

INPLASY PROTOCOL

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Corresponding author:

Juan Carlos Bernabeu-Mira

juancarlos_bernabeu@hotmail.com

Author Affiliation:

Faculty of Medicine and Dentistry, University of Valencia

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Non-conflicts of interest were presented.

In vitro, pre-clinical, and clinical factors of low-speed drilling without irrigation of the implant bed compared to the conventional drilling: a systematic review

Bernabeu-Mira, JC¹; Soto-Peñaloza, D²; Peñarrocha-Diago, M³; Peñarrocha-Oltra, D⁴.

Review question / Objective: Three different questions were formulated, according to the PICO (Patient, Intervention, Comparison, Outcome) question: 1. Do implant bed drilling without irrigation and low-speed (I) compared to implant bed drilling with irrigation and high-speed (C) show thermal differences (O) in the preparation of dental implants (P)? 2. Do implant bed drilling without irrigation and low-speed (I) compared to implant bed drilling with irrigation and high-speed (C) show differences in the osseointegration or/and cellular viability of collected bone (O) in dental implants (P)? 3. Do implant bed drilling without irrigation and low-speed (I) compared to implant bed drilling with irrigation and high-speed (C) show differences of survival rate or/and marginal bone loss (O) of dental implants (P)?

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 November 2020 and was last updated on 30 November 2020 (registration number INPLASY2020110138).

INTRODUCTION

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the preparation of dental implants (P)? 2. Do implant bed drilling without irrigation and low-speed (I) compared to implant bed drilling with irrigation and high-speed (C) show differences in the osseointegration or/and cellular viability of collected bone (O) in dental implants (P)? 3. Do implant bed drilling without irrigation and low-speed (I) compared to implant bed drilling with irrigation and high-speed (C) show differences of survival rate or/and marginal bone loss (O) of dental implants (P)?

Rationale: The systematic review is necessary to clarify the related factors of the biological drilling of the implant bed. This method appears more efficient than conventional drilling due to a major harvested autologous bone chips. The other variables also have to study to demonstrate comparable results with conventional drilling.

Condition being studied: The heat rise during the drilling of the bone is a multifactorial phenomenon that depends on: drilling technique, irrigation, rotational speed, axial load, drilling depth, drill design, drill material, drill wear and characteristics of the bone. This multitude of interrelated factors provides the possibility of changing one heating factor and at the same time regulating and compensating another one to avoid unsuitable bone thermal effects and to obtain one benefit too. The coolant irrigation has been classically and widely implemented as a preventative method against bone overheating. The thermal rise was statistically significant in the groups without irrigation than in the groups with irrigation. However, irrigation could difficult the operator's vision and autologous bone harvesting during the drilling. Biological drilling is a surgical drilling technique through the use of rotary surgical drills without irrigation, and which is thermally compensated for its low rotation speed. The main purpose of this systematic review is to provide a transversal comparative vision on in vitro, pre-clinical and clinical factors between low-speed drilling without irrigation and high-speed drilling with irrigation in dental implants.

METHODS

Search strategy: Five databases will be selected to formulate the search strategies. In PubMed-Medline the medical subject heading (MeSH) terms (and their entry terms) and non-MeSH will be used. To search in Embase, Emtree terms and their synonyms and non-Emtree terms were included. The Web Of Science and Cochrane Database were also consulted. A search of the grey literature will be also performed in Open Gray to include articles published in non-indexed journals or to retrieval the major quantity of studies. Furthermore, a hand-search will performed of the references of the articles retrieved by the previous search strategies. Search strategy: (dental implant OR dental implantation OR osseointegrated dental implant) AND (biological drilling OR biological osteotomy OR biological bed preparation OR low speed drilling OR low speed osteotomy OR low speed bed preparation OR drilling without irrigation OR osteotomy without irrigation OR bed preparation without irrigation OR biological perforation OR low speed perforation OR perforation without irrigation) AND (conventional drilling OR conventional osteotomy OR conventional bed preparation OR standard drilling OR standard osteotomy OR standard bed preparation OR classic drilling OR classic osteotomy OR classic bed preparation OR high speed drilling OR high speed osteotomy OR high speed bed preparation OR drilling irrigation OR osteotomy irrigation OR bed preparation irrigation OR conventional perforation OR standard perforation OR classic perforation OR high speed perforation) AND (thermal OR temperature change OR temperature OR histology OR cell culture OR cell viability OR cell adhesion OR cell differentiation OR cell proliferation OR bone to implant contact OR BIC OR osseointegration OR stability OR Osstell OR ISQ OR torque OR implant failure OR implant success OR peri-implant bone loss OR marginal bone loss OR bone loss).

Participant or population: (dental implant OR dental implantation OR osseointegrated dental implant)

Intervention: (biological drilling OR biological osteotomy OR biological bed preparation OR low speed drilling OR low speed osteotomy OR low speed bed preparation OR drilling without irrigation OR osteotomy without irrigation OR bed preparation without irrigation OR biological perforation OR low speed perforation OR perforation without irrigation).

Comparator: (conventional drilling OR conventional osteotomy OR conventional bed preparation OR standard drilling OR standard osteotomy OR standard bed preparation OR classic drilling OR classic osteotomy OR classic bed preparation OR high speed drilling OR high speed osteotomy OR high speed bed preparation OR drilling irrigation OR osteotomy irrigation OR bed preparation irrigation OR conventional perforation OR standard perforation OR classic perforation OR high speed perforation).

Study designs to be included: in vitro OR pre-clinical animal OR clinical.

Eligibility criteria: The inclusion and exclusion criteria will be created to select the research studies:

- Inclusion criteria:
 - o In vitro, animal pre-clinical and clinical studies (randomized trials, prospective or retrospective observational trial).
 - o Studies whose topic of investigation were the performing of the dental implant bed.
 - o Studies that compared at least one group with drilling without irrigation and slow-speed and another group with drilling with irrigation and high-speed.
 - o None limitation of language or publication date was executed until published posterior articles to November 2020.
- Exclusion criteria:
 - o Groups of studies with different methods of drilling to rotatory surgical drills: osseodensification technique, undersized drilling, piezoelectric technique and osteotome technique.
 - o Case report, letter to the editor, review, systematic review, meta-analysis and opinion article.
 - o Studies with duplicated data population.

Information sources: Five databases will be selected to formulate the search strategies. In PubMed-Medline the medical subject heading (MeSH) terms (and their entry terms) and non-MeSH will be used. To search in Embase, Emtree terms and their synonyms and non-Emtree terms will be included. The Web Of Science and Cochrane Database will be also consulted. A search of the grey literature will be also performed in Open Gray to include articles published in non-indexed journals or to retrieval the major quantity of studies. Furthermore, a hand-search will be performed of the references of the articles retrieved by the previous search strategies.

Main outcome(s): The main purpose of this systematic review is to provide a transversal comparative vision on in vitro, pre-clinical and clinical factors between low-speed drilling without irrigation and high-speed drilling with irrigation in dental implants.

Data management: Study data will be extracted in predefined Excel spreadsheets seeking its comparability.

Quality assessment / Risk of bias analysis: The analysis of risk of bias will be performed by two independent reviewers (JCBM and DSP) through different analytic tools depends on the type of included study. SYRCLE guideline will be applied for animal pre-clinical studies {{642 Hooijmans,C.R. 2014;}} , the Cochrane risk of bias tool will be used for randomized clinical trial {{641 Higgins,J.P. 2011;}} and ROBINS-1 will be consulted for non-randomized studies for interventions {{657 Hinneburg,I. 2017;}} . The risk of bias of in vitro experiments will be analyzed using ARRIVE and CONSORT modification as pervious reported {{643 Ramamoorthi,M. 2015;}} . Disagreements between reviewers were solved by discussion with a third advisor (DPO). The level of reviewer's agreement was assessed by Cohen's kappa coefficient {{658 Landis,J.R. 1977;}} .

Strategy of data synthesis: Study data will be extracted in predefined Excel spreadsheets seeking its comparability.

The following items will be extracted: author, year of publication, study design (in vitro, animal or human studies), sample size, drilling medium, measurement method, differences mean, standard deviation, significant differences and the relative P value. Specific information for the three groups will be added: • In vitro factors: thermal change, maximum temperature, time of drilling, radiographic volume analysis and quantity of harvested bone. • Pre-clinical factors: implant success rate, marginal bone loss, bone-to-implant contact, osseointegration, torque and histology of the implant bed. • Clinical factors: implant success rate, peri-implant bone loss, follow-up and histology, cell culture, cell viability, cell adhesion, cell differentiation of cell proliferation of the harvested autologous bone.

Author 4 - Miguel Peñarrocha-Diago - Conceptualization, methodology, data curation, supervision, validation, visualization, and writing-review and editing.

Email: penarrochamiguel@gmail.com

Subgroup analysis: Subgroup analysis was not planned because meta-analysis will be not conducted.

Sensibility analysis: Sensibility was not planned because meta-analysis will be not conducted.

Language: No language limits will be imposed on the search.

Country(ies) involved: Spain.

Keywords: low-speed drilling, without irrigation, biological drilling, conventional drilling and systematic review.

Contributions of each author:

Author 1 - Juan Carlos Bernabeu-Mira - Conceptualization, data curation, formal analysis, investigation, methodology and writing-original draft.

Email: juancarlos_bernabeu@hotmail.com

Author 2 - David Soto-Peñaloza - Formal analysis, methodology and supervision.

Email: dr.davidsotpe@gmail.com

Author 3 - David Peñarrocha-Oltra - Conceptualization, methodology, data curation, supervision, validation, visualization, and writing-review and editing.

Email: dpenarrocha@gamil.com