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ADMINISTRATIVE INFORMATION**Support** - No financial support.**Review Stage at time of this submission** - Data analysis.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202370115**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 July 2023 and was last updated on 30 July 2023.**INTRODUCTION**

Review question / Objective The aim of this systematic review is: 1- to evaluate the osseointegration process of dental implants in an animal model of induced osteoporosis, and 2- to point some factors, such as implant topography or local and systemic therapy that could improve the success rate in these situations. The criteria used in this systematic review (SR) for the selection of studies were based on the PICOS method as follows:

- (P) Population: animals with induced osteoporosis,
- (I) Intervention: implant placement,
- (C) Comparison: osseointegration in animals with osteoporosis X healthy animals
- (O) Outcomes: osseointegration of implants in osteoporotic animals and the influence of some factors on osseointegration.
- (T) Type of studies: preclinical animal study, evaluation of implant placement and Osteoporotic animals, studies in humans and In vitro studies were excluded.

Rationale For proper osseointegration of dental implants, the quality of the bone tissue is an important factor, considering that the characteristics of the bone microarchitecture influence the bone's ability to support the transmission and distribution of physiological forces. As a result of systemic metabolic disorders that affect the bone, giving it a more cortical and/or trabecular structural characteristic with lower density, the osseointegration response may be compromised. Consequently, implants installed in these areas may be subject to a greater chance of early failure or have an increased incidence of peri-implant marginal bone loss.

Osteoporosis is the most common chronic metabolic disease of bone, with more than 200 million people worldwide, mostly postmenopausal women (Lane, N. 2006) Look for some data from the UN or endocrinology association in the 2020s. characterized by a gradual loss of bone mass through the deterioration of its microarchitecture, resulting in reduced bone strength and alteration of

the trabecular bone characteristics (Raisz, 2005). Several factors can influence remodeling and subsequent bone loss. The decline in estrogen levels after menopause increases the recruitment and differentiation of osteoclasts, prolonging their survival, thus leading to excessive bone resorption and subsequent predominance of this process over bone formation. Glucocorticoids are commonly used drugs for a variety of medical conditions. However, they also affect bone quality primarily through reduced osteoblastogenesis and increased osteoblast and osteocyte apoptosis (Weinstein 2000; Schett et al. 2010). Although osteoporosis is not an absolute contraindication for treatment with dental implants or any procedure, the possible impairment of the bone-implant interface resulting from this pathology may represent a potential risk factor for treatment success.

Condition being studied Osteoporosis is the most common chronic metabolic disease of bone, with more than 200 million people worldwide, mostly postmenopausal women (Lane, N. 2006) Look for some data from the UN or endocrinology association in the 2020s. characterized by a gradual loss of bone mass through the deterioration of its microarchitecture, resulting in reduced bone strength and alteration of the trabecular bone characteristics (Raisz, 2005). Several factors can influence remodeling and subsequent bone loss. The decline in estrogen levels after menopause increases the recruitment and differentiation of osteoclasts, prolonging their survival, thus leading to excessive bone resorption and subsequent predominance of this process over bone formation. Glucocorticoids are commonly used drugs for a variety of medical conditions. However, they also affect bone quality primarily through reduced osteoblastogenesis and increased osteoblast and osteocyte apoptosis (Weinstein 2000; Schett et al. 2010). Although osteoporosis is not an absolute contraindication for treatment with dental implants or any procedure, the possible impairment of the bone-implant interface resulting from this pathology may represent a potential risk factor for treatment success.

METHODS

Participant or population Animal studies using healthy and osteoporosis induced method, with or without systemic medication and other local factors.

Intervention Implant Placement in healthy and osteoporotic sites, in use or not of systemic and

local medication and different types of implant surface and morphology.

Comparator Implant placement in healthy bone condition.

Study designs to be included Pre clinical studies using a methodology of induced osteoporosis in animals. Implant placement in osteoporotic test sites and healthy control sites. Bone to implant evaluation and any other histological or histomorphometrical analysis.

Eligibility criteria % of bone to implant contact (BIC) evaluation as inclusion criteria.

Information sources PubMed/Medline (National Library of Medicine, Bethesda, MD), were researched from 2002 to 2022, recording information from the last 20 years of the literature, using the combination: (((dental implant) AND (Osseointegration)) AND (osteoporosis)) AND (osteoporosis treatment) for keywords, obtaining the strategy of search.

Main outcome(s) % of Bone to implant contact and Mechanical test by Removal torque evaluation.

Additional outcome(s) Other histological and histomorphometric analysis.

Quality assessment / Risk of bias analysis All studies that met the inclusion criteria underwent quality assessment and data recording. A specifically designed standardized data extraction form was used to record data for each included study, covering article title, date, authors, number of patients, purpose of study, type of analysis used by authors, length of study follow-up, type of implant used, test and control groups, type of intervention and conclusions. At this stage of the process, a division was made between reviewers (KC, EK) for complete reading and data extraction performed independently. When any disagreement was detected between the reviewers, a consensus was reached through discussion between them, based on the previous calibration according to the inclusion and exclusion criteria.

Strategy of data synthesis Initial screening of potentially suitable titles against inclusion criteria to identify potentially relevant articles (authors KC and EK) and checked by a third reviewer (JS). Prior to the initial screening, all items found through electronic searches were grouped into a single list, excluding duplicates using Rayyan software. ai (<https://rayyan.ai/reviews/477968>). Full texts of studies deemed relevant by title and abstract were

read and independently assessed against eligibility criteria. Then, the reference lists of original and review studies considered relevant in the previous step were manually searched and checked for agreement through discussion between the authors.

All the implant characteristics, medications related and analysis performed were organized on a spreadsheet in a detailed approach, to improve the correct data extraction and synthesis.

Subgroup analysis Other evaluated parameters from the selected papers are (Bone mineral density / BA (bone area) – BV (bone volume) – TV (tissue volume)/ Osseointegration/ bone healing/ remodeling/ bone formation.

Sensitivity analysis Peri-implant bone behavior around dental implants (biological and mechanical).

Language restriction Papers published in English.

Country(ies) involved Brazil.

Keywords dental implant, osteoporosis, osteoporosis treatment, osseointegration.

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