

## Systematic Review Dental Implants

# Immediate versus conventional loaded single implants in the posterior mandible: a meta-analysis of randomized controlled trials

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**Abstract.** The purpose of this meta-analysis was to compare implant survival, marginal bone loss, and complications between immediate and conventional loading of single implants installed in the posterior mandible. An extensive electronic search was performed of PubMed, Web of Science, and the Cochrane Central Register of Controlled Trials to identify relevant articles published up to January 2015. After the selection process, five studies met the eligibility criteria and were included. The results of the meta-analysis were expressed in terms of the odds ratio (OR) or standardized mean difference (SMD), with a confidence interval (CI) of 95%. Results were pooled according to heterogeneity using the fixed- or random-effects model. There was no statistically significant difference between the two techniques (immediate loading vs. conventional loading) with regard to implant survival (OR 1.71, 95% CI 0.40 to 7.36;  $P = 0.47$ ). There was no statistically significant difference in marginal bone loss (SMD  $-0.58$ , 95% CI  $-1.55$  to  $0.38$ ;  $P = 0.24$ ). The reported mechanical and biological complications were common to both types of intervention, with the exception of probing depth, which was greater following the immediate loading technique (SMD  $0.13$ , 95% CI  $-0.19$  to  $0.44$ ), although this was not statistically significant ( $P = 0.43$ ).

**Key words:** dental implants; delayed loading; immediate loading; implant survival; marginal bone loss; meta-analysis.

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The replacement of teeth by means of single implants is a predictable treatment with a high success rate.<sup>1</sup> Historically, the recommended implant installation

protocol has been a two-stage surgery, with the sinking of the implants followed by a healing period free of mechanical load of 3 months for the mandible and 6

months for the maxilla.<sup>2</sup> However, with the growing demand for less invasive and faster procedures that optimize aesthetic requirements, single-stage surgery with

immediate prosthetic loading (immediate loading) has been adopted.

Immediate loading can be defined as the installation of the prosthetic crown on the implant within 1 week of surgery.<sup>3</sup> The single-stage installation of implants can also be classified as functional or non-functional, depending on the occlusal contact with the opposite arch.<sup>4</sup> The first immediate loading protocol was performed to treat edentulous patients through four splinted implants placed in the mandible.<sup>5</sup> The advantages of single-stage implant installation and the constant development of the implants and surgical techniques have encouraged further research into immediate loading of single implants in various regions of the mouth, with high rates of success and survival.<sup>6</sup>

The main criterion for performing immediate loading of single implants is primary stability. The parameters used to evaluate the initial stability of the implant are usually insertion torque, measured in Newton-centimetres (N cm), and the implant stability quotient (ISQ), measured by resonance frequency analysis (RFA). A low initial stability necessitates long-term osteogenesis and therefore a greater healing period.<sup>7</sup> Moreover, a lack of contact between the bone and the implant increases the risk of micro-movements, which decreases success rates.<sup>8</sup> The incidence of high masticatory forces in the posterior mandible discourages many clinicians from conducting immediate prosthetic loading in this region. Additionally, few clinical trials have evaluated the performance of a single posterior implant after immediate prosthetic loading.

Thus, the purpose of this meta-analysis was to compare implant survival, marginal bone loss, and complications in immediate and conventional loading of

single implants installed in the posterior mandible.

## Materials and methods

The methodology of this study was adapted from the PRISMA statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses).<sup>9</sup> Clinical questions were broken down and organized using the PICO<sup>10</sup> strategy, as proposed by evidence-based practice.

### Objective

The purpose of the present review was to test the null hypothesis of no difference in the implant survival rate, marginal bone loss, and complications in subjects who have received immediate or conventional loading of single implants installed in the posterior mandible.

### Focused question

What are the clinical outcomes of single implants placed in the partially edentulous posterior mandible between subjects who have received an immediate restoration and those who have received a late restoration in relation to the implant survival rate, marginal bone loss, and frequency of complications?

### Search strategy

An extensive electronic search, with no date or language restriction, was performed in PubMed, Web of Science, and the Cochrane Central Register of Controlled Trials, up to January 2015. The search strategy and the PICO tool are shown in Table 1. In addition, reference lists of potential studies for inclusion in the meta-analysis were explored for more studies.

## Selection criteria

This review sought randomized controlled trials (RCTs). Clinical studies in humans with at least 12 months of follow-up data, studies involving single implants placed in the posterior mandible, and studies comparing immediate versus conventional prosthetic loading were included. Studies involving animals, patients with decompensated metabolic diseases that could affect bone turnover, periodontal patients without prior treatment, and non-randomized clinical studies were excluded.

### Screening process

Both authors/reviewers (V.M.F. and E.P.B.) performed the search and selection process. First, titles and abstracts were analyzed. Next, full papers were read carefully and analyzed according to the eligibility criteria (inclusion/exclusion) for data extraction. Differences between the reviewers were resolved through detailed discussion. Concordance between the two reviewers in relation to the search was assessed by Cohen's kappa test ( $\kappa$ ). The authors of the studies were contacted by e-mail for any clarification when necessary.

### Quality assessment

The quality analysis was performed independently by both authors/reviewers using the Cochrane Collaboration tool for assessing risk of bias in RCTs.<sup>11</sup> The quality analysis of each study was based on four criteria: sequence generation (random selection in the population), allocation concealment (steps must be taken for strict implementation of the schedule of random assignments by preventing foreknowledge of the forthcoming allocations), incomplete outcome data (clear explanation of

Table 1. Systematic search strategy (PICO strategy).

Search strategy		
Population	#1	(partially edentulous mandible[MeSH] OR partially edentulous implant[MeSH] OR edentulous mandible[MeSH] OR edentulous posterior mandible[MeSH])
Intervention	#2	(implant*[all fields] OR dental implant surgery[MeSH] OR mandibular implant[MeSH] OR single implant[MeSH] OR single implant crown[MeSH] OR submerged implant[MeSH] OR non-submerged implants[MeSH] OR immediate loading[MeSH] OR immediate single implant[MeSH] OR immediate loading single tooth[MeSH] OR delayed load implants[MeSH] OR conventional loading implants[MeSH])
Comparisons	#3	(immediate loading single implants[MeSH] OR conventional loading single implants[MeSH])
Outcomes	#4	(survival*[all fields] OR implant survival[MeSH] OR dental implant survival[MeSH] OR marginal bone loss[MeSH] OR implant bone resorption[MeSH] OR dental implant bone loss[MeSH] OR complication*[all fields] OR dental implant complication[MeSH] OR postoperative complications[MeSH] OR randomized controlled trial[MeSH])
Search combination		#1 AND #2 AND #3 AND #4
Database search		
Language		No restriction
Electronic databases		MEDLINE/PubMed, Web of Science, and Cochrane Central Register of Controlled Trials

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