



Research Article

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Survival Rate of Immediately Loaded Implants Restored using the Intraoral Welding Technique: A Literature Review

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Abstract

Objective: The aim of this review is to determine survival rates of endosseous implants immediately loaded using intraoral welding technique.

Methods: The present review includes studies with patients planned for insertion of at least two adjacent dental implants into the maxilla and/or mandible followed by intraoral welding and immediate loading.

Results: Survival rate ranges between 97.92-100% at 12-24 months, 97-99.1% at 26-36 months. Survival rate is 99.3% at 60 months and 90.31% at 72 months.

Conclusions: long-term data are limited but survival rates are favourable over 60 month follow-ups. One-piece implants reveal higher survival rate in comparison with two-piece implants.

Keywords

Intraoral welding; Immediate loading; Survival rate

Introduction

The possibility of inserting dental implants within jawbones in order to replace missing teeth profoundly has changed dental treatment. Nowadays, there is an increased interest in dental implantology with less invasive surgical procedures and immediate oral rehabilitation. One-stage surgical approach with immediate loading makes possible immediate oral rehabilitation, which has proved good results on long-term [1,2].

The key factor associated to the success of the immediately loaded implants seems to be related to the absence of movement of 100 μ m or more just after their placement [3] and intraorally splinting of implant abutments just after implants placement stabilizes implants and reduces the range of implants' movement.

Immediate fixation of implants' abutments is possible with intraoral welding (IOW). During welding titanium wire is permanently connected to implant abutment. The welding between the titanium wire and the implants' abutments permits an immediate

and stable framework which provides support for temporary or long-term restorations.

Intraoral welding of titanium framework allows oral rehabilitation with fixed temporary or long-term prosthesis in the same day with surgery, which leads to multiple advantages due to reduced number of appointments: decreased chance of errors and damage, significantly lower cost, high rate of patient acceptance.

Intraoral welding is possible with a laser device - intraoral laser welding (ILW) or by electric resistance welding - intraoral welding (IOW). Electric resistance welding was introduced by Pier Luigi Mondani in 1976 and then developed and perfected [4] and is based on the creation of an electric arc between two electrodes under an argon gas flux and it is called "syncrystallisation" [5,6].

The aim of this review is to determine the survival rates of endosseous implants immediately loaded using IOW.

Methods

The present review includes studies with patients planned for insertion of at least two adjacent implants into the maxilla and/or mandible followed by IOW and immediate loading. Only studies involving dental implants and electric resistance welding are included without any restrictions to type of endosseous implant (Table 1).

Results

The electronic search in the database PubMed provided a total number of 36 abstracts that were considered potentially relevant. In the second phase of study selection, complete texts of 12 articles were sampled and reviewed and during this procedure all articles were selected for review (Table 2).

The majority of article selected are prospective studies and case reports; there are just two retrospective studies.

The data gathered after 12-24 months of evaluation shown an excellent survival rate between 97.92% [7] and 100% [8-16]. Among 26 and 36 months follow-up, survival rate range between 97% [17,18] and 99.1% [11].

Retrospective studies reported survival rate of 99.3% [17], at 60 months and 90.31% at 72 months [14].

Although implant survival is less than 100% in some situation, it is worthy to mention that prosthetic success is 100% because prosthetic restoration was adapted to the new situation [10,18].

Population	Edentulous or partially edentulous
Intervention	Dental implantation with IOW and immediate loading
Outcome	Implant success, marginal bone level under functional loading
Search combination	"intraoral welding": 36 hits
Database search	Electronic PubMed
Selection criteria	-Inclusion criteria Clinical studies with oral rehabilitation with endosseous implant and IOW, published in English -Exclusion criteria Studies in languages other than English, Studies with animal models or experimental in vitro studies, welding of dentures of orthodontics device Studies with mean follow-up time < 1 year

Table 1: Search strategy.

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Study	Study Type	No. of patients	Implant design	Implants	Indication (jaw region)	Follow-up (months)	Implant success rate	Mean marginal bone loss (mm)
Avvanzo et al. [7]	RCR	16	One-piece, Two piece	48	Maxilla	24	97.92%	ND
Degidi et al. [8]	PS	20	Two piece	153	Maxilla	12	100%	0.57
Degidi et al. [9]	PS	40	Two piece	160	Mandible	24	100%	0.91
Degidi et al. [10]	PS	30	Two piece	210	Maxilla	36	97.8% axial implant 99.2% tilted implant	0.92 axial implant 1.03 tilted implant
Degidi et al. [11]	PS	60	Two-piece	324	Maxilla and mandible	36	99.1%	0.967 maxilla 1.016 mandible
Degidi et al. [12]	PS	10	Two-piece	40	Maxilla	12	100%	ND
Degidi et al. [13]	PS	22	Two-piece	88	Mandible	12	98.9%	ND
Degidi et al. [14]	RS	52	Two-piece	256	Maxilla and mandible	72	90.31% 92.12% maxilla 87.89% mandible	1.39 maxilla 1.29 mandible
Fogli et al. [15]	CR	1	Two-piece	5	Mandible	12	100%	ND
Ghaleh Golab et al. [16]	PS	ND	One-piece	46	Maxilla and mandible	12	100%	ND
Hruska et al. [17]	RS	ND	One-piece	436	Maxilla and mandible	60	99.3%	ND
Marchesi et al. [18]	PS	17	Two-piece	68	Maxilla	26.5	97%	ND

Table 2: Summary of studies on intraoral welding.

CR case report

ND no data available or data cannot be separated

PS prospective study

RCR retrospective case report

RS retrospective study

Five studies documented also mean marginal bone loss, which is 0.57 mm after 12 months [8], 0.91 mm after 24 months [9], 0.92 mm and 1.03 mm after 36 months [10,11], and 0.967 for maxilla and 1.016 for mandible after 72 months [14]. Ghaleh Golab et al. [16] reported 0.59 mm marginal bone loss at 12 months for one-piece implants immediate loaded, but data cannot be separated for IOW implants.

Discussion

Intraoral welding has been used for many years [19] to weld titanium frameworks to abutments in order to allow immediate loading on implants inserted in edentulous jaws. In current dental literature IOW was reported in association with implantation in challenging situations like: augmented sites [7], split-crest and sinus lift [8], zygomatic implants [12], one piece implant [7,16,17,20,21], tilted implant [10], cyst enucleation and bone substitutes [22]. IOW is helpful in oral rehabilitation of atrophic maxilla and mandible with one-piece implant [20,23] and even needle implant [24,25]. Dal Carlo et al. [25] reported a rate of survival of 95.8% at 10 years for needle implant in posterior segment of mandible.

One advantages of intra-oral syncrystallization welding technology is the formation of a passive-fitting implant prosthesis, and provides a framework that accommodate any anatomic situation using any implant system [26].

Due to metal framework a significant reduction of deformation and strain within metal-reinforced provisional restorations was noticed and less time spent for repairing provisional restorations as a result of no or less frequent fracture [6].

When comparing ILW with IOW, laser welding gives a lower thermal increase than electric resistance welding at the bone close to implants and the strength of laser welded joints was higher than that of electric resistance welding, even if not statistically significant [27]. In comparison with ILW, IOW is cheaper, simpler, faster, and without parameters to adjust.

Up to date, there are few retrospective studies available to document survival rate of intraoral welded implants, although IOW is used for many years. There are case reports that described successful rehabilitation with IOW over seven years with satisfactory bone preservation [28].

Survival rates of welded implants appear to be similar compared with non-welded implants immediate loaded. Ji et al. [29] described 85.2% survival rate of immediate loaded implant for edentulous maxilla and mandible at a mean follow-up of 42.1 months and Rocci et al. [30] reported survival rate over 85.5% at 9 years follow-up. In the current review, the majority of investigated studies reported survival rates >95% and no study reported survival rates below 87.89%. This might suggest a reliable therapy option, but evaluation of the success of IOW implants should not be carried out exclusively on implant survival; also marginal bone level should be considered. This parameter is less considered, but selected studies report acceptable rate of bone resorption, comparable with data from the current dental literature [31].

One -piece implants present higher rate of survival in comparison with two-piece implants when are used with IOW; 99.3% at 60 months for one-piece implants and 90.31 for two-piece implants at 72 months. This fact is in accordance with long-term survival of one-piece implants [32]. One piece implants present fewer complications in comparison of two-piece implants and reduced the cost associated with bone grafting [33] and are useful in demanding situations like atrophic jaws, lingualized occlusion [34].

Conclusion

Survival rate of implants welded intraorally with electric resistance welding is well documented for short and medium-term time period. Long-term data are limited, but survival rates are favourable over 60 month follow-ups. One-piece implants present higher survival rate in comparison with two-piece implants. Intraoral welding seems to be

especially helpful for demanding oral rehabilitation with endosseous implants.

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