate, Osseointegration, Dental implant.

Introduction

Bisphosphonates are a group of drugs widely used for various bone diseases including osteoporosis, Paget's disease, osteolytic tumor-induced bone disease, non-tumor-induced hypercalcemia, and heterotopic calcification and ossification [1]. These pharmaceutical agents inhibit bone resorption, impede ectopic calcification, restrain activity and proliferation of oseteoblasts and subsequently inhibit osteoclastic activity [2-6]. Therefore bisphosphonate intake leads to increased bone mass and suppressed bone turnover [7]. This group of drugs has two routes of administration: oral and intravenous [8].

One of the complications associated with bisphosphonate therapy is osteonecrosis of the jaws [9]. This condition may occur due to placement of dental implants as a trigger factor [10]. In turn bisphosphonate-related osteonecrosis of the jaw may cause decreased

Table 1. Description of eligible articles

First Author/Year	Country	Study type	Outcome
Martin DC/2010	USA	retrospective	16 failures out of 589 patients
Goss A/2010	Australia	case series	7 failures out of nearly 800 patients
Shabestari GO/2009	Iran	case series	no failure in 21 patients
Fugazzotto PA/2007	USA	prospective	no failure in 61 patients

potential for osseointegration of dental implants [11]. Moreover, compromised bone turnover in patients with bisphosphonate intake may lead to impaired osseointegration, as osseointegration is a result of increased bone turnover in the implantation site [12].

The current literature presents somehow contradictory results regarding effect of systemic bisphosphonate intake on osseointegration of dental implants. Kasai et al in their prospective study reported a success rate of 86% for patients taking oral bisphosphonate [13]. While the large case series reported by Goss et al presented a success rate of 99.11% in these patients [14]. According to Chadha et al, a history of oral and intravenous bisphosphonate use is not an absolute contraindication for placement of dental implants and osseointegration can be successful in this group of patients [15].

Since implant techniques are improving rapidly, there is a need to assess the success rate of implant treatment in patients with systemic drug intake on a regular basis. Therefore the aim of this study was to review published articles regarding effects of oral bisphosphonate intake on osseointegration of dental implants.

Material and Methods

PubMed/Medline database was searched for published articles until 31 January 2014 using "osseointegration" and "bisphosphonate" as keywords. Inclusion criteria were human studies on the subject including case series, retrospective studies, and prospective studies. Exclusion criteria were case reports, intravenous bisphosphonate intake, and placement of implants in other parts of the body rather than jaws.

Results

Search with the keywords presented a total of 66 articles. The initial 66 articles included 39 animal experimental studies, 5 in-vitro experimental studies, 7 case reports and case series, 4 prospective studies, 2 retrospective studies, 7 review articles, and 1 randomized clinical trial. The design of 1 study was not determinable, as the English abstract did not reveal its type and the main article was in Japanese. Eventually 4 eligible articles were selected for inclusion in the review study. Description of eligible articles is shown in Table 1.

The eligible articles included nearly 1470 patients with placement of dental implants while in oral bisphosphonate therapeutic regimen or onset of oral bisphosphonate intake after placement of dental implants. Failure in osseointegration of dental implants or its loss occurred in 23 cases. This shows failure in integration between bone and implant in approximately 1 out of 64 patients taking oral bisphosphonates. Accordingly impaired osseointegration was observed in 1.56% of patients with bisphosphonate intake. Thus, based on the present literature implant success rate in patients with oral bisphosphonate therapeutic regimen is 98.44%.

Discussion

In the present review article 4 eligible articles regarding effects of systemic oral bisphosphonate intake on osseointegration of dental implants were investigated. Since small case reports weren't representative of a population, they were excluded from the study. The overall results indicate that the success rate of implant treatment in patients taking oral bisphosphonates is approximately 98.44%. Therefore, placement of dental implants in these patients can be considered safe, if conservative approach is followed.

Bisphosphonate-related osteonecrosis of the jaw is a complication manifesting as exposed bone accompanied by swelling, pain, and purulent secretions [10]. First diagnosed by Marx et al in 2003, this condition is mostly triggered by dentoalveolar surgery, dental extractions and placement of dental implants [10, 16]. In turn, bisphosphonate-related osteonecrosis of the jaw may influence osseointegration of dental implants, as it is an avascular necrotic area [11]. Hence, for a successful implant treatment, utmost care must

be employed to avoid this condition, although it is not common. The incidence of bisphosphonate-related osteonecrosis of the jaw is between zero and 0.04% in patients taking oral medication [17]. Based on the American Dental Association, the patient may be at increased risk of developing osteonecrosis of the jaw when extensive implant placement is necessary or when guided bone regeneration is required to augment a deficient alveolar ridge before placement of dental implant [17]. But if surgeries are necessary, conservative surgical technique with primary closure should be followed. Additionally, immediately before and after surgical procedures involving bone, the patient should rinse his mouth gently with a chlorhexidine mouthwash. Chlorhexidine should be used twice per day for two months [11]. Moreover, Since recent studies have shown that osteoclastic activity returns after 2 months off oral bisphosphonate, this is the best time to perform any type of surgery if possible [11,18]. Therefore, following the conservative method and post-operative care is prudent.

Another consequence that can affect osseointegration in patients in bisphosphonate therapy is reduction in bone turnover. Since osteoblasts and osteoclasts are the main cells responsible for the osseointegration process, reduction in their activity may hinder osseointegration [19]. But as the present review demonstrates, the risk of this condition is low. Even in cases requiring more extensive surgeries for placement of dental implants, the 2-month-off-bisphosphonate period, may even lessen the risk.

Still there is a paucity of information regarding safety of implant placement and its success in patients with bisphosphonate intake. Thus, well-controlled studies on incidence of complications and methods for prevention of them must be conducted to establish appropriate guidelines for implant treatment of this rapidly increasing group of patients.

Conclusion

Although failure in osseointegration of dental implants in patients with oral bisphosphonate intake is unlikely, the risk of failure should be considered in treatment planning for these patients and utmost care should be employed to prevent possible complications.

Conflict of interest: *The authors declared no conflict of interest.*

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