Systematic Review

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Outcomes of Immediately & Conventionally Loaded Dental Implants

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Author`s Contribution

[1]Substantial contributions to the conception or design of the work; or the acquisition, [1]Final approval of the study to be published/ supervision,[2]Active participation in active methodology, [2]analysis, or interpretation of data for the work, [3]Drafting the work or revising it critically for important intellectual content

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ABSTRACT

Clinical dentistry has been subjected to a revolution by introduction of "Osseo integrated" dental implants. New trends have always been of keen interest in "implant prosthodontics". The aim behind this systematic review was to compare & assimilate the outcomes of "immediately" & "conventionally" loaded dental implant prosthesis.

A thorough electronic search was conducted on PubMed, Science Direct, and Research Gate to find pertinent scientific publications published between 2000 and 2021 in order to fulfil the aforementioned goal. Six published papers were considered and chosen for this project after being carefully examined to ensure they matched the eligibility requirements.

Regarding the results, there was no discernible difference in the implant groups that were loaded "immediately" and "conventionally" in terms of success. As long as immediately loaded implants exhibited considerable primary stability, there was no discernible difference between the two groups in terms of marginal bone levels, masticatory efficiency, bleeding on probing, implant stability quotients, or peri-implant soft tissue shapes.

In selected patients "immediate loading protocol" can successfully & predictably be practiced ensuring that adequate "primary implant stability" has been achieved.

Key words: Immediate loading, conventional loading, comparison, survival Cochrane.
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Introduction

Clinical dentistry has been subjected to a revolution by introduction of "Osseo integrated"dental implants. Primary implant stability at time of introduction in the bone & following its loading is a rudimental prerequisite for successful implant treatment.[1]

To minimize the risk of implant loss, it has been the practice for many years to keep the implant submerged for a period of 03-06 months for optimum osseointegration to occur.[2] Concerns regarding prolonged duration of treatment were raised; devising the protocol of immediate loading with provisional prosthesis at time of surgical intervention. Howbeit using such protocol, fibrous encapsulation of implants was reported which ultimately culminated in implant failure[3]. Later advancements in implant characteristics & surgical techniques led to indication that immediate loading protocol can be successful.[4-6]

The concept of "immediate loading (IL)" has earned popularity recently on account of several variables such as reduced treatment duration & trauma along with psychological & aesthetic felicity to subjects. To add more, "IL protocol" maintains peri-implant soft tissues' height & enhanced bone quality & density in implant vicinity.[7] Initial stability of implant inserted via "IL protocol" is of paramount importance & influenced by several contributing factors such as implant topography, splinting, bone quality, control of occlusal load & lack of evidence of detrimental patient habits. Success rate of 95-

100% has been reported with "IL" protocol by several studies.[8-10]

The aim behind design of current systematic review was to compare & assimilate the success outcomes of immediately versus conventionally loaded implants. There is no remarkable difference in outcome rates between "immediate" & "conventional loading" protocols in view of previously conducted studies.

Methodology

PRISMA statement was applied on the methodology of this quantitative study. PICOS format was used to structure the question serving for relevant literature search as described in table I.

Table 1: PICOS Search Strategy

"P= Population"	Human subjects with stable dental implants
"I= Intervention"	Immediate loading of dental implants
"C= Comparison"	Conventional loading of dental implants
"O= Outcomes"	Masticatory efficiency, Mucogingival junction contours (MGJ), implant stability quotient (ISQ), bleeding on probing & marginal bone loss (MBL)
"S= Study design"	Randomized control trials (RCTs) & Prospective cohort studies

A detailed online search for available literature was conducted in international databases such as PubMed, Research gate , and Science Direct, between 2000 to 2021. "MeSH" words used for relevant literature search were "comparison", "contrast", "difference", "immediate loading","conventional loading" & "dental implants". The "Boolean terms" used for search were "and", "versus" & "or".

Inclusion Criteria:

- Studies on human subjects
- Literature published in English only
- Randomized control trials (RCTs)
- Prospective Cohort studies

Exclusion Criteria:

- Invitro/ animal studies
- Literature published in other languages
- Case series/ case reports/review articles
- Co-morbidities (metabolic/ physical disorders)
- Smoking/alcoholism/ drug abuse

The process of study recruitment was done in two rounds by authors N.N & Z.I in each round. The decision of third investigator B.A was considered final in case of disagreement between two primary authors. Titles /abstracts of the articles were reviewed in this first round. After removal of duplications, nine hundred & ninety three articles were retrieved from afore mentioned databases. After screening twenty two articles were considered for further scrutiny. These articles were subjected to afore mentioned exclusion & inclusion criteria; yielding 13 articles for full text analysis. After reviewing full text literature in round two, 6 articles were finally considered for this systematic review considering that appropriate information regarding the comparison of immediate & conventionally loaded dental implants was provided.

Following the search of initial literature, relevance of present study was assessed by reviewing titles & abstract of retrieved articles. After which, the complete texts of the included articles were subjected to assessment for detailed scrutiny.

Results

Quality Assessment of finalized studies

Table III depicts the quality assessment of the selected researches done independently by two researchers (N.N & Z.I). Risk of bias was evaluated by applying "Cochrane collaboration tool" on selected studies. The shortlisted studies were assessed according to recommended tools by the investigators (N.N & Z.I.); considering an average value of each question as a final answer.

After detailed scrutiny & application of exclusion & inclusion criteria, six studies were finalized for this systematic review. PRISMA flow diagram following 2009 guidelines (Figure 1) shows the criteria followed for recruiting the shortlisted studies.

Characteristics of selected studies:

Table IV shows the attributes of studies shortlisted in current systematic review. The total number of dental implants installed in 6 RCTs was 491. The number of subjects in these studies fell in range of 15 to 60 & total subjects were 174. The selected subjects' age range fell in between 25-71 years. The time period of follow-up in selected studies ranged from 12-120 months.

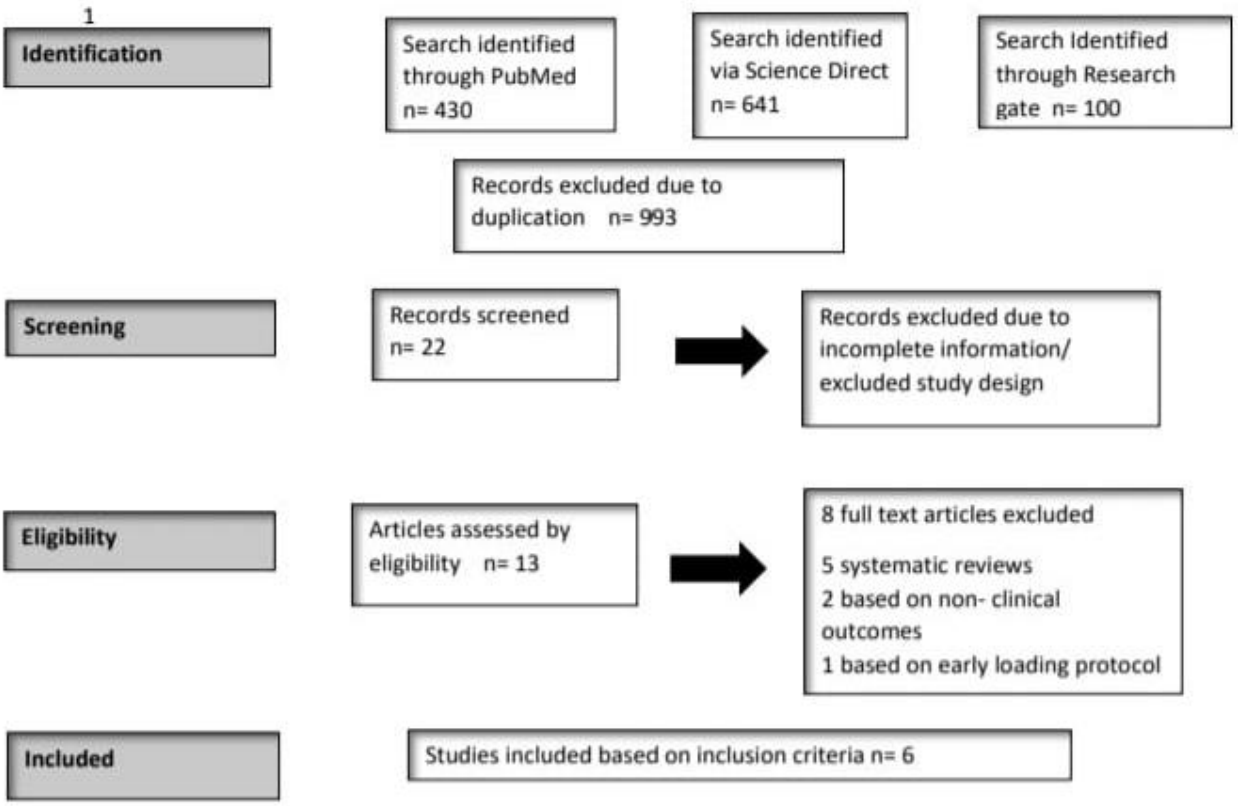

Figure 1: PRISMA flow diagram highlighting study selection & screening process

Table II: Quality assessment of selected studies using Cochrane tool for risk assessment where"+" shows low bias, "-" shows high bias risk & "?" shows unclear bias.

	Bernard et al 2019	Katheng et al 2021	Alfadda et al 2019	Shibly et al 2010	Guruparasada et al 2012	Daher et al 2020
Random sequence generation	+	+	+	+	+	+
Allocation Concealment	–	+	+	+	–	+
Blinding of participants & personnel	–	–	–	+	–	–
Blinding of outcome assessment	?	?	+	+	–	+
Incomplete outcome data	+	+	+	+	+	+
Selective reporting	+	+	+	+	+	+
Other bias	?	?	?	?	?	?

"Immediate implant" insertion in fresh extraction sites was carried out in only one study[11]; remaining studies utilized healed sockets. All surgeries involved intraoperative flap raising protocol except the one conducted by Bernard et al. The implant brand employed commonly in finalized studies was "Nobel Biocare."[11,13-15] Only three studies mentioned the exact location of placed implants i-e Alfadda et al (interforamen region), Guruparasada et al (1st mandibular molar region) & Daher et al (maxillary premolar & molar region).[13,14,15]

The healing period followed for conventional loading protocol was 3-6 months after which implants were subjected to definitive loading. In three of the short listed studies, implants in "IL group" were subjected to load at the time of surgery while in other 3 studies, loading was delayed until 48-72 hours. Minimum insertion torque for implant installation was 10-35 Ncm. Only one study measured implant stability quotient (ISQ) of > 60 for 80%

Table III Characteristics of the studies selected.

Authors (years)	Loading protocol	Follow up period (months)	No. of participants	Gender (male/ female)	Age Range (years)	Region	No. of drop- outs	Implant number/ Brand of implants	Implant size (Diameter & length in mm)
Bernard et al (2019)	Conventional Immediate	24	8 7	7/1 5/2	49-70 45-71	Maxilla	0	90 Ankylos; Dentsply Sirona	3.5-5.5 9.5-14
Ketheng et al (2021)	Conventional Immediate	60	9 10	3/6 6/4	66.1 69.2	Mandible	6	38 Nobel Speedy Groovy RP	4 10-18
Alfaddah et al (2019)	Conventional Immediate	120	22 20	11/11 7/13	61.1-61.5 61.3-60.6	Interforamen region	8	168 Nobel Biocare	3.30-4.00 10-15
Shibly et al (2012)	Conventional Immediate	12	30 30	25/35	25-94	Maxilla/Mandible	5	55 Nobel Biocare	4.3-5 10-13
Guruparasada et al (2013)	Conventional Immediate	12	10 10	NR	25-50	1st mandibular molar	0	20 Nobel Biocare	3.5-4.3 10-13
Daher et al (2021)	Conventional Immediate	12	18 (split mouth technique)	7/11	34-67	Maxillary posteriors	8	120 Nobel Biocare	3.5-5 10-15

of immediately & 71.7% for conventionally loaded implants.``[15] All included studies made use of antibiotics & chlorhexidine mouth rinses following implant surgery while Alfadda et al & Guruparasada et al mentioned the use of pre-operative antibiotics as well.[13-14]

Measures of outcome assessment:

Four studies measured marginal bone level changes while one of them (Shibly et al) also took into account, the contour of mucogingival junction (MGJ); which was relocated to the coronal aspect in 65% implant sites in conventionally loaded group as compared to immediately loaded group which was 15% . Bernard et al also took into account the bleeding on probing which was almost same in both the groups. Guruparasada et al also measured the health of peri-implant soft tissue via "Gingival index (G.I)", "Plaque index (P.I)" & "Calculus Index (C.I)" which was same in both the groups. The radiographs used for this purpose by Alfaddah et al, Shibly et al & Bernard et al were standardized periapical views. While Guruparasada reported using panoramic radiographs in addition to periapical views. Marginal bone loss (MBL) ranged from 0.06 to 1.15 mm. Katheng et al measured the outcomes via masticatory performance (M.P), using color changeable chewing gum & gummy jelly test which showed no significant difference in both groups. On the other hand Daher et al took into account the implant stability quotient to measure radiofrequency analysis of loaded implants via Osstell (Osstell AB, Gothenburg, Sweden) where ISQ ranged from 67.9 to 71.7 at 12 months follow-up.[11-15] Figure 2 shows implant survival rates of immediately & conventionally loaded implants

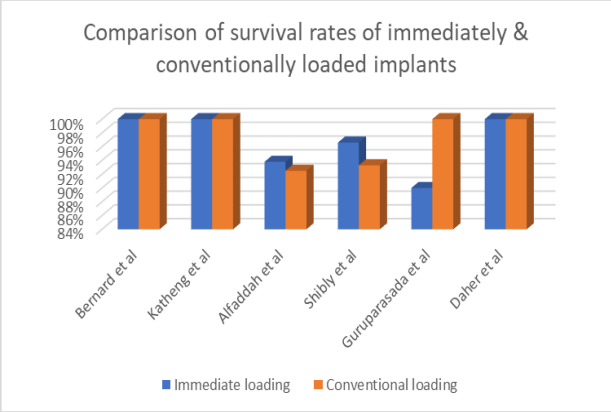

Figure 2. Implant survival rates of immediate vs conventionally loaded implants.

Discussion

The systematic reviews that undertake "RCTs" to analyze their results, show high level of scientific validation to answer a clinical querry as risk of bias is likely to be high in non- randomized clinical trials.[17-19] For present systematic review six RCTs comparing the results of immediately versus conventionally loaded implants were selected.

"IL protocol" has significant survival rate, reduces the treatment span & is associated with definite patient benefit. Undoubtfully conventional loading protocol had been in use for so many years, dictating the fact that higher scientific evidence is available for this protocol as compared to "IL protocol". Howbeit a longitudinal prospective study on "IL protocol" showed commendable improvement in life quality & patient satisfaction after implant placement.[20-22]

Previous publications have shown that primary stability has a pivotal role in success of "IL protocol"; diminished initial stability being a key factor in early implant failure. In contrast, another publication revealed a high final success rate of implants loaded immediately subjected to low insertion torques i-e < 25 N-cm[23-30]Hence, ideal value of insertion torque dictating successful osseointegration still needs to be set by conducting further investigations.

In current systematic review, two of the shortlisted studies used non-functional "IL- protocol"[14-15]. This is attributed to the fact that overdue stress at bone-implant interface & subsequent implant failure might occur when implant is subject to load beyond bearing capacity of peri-implant bone. Micromotion below certain threshold can be tolerated at this interface. Howbeit biomechanics at interface of bone-implant should be paid special importance to decrease the load on implant & the prosthesis it supports.[30-33]

Implant micromotion can also be reduced by altering surface attributes of implants. Implant surface characteristics potentiates the generation of lamellar bone & enhances implant-bone contact which in turns favors the "IL protocol". Surface conditioning of implant can be utilized as a compensation of risk of "IL protocol"[34-36].In contrast another study revealed that implant stability is more critical to design rather than surface characteristics of implants. Primary implant stability improved when implant length was decreased & width of implants was enhanced.[37-40]

All six shortlisted studies, revealed no statistically remarkable difference between two loading protocols. Reported implant losses in selected studies, occurred within 03 months of healing period; therefore they can be labelled as "early implant loss."[41-44]

"IL protocol" when used rationally, may have an additive effect on marginal bone levels. The initial implant stability reduces 3-6 weeks following insertion due to osseous remodeling; strain during this period can be minimized by implant splinting & by reducing the occlusal loads. Strain in balanced amounts is responsible for exciting osteocytes, contributing to development of increased bone to implant contact area & well-organized osteological configuration.[45-46] Bone loss in implant vicinity can be contributed by multitude of factors such as surgeon's skills, bone type, type of implant used & patient centered factors.[47-50]

Conclusion

Upshots of this systematic review reveal that advancements in implant characteristics have led to successful implant placement & outcomes using "IL protocol". Regardless of the site of implant placement (maxilla or mandible) & assessment of bone quality & density, all studies revealed considerably high success rates for "IL protocol" which was comparable to that of conventionally loaded group. Thus in suitable patients, "IL protocol" can predictably be achieved depending on expertise & experience of clinician. Howbeit, primary/initial implant stability is a basic pre-requisite for successful outcome & should be taken into account while opting "IL protocol".

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