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SYSTEMATIC REVIEW

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Esthetic patient satisfaction, marginal bone loss and peri-implant tissue success in esthetic zone: systematic review

Satisfação estética do paciente, perda óssea marginal e sucesso do tecido peri-implantar na zona estética: revisão sistemática

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ABSTRACT

Increased patient demands for highly esthetic implant superstructure in the anterior esthetic zone has increased in the last decades. Moreover, the absence of periodontal ligament in implant supported prosthesis causes forces to be transferred without cushioning effect to the alveolar bone, resulting in increased marginal bone loss (MBL) and influence the heath of peri-implant tissue. Evaluate the available evidence on the effect implant superstructure and it consequences on patient satisfaction, MBL, bleeding on probing (BOP) and probing depth (PD). A protocol of electronic and hand research was performed for English based researches comparing implants inserted in the esthetic zone with all ceramic superstructure: "Will the use of different types of all ceramic superstructure show different esthetic patient satisfaction, marginal bone loss, bleeding on probing and probing depth? Thirteen publications from one thousand one hundred and sixteen research studies were included. This systematic review showed that all ceramic implant superstructure was a versatile treatment option with higher esthetic patient satisfaction and better color of peri-implant mucous especially in patients having thin biotype. On the other hand there wasn't significant difference in MBL, PD and BOP compared to other conventional implant superstructure. More randomized controlled clinical trials with bigger samples are needed to confirm our findings. All ceramic implant superstructure is versatile and highly esthetic treatment option for implant placed in the anterior esthetic zone.

KEYWORDS

Esthetic; Patient satisfaction; Tissue success; Marginal bone loss; Superstructure.

RESUMO

A demanda do paciente por superestruturas de implante altamente estéticas na zona anterior aumentou nas últimas décadas. Além disso, a ausência de ligamento periodontal em próteses implantossuportadas faz com que as forças sejam transferidas para o osso alveolar sem amortecimento, resultando em aumento da perda óssea marginal (MBL) e influenciando na saúde do tecido peri-implantar. Avaliar as evidências disponíveis sobre o efeito da superestrutura do implante e suas consequências na satisfação do paciente, perda óssea marginal, sangramento à sondagem (SS) e profundidade de sondagem (PS). Um protocolo de pesquisa eletrônica e manual foi realizado para a análise de artigos em inglês comparando implantes com toda a superestrutura em cerâmica inseridos na zona estética: "O uso de diferentes tipos de superestrutura em cerâmica mostrará diferentes níveis de satisfação estética do paciente, perda óssea marginal, sangramento em profundidade de sondagem e sondagem?". Foram selecionadas 1116 publicações e apenas treze estudos foram incluídos na análise final. Esta revisão sistemática mostrou que toda superestrutura do implante em cerâmica foi uma opção de tratamento versátil, com maior satisfação estética do paciente e melhor coloração da mucosa peri-implantar, especialmente em pacientes com biótipo fino. Por outro lado, não houve diferença significativa em MBL, PS e SS em comparação com outras superestruturas de implantes convencionais. Porém, mais ensaios clínicos controlados randomizados com amostras maiores são necessários para confirmar nossos achados. Implicações clínicas: Toda superestrutura do implante em cerâmica é uma opção de tratamento versátil e altamente estética para implantes colocados na zona anterior.

PALAVRAS-CHAVE

Estética; Satisfação do paciente; Sucesso tecidual; Perda óssea marginal; Superestrutura.

INTRODUCTION

The use of endosseus dental implants represents a treatment option with high survival rates for the implant superstructure complex [1]. Achieving an optimal esthetic outcome especially with implant in the esthetic zone remains a major challenge. An ideal esthetic implant restoration is defined as a combination of a natural looking superstructure and healthy peri-implant soft and hard tissues [2].

In clinical studies, esthetic indices for the peri-implant mucosa and the implant supported restoration have been used to evaluate the esthetic outcome and to compare the data with those of other studies. The long-term clinical and esthetic success of dental implants supported restorations depends primarily on the preservation of soft and hard tissues surrounding implant replicating the natural teeth [3], thus the overall amount of marginal bone loss may influence the clinical and esthetic outcomes.

To assess a dental implant's success, different criteria have been described, such as: absence of peri-implant radiolucency, absence of mobility, annual bone loss of less than 0.2 mm after the first year of loading and absence of pain, infection and paresthesia [4]. Initial breakdown of peri-implant bone occurs in the marginal bone surrounding the implant neck. Physiological bone resorption ranging from 1.5 to 2mm is observed during the first year of function. Successive annual bone loss of 0.2mm occurs after the first year of loading [5].

Aim of research

The objectives of the current research review study was to assess the effect of implant superstructure on esthetic patient satisfaction, marginal bone loss and peri-implant tissue success.

MATERIALS AND METHODS

Types of publications

The present review searched for prospective cohort studies, controlled clinical trials (CCTs) and Randomized controlled clinical trials (RCTs) that analyzed esthetic patient satisfaction, marginal bone loss and peri-implant tissue success.

Study variables: different implant design, different implant brands, different loading protocols and different imaging technique.

Source of information and search strategy

For the identification of studies to be involved in this review, a computer search strategy was developed for the following electronic databases: PubMed/ MEDLINE and Cochrane Library. The search was limited to studies involving human subjects, published in English. A further manual search was performed. The search was completed by adding a manual review of the references of the included studies. Searching keywords is listed in Table I.

Table I - Searching keywords

PICO Items	Synonyms
Missing teeth (P1)	Lost teeth, extracted teeth, missing tooth, lost tooth, partially edentulous, congenitally missing teeth, dental space, free space, multiple spaces, multiple dental spaces.
Esthetic zone (P2)	Anterior region, anterior area, esthetic region, esthetic area, esthetic spaces, anterior zone, anterior teeth, anterior tooth, upper central, lower central, central incisors, canines, lateral incisors, upper premolar, lower premolar, incisor zone, anterior partially edentulous, dental implant esthetic zone, smile zone, dental smile zone, smile esthetic zone, esthetic zone implant, esthetic zone.
Dental Ceramic (C)	New ceramic, new dental ceramics, new ceramic superstructure, new ceramic full coverage crown, monolithic dental ceramics, one layer ceramics, two layers ceramics, translucent ceramic, bondable ceramics, silica crowns, glass ceramics, IPS e-max, e-max, e-max cad, e-max press, e-max crowns, e-max crown, Pressable ceramic.
Hybrid Ceramic. (I)	Resin ceramic, composite ceramic, dental hybrid ceramics, Nano hybrid ceramics, hybrid ceramic superstructure, resin ceramic superstructure, hybrid ceramic full coverage, compound ceramics, hybrid ceramics.
Implant	dental implants, oral implants, fixture, dental fixture, oral fixtures, dental insert, oral insert, titanium implant, Ti implant, ceramic implant, Zirconia implant, zircon implant, ceramic fixture, Zirconia fixture, titanium fixture, Ti fixture.
Abutment	Zirconia abutment, zircon abutment, Zirconia healing abutments, zircon healing abutments, ceramic abutments, ceramic gingival former, zirconium gingival former, zircon gingival former, healing cap, metallic abutment, non-metallic abutment, non-metallic healing cap, straight abutment, angled abutments, straight abutments, implant superstructure.

Note. Searching keywords used in the systematic review.

The following search string was applied: ((((((((((((Lost teeth) OR Extracted teeth) OR missing tooth) OR lost tooth) OR partially edentulous) OR congenitally missing teeth) OR dental space) OR free space) OR multiple spaces) OR multiple dental spaces)) OR ((((((((((((((((((((((anterior region) OR anterior area) OR esthetic region) OR esthetic area) OR anterior zone) OR anterior teeth) OR anterior tooth) OR upper central) OR lower central) OR central incisors) OR canines) OR lateral incisors) OR esthetic spaces) OR upper premolar) OR lower premolar) OR incisor zone) OR anterior partially edentulous,) OR dental implant esthetic zone) OR smile zone) OR dental smile zone) OR smile esthetic zone) OR esthetic zone implant) OR esthetic zone))) AND ((((((((((((((((((New ceramic) OR new dental ceramics) OR new ceramic superstructure) OR new ceramic full coverage crown) OR monolithic dental ceramics) OR one layer ceramics) OR two layers ceramics) OR translucent ceramic) OR bondable ceramics) OR silica crowns) OR glass ceramics) OR IPS e-max) OR e-max) OR e-max cad) OR e-max press) OR e-max crowns) OR e-max crown) OR Pressable ceramic)) OR ((((((((Resin ceramic) OR composite ceramic) OR dental hybrid ceramics) OR Nano hybrid ceramics) OR hybrid ceramic superstructure) OR resin ceramic superstructure) OR hybrid ceramic full coverage) OR compound ceramics) OR hybrid ceramics))

Study selection

Two authors (SB and NF) independently screened the titles derived from the extended search, based on the inclusion criteria; whenever conflict occurred a 3rd author was consulted

Data base index:

The essential items of interest from PICO are:

P: Missing teeth

I: Hybrid Ceramics

C: Dental Ceramic and E-max.

PubMed database:

A) "P1" combined with OR:

Articles: 6,218

Filters: Clinical trial

Time = 23/6/2020

Search strategy: ((((((((Lost teeth) OR extracted teeth) OR missing tooth) OR lost tooth) OR partially edentulous) OR congenitally missing teeth) OR dental space) OR free space) OR multiple spaces) OR multiple dental spaces

URL of "P" in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28Lost+teeth%29+OR+extracted+teeth%29+OR+missing+tooth%29+OR+lost+tooth%29+OR+partially+edentulous%29+OR+congenitally+missing+teeth%29+OR+dental+space%29+OR+free+space%29+OR+multiple+spaces%29+OR+multiple+dental+spaces

B) "P2" combined with OR:

Articles: 18,172

Filters: Clinical trial

Time = 23/6/2020

Search strategy: ((((((((((((((((((((Anterior region) OR anterior area) OR esthetic region) OR esthetic area) OR anterior zone) OR anterior teeth) OR anterior tooth) OR upper central) OR lower central) OR central incisors) OR canines) OR lateral incisors) OR esthetic spaces) OR upper premolar) OR lower premolar) OR incisor zone) OR anterior partially edentulous,) OR dental implant esthetic zone) OR smile zone) OR dental smile zone) OR smile esthetic zone) OR esthetic zone implant) OR esthetic zone

URL of "I1" in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28Anterior+region%29+OR+anterior+area%29+OR+esthetic+region%29+OR+esthetic+area%29+OR+anterior+zone%29+OR+anterior+teeth%29+OR+anterior+tooth%29+OR+upper+central%29+OR+lower+central%29+OR+central+incisors%29+OR+canines%29+OR+lateral+incisors%29+OR+esthetic+spaces%29+OR+upper+premolar%29+OR+lower+premolar%29+OR+incisor+zone%29+OR+anterior+partially+edentulous%2C%29+OR+dental+implant+esthetic+zone%29+OR+smile+zone%29+OR+dental+smile+zone%29+OR+smile+esthetic+zone%29+OR+esthetic+zone+implant%29+OR+esthetic+zone

C) "C" combined with OR:

Articles: 587

Filters: Clinical trial

Time = 23/6/2020

Search strategy: ((((((((((((((((New ceramic) OR new dental ceramics) OR new ceramic superstructure) OR new ceramic full coverage crown) OR monolithic dental ceramics) OR one layer ceramics) OR two layers ceramics) OR translucent ceramic) OR bondable ceramics) OR silica crowns) OR glass ceramics) OR IPS e-max) OR e-max) OR e-max cad) OR e-max press) OR e-max crowns) OR e-max crown) OR Pressable ceramic

URL of "C" in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28New+ceramic%29+OR+new+dental+ceramics%29+OR+new+ceramic+superstructure%29+OR+new+ceramic+full+coverage+crown%29+OR+monolithic+dental+ceramics%29+OR+one+layer+ceramics%29+OR+two+layers+ceramics%29+OR+translucent+ceramic%29+OR+bondable+ceramics%29+OR+silica+crowns%29+OR+glass+ceramics%29+OR+IPS+e-max%29+OR+e-max%29+OR+e-max+cad%29+OR+e-max+press%29+OR+e-max+crowns%29+OR+e-max+crown%29+OR+Pressable+ceramic&ac=no&user_filter=clinical+trial&schema=none

D) "I" combined with OR:

Articles: 570

Filters: Clinical trial

Time = 23/6/2020

Search strategy: (((((((Resin ceramic) OR composite ceramic) OR dental hybrid ceramics) OR Nano hybrid ceramics) OR hybrid ceramic superstructure) OR resin ceramic superstructure) OR hybrid ceramic full coverage) OR compound ceramics) OR hybrid ceramics

URL of "C" in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28Resin+ceramic%29+OR+composite+ceramic%29+OR+dental+hybrid+ceramics%29+OR+Nano+hybrid+ceramics%29+OR+hybrid+ceramic+superstructure%29+OR+resin+ceramic+superstructure%29+OR+hybrid+ceramic+full+coverage%29+OR+compound+ceramics%29+OR+hybrid+ceramics

E) "Implant" combined with OR:

Articles: 5,461

Filters: Clinical trial

Time = 23/6/2020

Search strategy:

URL of "Implant" in PubMed: ((((((((((((((dental implants) OR oral implants) OR fixture) OR dental fixture) OR oral fixtures) OR dental insert) OR oral insert) OR titanium implant) OR Ti implant) OR ceramic implant) OR Zirconia implant) OR zircon implant) OR ceramic fixture) OR Zirconia fixture) OR titanium fixture) OR Ti fixture https://pubmed.ncbi.nlm.nih.gov/?term=+%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28dental+implants%29+OR+oral+implants%29+OR+fixture%29+OR+dental+fixture%29+OR+oral+fixtures%29+OR+dental+insert%29+OR+oral+insert%29+OR+titanium+implant%29+OR+Ti+implant%29+OR+ceramic+implant%29+OR+Zirconia+implant%29+OR+zircon+implant%29+OR+ceramic+fixture%29+OR+Zirconia+fixture%29+OR+titanium+fixture%29+OR+Ti+fixture+

F) "Abutment" combined with OR:

Articles: 400

Filters: Clinical trial

Time = 23/6/2020

Search strategy: ((((((((((((((Zirconia abutment) OR zircon abutment) OR Zirconia healing abutments) OR zircon healing abutments) OR ceramic abutments) OR ceramic gingival former) OR zirconium gingival former) OR zircon gingival former) OR healing cap) OR metallic abutment) OR non-metallic abutment) OR nonmetallic healing cap) OR straight abutment) OR angled abutments) OR straight abutments) OR implant superstructure

URL of "I2" in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28Zirconia+abutment%29+OR+zircon+abutment%29+OR+Zirconia+healing+abutments%29+OR+zircon+healing+abutments%29+OR+ceramic+abutments%29+OR+ceramic+gingival+former%29+OR+zirconium+gingival+former%29+OR+zircon+gingival+former%29+OR+healing+cap%29+OR+metallic+abutment%29+OR+non-metallic+abutment%29+OR+nonmetallic+healing+cap%29+OR+straight+abutment%29+OR+angled+abutments%29+OR+straight+abutments%29+OR+implant+superstructure

G) “C” OR “I” combined with OR:

Articles: 981

Filters: Clinical trial

Time = 23/6/2020

Search strategy: (((((((((((((((((New ceramic) OR new dental ceramics) OR new ceramic superstructure) OR new ceramic full coverage crown) OR monolithic dental ceramics) OR one layer ceramics) OR two layers ceramics) OR translucent ceramic) OR bondable ceramics) OR silica crowns) OR glass ceramics) OR IPS e-max) OR e-max) OR e-max cad) OR e-max press) OR e-max crowns) OR e-max crown) OR Pressable ceramic)) OR ((((((((Resin ceramic) OR composite ceramic) OR dental hybrid ceramics) OR Nano hybrid ceramics) OR hybrid ceramic superstructure) OR resin ceramic superstructure) OR hybrid ceramic full coverage) OR compound ceramics) OR hybrid ceramics)

URL of “C” OR “I” in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28New+ceramic%29+OR+new+dental+ceramics%29+OR+new+ceramic+superstructure%29+OR+new+ceramic+full+coverage+crown%29+OR+monolithic+dental+ceramics%29+OR+one+layer+ceramics%29+OR+two+layers+ceramics%29+OR+translucent+ceramic%29+OR+bondable+ceramics%29+OR+silica+crowns%29+OR+glass+ceramics%29+OR+IPS+e-max%29+OR+e-max%29+OR+e-max+cad%29+OR+e-max+press%29+OR+e-max+crowns%29+OR+e-max+crown%29+OR+Pressable+ceramic%29%29+OR+%28%28%28%28%28%28%28%28%28Resin+ceramic%29+OR+composite+ceramic%29+OR+dental+hybrid+ceramics%29+OR+Nano+hybrid+ceramics%29+OR+hybrid+ceramic+superstructure%29+OR+resin+ceramic+superstructure%29+OR+hybrid+ceramic+full+coverage%29+OR+compound+ceramics%29+OR+hybrid+ceramics%29

H) “P1 or P2” AND “C OR I” combined with AND:

Articles: 261

Filters: Clinical trial

Time = 23/6/2020

Search strategy:

((((((((((((Lost teeth) OR Extracted teeth) OR missing tooth) OR lost tooth) OR partially edentulous) OR congenitally missing teeth) OR dental space) OR free space) OR multiple spaces) OR multiple dental spaces)) OR (((((((((((((((((((((anterior region) OR anterior area) OR esthetic region) OR esthetic area) OR anterior zone) OR anterior teeth) OR anterior tooth) OR upper central) OR lower central) OR central incisors) OR canines) OR lateral incisors) OR esthetic spaces) OR upper premolar) OR lower premolar) OR incisor zone) OR anterior partially edentulous,) OR dental implant esthetic zone) OR smile zone) OR dental smile zone) OR smile esthetic zone) OR esthetic zone implant) OR esthetic zone))) AND ((((((((((((((((((New ceramic) OR new dental ceramics) OR new ceramic superstructure) OR new ceramic full coverage crown) OR monolithic dental ceramics) OR one layer ceramics) OR two layers ceramics) OR translucent ceramic) OR bondable ceramics) OR silica crowns) OR glass ceramics) OR IPS e-max) OR e-max) OR e-max cad) OR e-max press) OR e-max crowns) OR e-max crown) OR Pressable ceramic)) OR ((((((((Resin ceramic) OR composite ceramic) OR dental hybrid ceramics) OR Nano hybrid ceramics) OR hybrid ceramic superstructure) OR resin ceramic superstructure) OR hybrid ceramic full coverage) OR compound ceramics) OR hybrid ceramics))

URL of “P” AND “C OR I1” in PubMed: https://pubmed.ncbi.nlm.nih.gov/?term=%28%28%28%28%28%28%28%28%28%28%28%28Lost+teeth%29+OR+Extracted+teeth%29+OR+missing+tooth%29+OR+lost+tooth%29+OR+partially+edentulous%29+OR+congenitally+missing+teeth%29+OR+dental+space%29+OR+free+space%29+OR+multiple+spaces%29+OR+multiple+dental+spaces%29%29+OR+%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28anterior+region%29+OR+anterior+area%29+OR+esthetic+region%29+OR+esthetic+area%29+OR+anterior+zone%29+OR+anterior+teeth%29+OR+anterior+tooth%29+OR+upper+central%29+OR+lower+central%29+OR+central+incisors%29+OR+canines%29+OR+lateral+incisors%29+OR+esthetic+spaces%29+OR+upper+premolar%29+OR+lower+premolar%29+OR+incisor+

zone%29+OR+anterior+partially+edentulous%2C%29+OR+dental+implant+esthetic+zone%29+OR+smile+zone%29+OR+dental+smile+zone%29+OR+smile+esthetic+zone%29+OR+esthetic+zone+implant%29+OR+esthetic+zone%29%29%29+AND+%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28%28New+ceramic%29+OR+new+dental+ceramics%29+OR+new+ceramic+superstructure%29+OR+new+ceramic+full+coverage+crown%29+OR+monolithic+dental+ceramics%29+OR+one+layer+ceramics%29+OR+two+layers+ceramics%29+OR+translucent+ceramic%29+OR+bondable+ceramics%29+OR+silica+crowns%29+OR+glass+ceramics%29+OR+IPS+e-max%29+OR+e-max%29+OR+e-max+cad%29+OR+e-max+press%29+OR+e-max+crowns%29+OR+e-max+crown%29+OR+Pressable+ceramic%29%29+OR+%28%28%28%28%28%28%28%28%28%28Resin+ceramic%29+OR+composite+ceramic%29+OR+dental+hybrid+ceramics%29+OR+Nano+hybrid+ceramics%29+OR+hybrid+ceramic+superstructure%29+OR+resin+ceramic+superstructure%29+OR+hybrid+ceramic+full+coverage%29+OR+compound+ceramics%29+OR+hybrid+ceramics%29%29

Cochrane database

A) "P1" combined with OR:

Articles: 4,075

B) "P2" combined with OR:

Articles: *228,780*

C) "C" combined with OR:

Articles: 3,596

D) "I" combined with OR:

Articles: 412

E) "Implant" combined with OR:

Articles: 4,789

F) Abutment" combined with OR:

Articles: 306

G) "C" OR "I" combined with OR:

Articles: 3,883

H) "P1 OR P2" AND "C OR I" combined with AND:

Articles: 999

Time = 23/6/2020

3.5. All synonyms were searched in the databases separately.

3.6. The Synonyms were then combined by the use of OR.

3.7. The synonyms of "P" and "C" were then combined by the use of AND.

3.8. Filter trials was applied to all search

3.9. Time of Search: Tuesday **23/6/2020**-12:00:00 PM Cairo, Egypt.

{Lost teeth OR Extracted teeth OR missing tooth OR lost tooth OR partially edentulous OR congenitally missing teeth OR dental space OR free space OR multiple spaces OR multiple dental spaces OR anterior region OR anterior area OR esthetic region OR esthetic area OR anterior zone OR anterior teeth OR anterior tooth OR upper central OR lower central OR central incisors OR canines OR lateral incisors OR esthetic spaces OR upper premolar OR lower premolar OR incisor zone OR anterior partially edentulous, OR dental implant esthetic zone OR smile zone OR dental smile zone OR smile esthetic zone OR esthetic zone implant OR esthetic zone} {New ceramic OR new dental ceramics OR new ceramic superstructure OR new ceramic full coverage crown OR monolithic dental ceramics OR one layer ceramics OR two layers ceramics OR translucent ceramic OR bondable ceramics OR silica crowns OR glass ceramics OR IPS e-max OR e-max OR e-max cad OR e-max press OR e-max crowns OR e-max crown OR Pressable ceramic OR Resin ceramic OR composite ceramic OR dental hybrid ceramics OR Nano hybrid ceramics OR hybrid ceramic superstructure OR resin ceramic superstructure OR hybrid ceramic full coverage OR compound ceramics OR hybrid ceramics}

Inclusion criteria:

The review of the articles was accomplished in two consecutive screening steps. In the first screening, two independent review authors screened all the titles and abstracts to eliminate the irrelevant articles or reviews.

While, the second screening was aimed at collecting only the pertinent papers: each examiner reviewed the complete text of all articles that passed the first screening, using the following including criteria:

1. Implant in the esthetic zone.

2. All ceramic superstructure.
3. Fixed prosthodontics
4. Human trial studies.
5. English language papers
6. Paper measuring any of the following outcomes. Patient satisfaction, marginal bone loss, periimplant bleeding on probing and periimplant probing depth.

Exclusion criteria

All the human studies not fulfilling all the above inclusion criteria, were also excluded.

1. Case Reports.
2. Animal studies.
3. Studies studying mini-implants and/or orthodontic devices.
4. Studies assessing the behavior of abutments used to hold removable prosthesis.
5. Uncontrolled randomized clinical trials.
6. In-vivo studies with a retrospective design.
7. Review (systematic or ordinary).
8. Unpublished articles.
9. Paper that has less than 1 year follow up for marginal bone loss.

Data extraction and management

For each trial, the following informations from the included articles were collected: author(s), year of publication, study design, details of participants including demographic characteristics, number of inserted implants, type of abutment, final crown follow up period, marginal bone loss, esthetic patient satisfaction, bleeding on probing and peri-implant probing depth.

Quality assessment and risk of bias

The methodological quality of all the included studies was independently evaluated, in duplicate, by the two reviewers.

The following criteria were considered: sample size determination, randomization sequence (selection bias), allocation concealment (selection bias), operators and participant blinding (performance bias), incomplete outcome data (attrition bias), selective outcome reporting (reporting bias), group imbalance and follow up duration. A judgment as to the possible risk of bias on each domain was made from the extracted information, rated as “high risk” or “low risk”.

List of Excluded Studies with Reasons

List of Included Studies

RESULTS

The electronic search found 1,202 studies and the manual search provided 9 additional publications. After abstract examination, duplicate removal, 1,086 articles of 1,117 were excluded by title or by abstract, Figure 1. 31 articles were then assessed for eligibility by full articles evaluation, 18 article were further excluded, with a reason, Table II.

13 articles of 1,117 were included in this review because they were evaluating esthetic patient satisfaction, marginal bone loss, peri-implant tissue success, Table III and were in agreement with the inclusion criteria.

Eighteen articles were excluded out of thirty one articles. Two articles were evaluating implants in the posterior zone [21,22]. Three were evaluating peri-implant mucosa color using spectrophotometer [16,20,23]. Two were evaluating implant survival rate [11,19]. Three were evaluating surface finish or marginal adaptation [7,8,18]. Five were evaluating clinical performance [6,9,10,13,17]. Two were evaluating laminate veneer [12,15] and two were testing different implant surface treatment [9,14].

Risk of bias assessment of all included studies were done using ROBINS-E and RoB 2. Two studies were moderate risk of bias, two were some concern and nine were low risk of bias out of thirteen included articles, Table IV.

Included studies were then listed to show the intervention, comparator and sample size of each study, Table V, six of them were single arm studies, in this studies intervention was only mentioned. The thirteen studies were further compared according to demographic parameters in Table VI.

Summary of findings table (SOFT)

Tables of results

A- Esthetic Patient Satisfaction:

B- Peri-Implant Tissue Success:

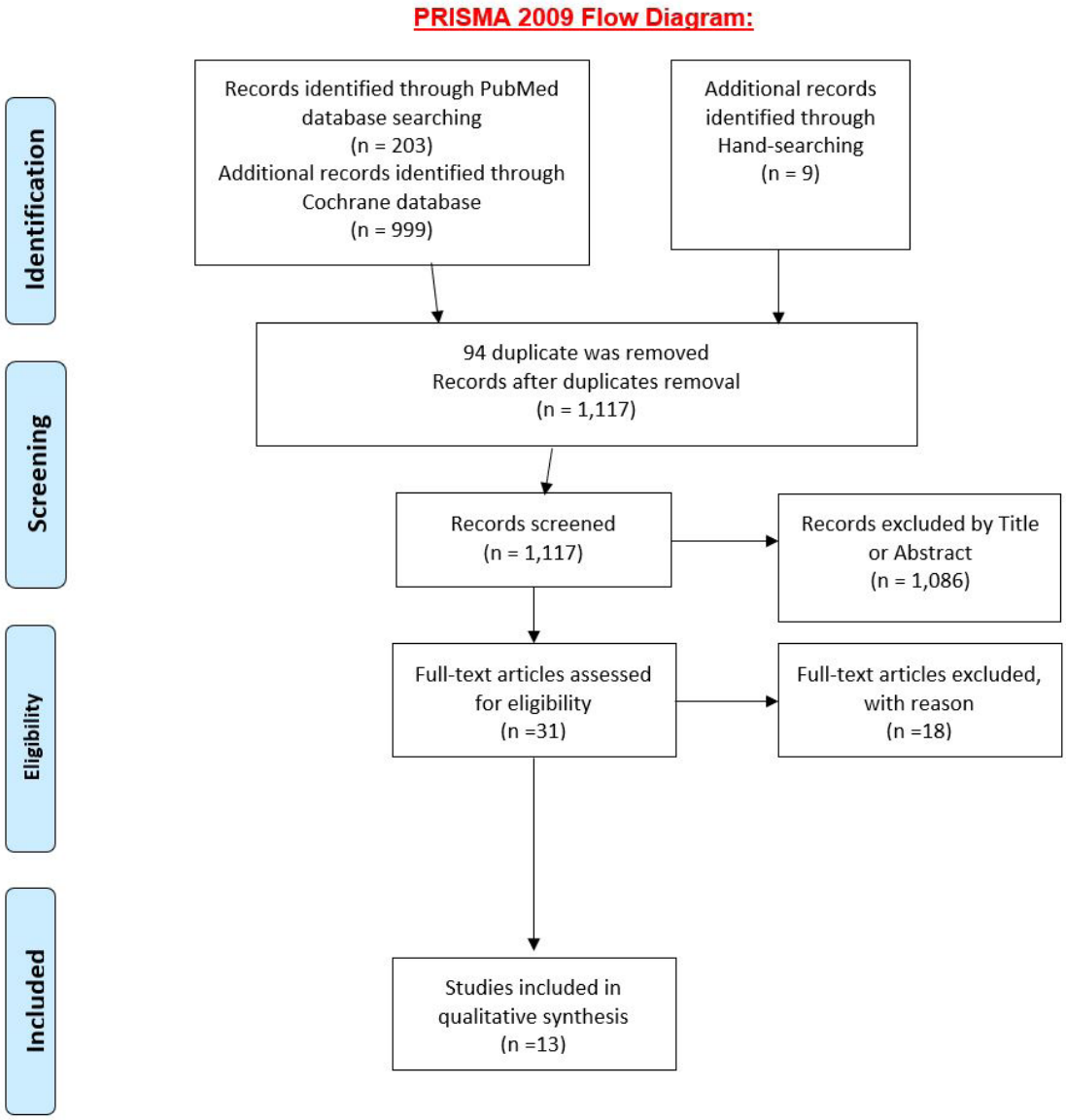

Figure 1 - Flowchart of study selection.

DISCUSSION

This systematic review was conducted to investigate the effect of implant superstructure on esthetic patient satisfaction, marginal bone loss and peri-implant tissue. Earlier studies have confirmed that all ceramic restorations have superior esthetic outcome compared to the conventional restorations. All ceramic restorations showed higher patient esthetic satisfaction and better peri-implant tissue color especially in patients having thin gingival biotype where the gingiva may transmit the color of the underlying material.

Lee & Hasegawa [24] reported in their 12 month prospective study that all ceramic restoration system have a very high level of esthetic patient satisfaction, their only being there high cost. Chen et al. [30] compared alumina and zirconia abutments with final IPS- Empress2 crowns and found that both ceramic abutments showed an acceptable biological and esthetic outcome, Table VII. Zirconia abutment showed better mechanical properties, it was easier in fabrication due to phase transformation which help to absorb energy and inhibit crack propagation [37].

Bressan et al. [16] observed significantly more esthetic peri-implant soft tissue color when gold or zirconia abutments were selected. They reported that thickness of the peri-implant soft tissue was not an important factor in the abutment

Table II - Excluded Articles

No	Title of the Article	Source	Reason for Exclusion
1.	Short-term results of IPS-Empress full porcelain crowns [6].	PubMed / Cochrane	Testing IPS-Empress material.
2.	Clinical and scanning electron microscopic assessments of porcelain and ceromer resin veneers [7].	PubMed / Cochrane	Evaluation of esthetic quality and surface finish.
3.	Clinical experience with Empress crowns [8].	PubMed	Evaluation of color match, contour, marginal integrity, recurrent caries, and marginal discoloration.
4.	Computer-aided designed/computer-assisted manufactured composite resin versus ceramic single-tooth restorations: a 3-year clinical study [9].	PubMed	Evaluate the clinical performance composite resin indirect restorations.
5.	Five-year follow-up with Procera all-ceramic crowns [10].	PubMed	Evaluation of the clinical performance of Procera All Ceramic crowns.
6.	Preliminary clinical results of a prospective study of IPS E.max Press- and Cerec ProCAD- partial coverage crowns [11].	PubMed	Evaluation of the survival rate and long-term behavior of all-ceramic partial coverage restorations on molars.
7.	Six-year follow-up with Empress veneers [12].	PubMed	Laminate veneers evaluating Color match, marginal discoloration, recurrent caries, contour, and marginal integrity.
8.	Two-year clinical trial of resin-bonded fixed partial dentures incorporating novel attachments [13].	PubMed / Cochrane	Comparison between new resin-bonded fixed partial denture system and performance with that of conventional FPDs.
9.	Immediate, non-submerged, root-analogue zirconia implants placed into single-rooted extraction sockets: 2-year follow-up of a clinical study [14].	PubMed	Surfaces of fixture for immediate single-rooted tooth replacement.
10.	Patients' satisfaction with different types of veneer restorations [15].	PubMed	Investigation of Patient satisfaction with different type of veneer.
11.	Influence of abutment material on the gingival color of implant-supported all-ceramic restorations: a prospective multicenter study [16].	PubMed	Influence of Abutment type on the color of peri-implant soft tissue.
12.	Survival rate of mono-ceramic and ceramic-core CAD/CAM-generated anterior crowns over 2-5 years [17].	PubMed	Evaluation of the clinical performances of CAD/CAM generated monoceramic Mk II and In-Ceram Spinell ceramic-core.
13.	IPS e. Max press porcelain crown in esthetic restoration of anterior teeth: a follow-up of marginal adaptation and color match [18].	Cochrane	The effect of IPS e. max Press porcelain crown in esthetic restoration of anterior teeth in terms of marginal adaptation and color match.
14.	Randomized clinical trial of implant supported ceramic-ceramic and metal-ceramic fixed dental prostheses: preliminary results [19].	Cochrane	survival rates over time of implant supported ceramic-ceramic and metal-ceramic prostheses as a function of core-veneer thickness ratio, gingival connector embrasure design, and connector height
15.	A prospective clinical trial to assess the optical efficacy of pink neck implants and pink abutments on soft tissue esthetics [20].	Cochrane	The color of the peri-implant mucosa was measured using a dental spectrophotometer and analyzed using CIELAB color system.
16.	Screw-retained monolithic zirconia vs. cemented porcelain-fused-to-metal implant crowns: a prospective randomized clinical trial in split-mouth design [21].	PubMed	single-tooth gaps in the premolar or molar region
17.	Immediate single implant restorations in mandibular molar extraction sockets: a controlled clinical trial [22].	PubMed / Cochrane	Implant placement placed in either a fresh molar extraction socket
18.	The Two-Dimensional Size of Peri-Implant Soft Tissue in the Anterior Maxilla and Some Relevance: A 1- To 7-year Cross-Sectional Study [23].	Hand searching	Compared soft dimension in relation to the marginal bone loss

Note. Excluded articles list, with the source of the article and reason of exclusion for each article.

Table III - Included Articles

No	Title of the Article	Source
1.	Immediate load and esthetic zone considerations to replace maxillary incisor teeth using a new zirconia implant abutment in the bone grafted anterior maxilla [24].	PubMed
2.	Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 1-year report [25].	PubMed
3.	Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 5-year results from a prospective single-arm clinical trial [26].	PubMed
4.	Effects of Immediate Loading with Threaded Hydroxyapatite-Coated Root-Form Implants on Single Premolar Replacements: A Preliminary Report [27].	Hand searching
5.	Experimental zirconia abutments for implant-supported single-tooth restorations in esthetically demanding regions: 4-year results of a prospective clinical study [28].	PubMed
6.	Zirconia Abutment Supporting All Ceramic Crowns in the Esthetic Zone: Interim Results of a Prospective Study [29].	PubMed
7.	Clinical evaluation of ceramic implant abutments in anterior restorations [30].	PubMed / Cochrane
8.	Marginal bone loss of two implant systems with three different superstructure materials: a randomised clinical trial [31].	Hand searching
9.	A 1-year randomised controlled trial comparing zirconia versus metal-ceramic implant supported single-tooth restorations [32].	Hand searching
10.	Natural or palatal positioning of immediate post-extractive implants in the aesthetic zone? 1-year results of a multicentre randomised controlled trial [33].	Cochrane
11.	Natural or palatal positioning of immediate post-extractive implants in the aesthetic zone? Three-year results of a multicentre randomised controlled trial [34].	Cochrane
12.	Clinical and esthetic outcomes of two different prosthetic workflows for implant-supported all-ceramic single crowns-3 year results of a randomized multicenter clinical trial [35].	Hand searching
13.	All-ceramic Restoration of Zirconia Two-Piece Implants--A Randomized Controlled Clinical Trial [36].	Hand searching

Note. List of included article with its source.

impact on the soft tissue color. Similar findings were reported by Pitta et al. [38] in their systematic review where ceramic abutments appeared to provide a better color matching between peri-implant soft tissues and that of the natural teeth. These findings support the preference for all-ceramic or "white" abutments in patient have high esthetic demands. Further studies were done by Zarauz et al. [39], they found that all ceramic abutments / superstructures improved esthetic outcome of the final restoration.

On the other hand others reported different findings; Hosseini et al. [32] Table VII, reported similar esthetic patient satisfaction for all ceramic and metal ceramic crown, even though more favorable color match for all ceramic restoration. Furthermore Bittencourt [29] reported that there was not statistically significant differences in WES (White esthetic score) and PES (pink esthetic score) between all-ceramic crowns and porcelain-fused-to-metal crowns compared to ceramic abutments.

Esposito et al. [33] and Peñarrocha-Oltra et al. [34], Table VIII compared implant placed in the normal position versus implants placed 3mm more palatally, they found that positioning of immediate post-extractive implants 3 mm more palatally did not improving aesthetics.

All implants have some degrees of marginal bone loss (MBL) after implant placement and loading. Implant bone loss of 1.5mm occurs initially during the healing phase and the first year of function especially at the peri-implant marginal bone level, which is considered bone remodelling, followed by an annual bone loss of 0.2mm after functional loading [3, 40].

Surgical trauma, biologic width establishment, superstructures lacking passive fit, the presence of a microgap at implant abutment interface, occlusal overload, and design of the implant neck are among the factors that can cause MBL [41, 42]. MBL can be influenced by other factors than implant-abutment connection, including other technical differences such as design of the implant [43], platform reduction [44], micron-sized gap position [45] and implant surface treatment [46].

In the current systematic review marginal bone loss was measured using different modalities due to lack of standard method of measuring MBL. Periapical x-ray, parallel technique, custom parallel, panoramic and CBCT are the methods that authors of the included studies used to evaluated the MBL. Studies have demonstrated that CT-scans and intraoral radiographies have comparable

Table IV - Risk of Bias Assessment

No	Title of the Article	Study Design	Assessment tool	Risk of bias judgment
1.	Immediate load and esthetic zone considerations to replace maxillary incisor teeth using a new zirconia implant abutment in the bone grafted anterior maxilla [24].	Prospective clinical study.	ROBINS-E	Moderate risk of bias. (No marginal bone loss measurements)
2.	Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 1-year report [25].	Prospective single arm clinical trial	ROBINS-E	Low risk of bias
3.	Immediately restored single implants in the aesthetic zone of the maxilla using a novel design: 5-year results from a prospective single-arm clinical trial [26].	Prospective single arm clinical trial	ROBINS-E	Low risk of bias
4.	Effects of Immediate Loading with Threaded Hydroxyapatite-Coated Root-Form Implants on Single Premolar Replacements: A Preliminary Report [27].	Prospective clinical study.	ROBINS-E	Low risk of bias
5.	Experimental zirconia abutments for implant-supported single-tooth restorations in esthetically demanding regions: 4-year results of a prospective clinical study [28].	Prospective clinical study.	ROBINS-E	Low risk of bias
6.	Zirconia Abutment Supporting All Ceramic Crowns in the Esthetic Zone: Interim Results of a Prospective Study [29].	Prospective clinical study.	ROBINS-E	Moderate risk of bias. (No marginal bone loss measurements)
7.	Clinical evaluation of ceramic implant abutments in anterior restorations [30].	RCT	RoB 2	Some Concern. (Blinding of the patient and the operator wasn't mentioned)
8.	Marginal bone loss of two implant systems with three different superstructure materials: a randomised clinical trial [31].	RCT	RoB 2	Some Concern. (Blinding of the patient and the operator wasn't accomplished)
9.	A 1-year randomised controlled trial comparing zirconia versus metal-ceramic implant supported single-tooth restorations [32].	RCT	RoB 2	Low risk of bias
10.	Natural or palatal positioning of immediate post-extractive implants in the aesthetic zone? 1-year results of a multicentre randomised controlled trial [33].	RCT	RoB 2	Low risk of bias
11.	Natural or palatal positioning of immediate post-extractive implants in the aesthetic zone? Three-year results of a multicentre randomised controlled trial [34].	RCT	RoB 2	Low risk of bias
12.	Clinical and esthetic outcomes of two different prosthetic workflows for implant-supported all-ceramic single crowns-3 year results of a randomized multicenter clinical trial [35].	RCT	RoB 2	Low risk of bias
13.	All-ceramic Restoration of Zirconia Two-Piece Implants--A Randomized Controlled Clinical Trial [36].	RCT	RoB 2	Low risk of bias

Note. Risk of bias assessment for prospective clinical study and RCT. Tools used are ROBINS-E and RoB 2 respectively. Each article was evaluated and judged to either low risk, moderate risk or high risk of bias.

levels of precision in evaluation of peri-implant marginal bone. The lack of standardized method in evaluation of the MBL is considered one of the limitations detected by the present systematic review.

T€urk et al. 2013 reported that the base metal restoration showed more marginal bone loss than Nobel metal restorations and zirconia based restorations although all restorations were clinically acceptable. Payer et al. [36] evaluated the outcome of two-piece zirconia implants compared to titanium implants over a period of up to two years. The concluded that there was no statically significant difference in the marginal bone loss between the two groups Table IX.

Other single arm clinical studies included in this systematic review showed marginal bone loss after 12 month of functional loading ranging between 0.9-1.2mm, this bone loss was within the accepted range and there was no

Table V - Comparators and Interventions

	Author & date	Comparators	Interventions	Sample size
1-	Lee & Hasegawa in 2008 [24]	Zirconia Abutment (Zimmer Dental) & All ceramic Crown (CAD/CAM)	----------	9
2-	Brown & Payne in 2011 [25].	Immediate Implant (Co-Axis 12d, Southern Implants Irene, South Africa) & immediate Restoration (Cerec Mk II bloc, VITA,).	----------	28
3-	Proussaefs et al. in 2002 [27].	Immediate Loading of single, threaded, root form implants. (Replace, Nobel Biocare, Yorba Linda, CA)	----------	10
4-	Glauser et al. in 2004 [28],	Zirconia Abutment (Noble Biocare) & All ceramic Crown. (Empress1)	----------	54
5-	Bittencourt et al. in 2016 [29].	Zirconia Abutment. (Conexão Sistemas de Prótese, Arujá, São Paulo, Brazil).	----------	25
6-	Chen et al. in 2008 [30].	Alumina Abutment. (CeraAdapt)	Zirconia Abutment. (Nobel Biocare).	23
7-	Türk et al. in 2013 [31].	DENTSPLY Friadent-Xive.	Zimmer-Tapered Screw Vent.	67
		Porcelain Fused to Metal Crown.	1-Porcelain Fused to Nobel Alloy Crown.	
			2-Zirconium Oxide Ceramic.	
8-	Hosseini et al. in 2011 [32].	Titanium abutment (Astra Tech), with metal ceramic crown.	Zirconium abutment (Astra Tech), with all ceramic crown.	75
9-	Ma et al. in 2019 [26].	Immediate Implant (Co-Axis 12d, Southern Implants Irene, South Africa) & immediate Restoration. 5 years follow up	----------	28
10-	Esposito et al. in 2018 [33].	Implant placed in natural position	Implant placed in Palatal position	30
11-	Peñarrocha-Oltra et al. in 2019 [34].	Implant placed in natural position	Implant placed in Palatal position	20
12-	Wittneben et al. in 2020 [35].	Restored with one piece single crown made of a prefabricated zirconia abutment with pressed ceramic	Individualized CAD/CAM zirconia abutment with the hand-layered technique.	40
13-	Payer et al. in 2015 [36].	Titanium abutment. (Ziterion_-Titanium abutment)	Zirconium Abutment. (Ziterion_ ZrO2 Abutment)	31

Note. Table showing included studies, comparator, interventions and sample size.

significant difference between different prosthetic superstructures used [27,28,30,35].

On the other hand, Hosseini et al. [32] reported that there was significant difference in marginal bone resorption between the all ceramic and the metal ceramic crowns. However, the frequency of inflammatory reactions was higher in case of all ceramic crowns. Also the marginal adaptation of the metal ceramic was better than the all ceramic and the authors claimed that that may be due to the sensitivity of technique of fabrication of pre-sintered zirconia Table IX.

Esposito et al. [33] and Peñarrocha-Oltra et al. [34] evaluated immediate post-extraction implants in the natural position versus 3 mm more palatally placed implants, for one year and three years follow up. They found that there was bone gain in the first year followed by normal pattern of marginal bone loss. This bone gained may be attributed to the gap filled with bone after tooth extraction. On the other hand Brown & Payne [25] and Ma et al. [26] evaluated immediately placed novel implant with a 121-angled prosthodontic platform in anterior maxillary fresh extraction sockets, and immediately restored with provisional crowns and subsequent definitive crowns at 8 weeks for 1 year and 5 years follow up. Marginal bone loss was 0.8-1 mm in the first year, there was no difference in the normal pattern of bone resorption even after five years follow up.

Periodontal probing is one of the most common basic diagnostic tool around teeth ever since 1970s. Periodontal probing depth (PPD) measurements around natural dentition provide information regarding the ability of

Table VI - Demographic Table

	Author Name	Date of Pub.	Study Design	Age		Group		Pt No	Site	Implant Size	Implant Brand	*Manufacturer Country*	Population	Follow up /month
				Range	Mean	M	F							
1.	Lee & Hasegawa [24].	2008	Prospective	18-57	42	1	8	9	Max. Lateral or central Incisor	Varied	Zimmer	USA	----------	12
2.	Brown & Payne [25].	2011	Research	21-71	47.1	9	18	27	Anterior Maxilla	A- 4mm-Diamter Tapered Bodies B- 4.7mm- Diamter Tapered Bodies	Southern Implants	South Africa	New Zealand	12
3.	Proussaefs et al. [27].	2002	Prospective	--------	-------	-	-	10	Maxillary Premolars	---	Noble Biocare	USA	USA	12
4.	Glauser et al. [28].	2015	Prospective	--------	44	11	16	27	Maxillary, Mandibular Incisors & Premolars	---	Branemark	Switzerland	Switzerland.	49.2
5.	Bittencourt et al. [29].	2016	Prospective	--------	38	11	14	25	Maxillary Incisors & Premolars	Range between (3.3-4) Diameter,(10-13) Length	Conexao prothetic systems	Brazil	Brazil	6
6.	Chen et al. [30].	2008	Prospective	18-46	33	13	10	23	Anterior Esthetic region	3.75 mm in diameter	Branemark / Nobel Biocare	USA	----------	21
7.	Türk et al. [31].	2013	Clinical study,	27-68	52.4	10	13	23	Different zone of maxilla and mandible	----	Dentsply Fridadent Xive / Zimmer (TSV)	Germany. USA.	Turkey	12
8.	Hosseini et al. [32].	2011	Randomized Clinical Trials	19-57	28.1	18	18	36	Premolar region	-----	Astra Tech	Sweden	Denmark	12
9.	Ma et al. [26].	2018	Prospective	21-71	47.1	9	18	27	aesthetic zone of maxilla	-----	Co-Axis 12d, Southern Implants, Irene	South Africa	New Zealand	60
10.	Esposito et al. [33].	2018	Randamoized con trolled		47	11	19	30	Aesthetic Zone	Diameter 3.75-4.25 mm Length 11.5-15 mm	Ticare inhex cylindrical implant	Spain	Spain	12
11.	Peñarrocha-Oltra et al. [34].	2019	Randamoized con trolled	23-70	51	7	13	20	Aesthetic Zone	Diameter 3.75-4.25 mm Length 11.5-15 mm	Ticare inhex cylindrical implant	Spain	Spain	36
12.	Wittneben et al. [35].	2020	randomized multicenter clinical trial	-------	-------	---	---	40	Anterior maxilla position	4.1mm diameter Length 8,10 or 12	Trumann AG, Basel	Switzerland	Switzerland	36
13.	Payer et al. [36].	2014	Prospective	24-77	46	13	9	22	Different zone of maxilla and mandible	Min. of 10mm L & 4mm W	Ziterion	Germany	Austria	24

Note. Demographic table for the included studies.

Table VII - Comparison between Different Abutments and Effect On patient Satisfaction

	Author	Zirconia Abutment & All ceramic crown	Alumina Abutment	Titanium abutment (Astra Tech), with metal ceramic crown.
1	Lee CY, Hasegawa H [24].	Extremely Satisfied	----------	----------
2	Chen et al. [30].	Satisfied	Satisfied	----------
3	Hosseini et al. [32]	Satisfied	----------	Satisfied

Note. Comparing between Zirconia Abutment with all ceramic crown, alumina abutment and Titanium abutment with metal ceramic crown in term of esthetic patient satisfaction.

Table VIII - Comparison between Implant Position and Patient Satisfaction

	Author	Natural positioned implants	Palatally positioned implants
1	Esposito et al. [33]	Satisfied	Satisfied, implant placed in the palatal position doesn't show better esthetic compared to natural position.
2	Peñarrocha-Oltra et al. [34]	There were not statistically significant differences between the groups for satisfaction with function and aesthetics of their implant supported crowns	

Note. Two studies comparing naturally placed implant and palatally placed implants in term of functional and aesthetic patient satisfaction.

the periodontium to resist probe penetration, measuring tissue inflammatory condition. In case of an inflammation, the probe penetrates the epithelium into the connective tissue, overextending the depth of the pocket. In case of a healthy gingiva, increased resistance of the periodontal tissues resist the tip of the probe to reach the most apical cell of the epithelium, thus underestimating the depth of the pocket [47]. Ericsson & Lindhe [48], in there animal studies had confirmed this finding, they also reported that in healthy soft tissues conditions probe penetration was more at implants than natural dentition and they concluded that the difference in the attachment structure between of the natural dentition and the peri-implant mucosa made the conditions for PPD measurements different.

Winitsky et al. [49], confirmed these findings, concluding that there was a lack of correlation between radiographically MBL and periodontal indices such as PPD >6 mm bleeding on probing (BOP) in a follow-up of 48 single implants in the maxillary anterior region having a survival rate of 96%. The authors reported by that PPD and BOP as diagnostic measurements of implant health is questionable.

BOP was not related to the PPD measured, this finding was also reported by other studies, where they observed that the bleeding of the peri-implant tissues and deep pockets had no correlation to MBL or to histological changes indicative as signs of periodontitis or to the presence of a pathogenic microflora [50]. These findings were confirmed later by Dierens et al. [51] they concluded that there was not correlations between PPD or BOP and MBL around single restored implants functioning for 16-22 years. PPD and BOP were found to have low diagnostic value, especially in evaluating the peri-implant tissue.

A recent systematic review with meta-analysis showed that for BOP-positive implants (BOP around implants) there was a 24.1% chance of being diagnosed with peri-implantitis, while for BOP-positive patients (BOP around natural teeth) there was a 33.8% probability of being diagnosed with peri-implantitis. They concluded that considerable false-positive rate of BOP, clinician should be aware of it in order to properly diagnose peri-implantitis [52].

In the current systematic review there was no significant difference in the peri-implant probing depth, all researches showed probing depth within the normal probing depth of implant sulcus ranging from 3-5mm [27,29,35]. BOP showed also no significant difference [27,29,30,32,36], except for one research were they showed lower bleeding on probing for the readymade zirconia abutment and the custom made zirconia abutment, where the custom made abutment showed lower bleeding although this difference was not significant [35] Table X, Table XI.

Table IX - Marginal Bone Loss

	Author	Marginal Bone Loss																						
		Zirconia Abutment & All ceramic Crown							Titanium Abutment & Ceramo-metallic (base metal) Crown					Titanium Abutment & Ceramo-metallic (Noble metal) Crown			Imme-diate Implant & Resto-ration	Imme-diate Implant & Resto-ration	Delayed implant placement & Immediate loading			Two Stage Implant Placements.		
		3M	6M	12M	18M	24M	36M	60 M	3M	6M	12M	18M	24M	3M	6M	12M	12M	36M	3M	6M	12M	3M	6M	12M
1.	Brown & Payne [25].																+0.98 (SD 2.67) **(Bone gain)**							
2.	Proussaefs et al. [27].																		0.73 ± 0.23mm	0.84 ± 0.30mm	0.90 ± 0.32mm			
3.	Glauser et al. [28].			1.1 mm (SD o.5)																				
4.	Chen et al. [30].			1.2 mm (± o.5)																				
5.	Türk et al. [31].	0.452 mm	0.555 mm	0.68 7mm					0.626 mm	0.742 mm	1.079 mm			0.381 mm	0.571 mm	0.687 mm						0.496 mm 0.467 mm	0.644 mm 0.597 mm	0.802 mm 0.831 mm
6.	Hosseini et al. [32].			0.08 mm, (SD 0.25)							0.10 mm, (SD 0.25)													
7.	Ma et al. [26].			+ 0.1mm Mean marginal bone SD 0.57 **(Bone gain)**				-0.1 mm Mean marginal bone SD 0.25																
8.	Esposito et al. [33].																A)0.81 S.D 0.43 central implant. B) 1.02 S.D 0.57 Palatally Placed Implant							
9.	Peñarrocha-Oltra et al. [34].																	A) 1.45 Central implant. B) 1.48 Palatally Placed Implant						
10.	Wittneben [35].	Prefabricated Custom made CAD-CAM	0.88mm 0.89mm	1.01mm 1.08mm			0.42mm 0.68mm																	
11.	Payer et al. [36]		0.4 mm	0.88 mm	1.15 mm	1.43 mm				0.67 mm	1.16 mm	1.2 mm	1.48 mm											

Note. Marginal bone loss for, Zirconia Abutment with All ceramic Crown, titanium abutment with ceramo-metallic (base metal) Crown, titanium abutment with Ceramo-metallic (Noble metal) crown, immediate implant with restoration, immediate implant & restoration, delayed implant placement with immediate loading and two stage implant placements.

Table X - Peri- Implant Probing Depth & Sulcus Bleeding

	Author	Peri-Implant Probing Depth											Sulcus Bleeding										
		Immediate Loading of single, threaded, root form implants.			Zirconia Abutment & All ceramic crowns				Immediate Loading of single, threaded, root form implants.				Zirconia Abutment & All ceramic crown						Ti Abutment				Alumina Abutment.
		3M	6M	12M	0M	6M	12M	36M	0M	3M	6M	12M	0M	3M	6M	12 M	24M	36M	0M	6M	12M	24M	12M
1	Proussaefs et al. [27].	3.60 ± 1.02mm	3.27 ± 0.57mm	3.20 ± 0.45mm						0.40± 0.36 mm	0.35± 0.32mm	0.45 ± 0.42mm		---	----		----						.....
2	Bittencourt et al. [29].	----	----	----					----		----			0.56mm (± 0.59)	0.48mm (± 0.77)		----						.....
3	Chen et al. [30]	----	----	----										----	----	0.6 ± 0.2 mm (Gingival score)							0.6 ± 0.2 mm (Gingival score)
4	Hosseini et al. [32] Modified Sulcus Bleeding Index (mBI) [A]												median 0 (range 0–2)			median 0 (range 0–2)			median 0 (range 0–2)		median 0 (range 0–2)		
5	Wittneben [35]	(A = prefabricated stock abutment; B = individualized CAD/CAM abutment)			A 3.05	3.07	3.04	3.04					0.18		0.13	0.21		0.31					
					B 2.64	2.92	3.08	2.83					0.08		0.10	0.18		0.24					
6	Payer et al. [B] [36]	Bleeding on probing (BOP)											±5.63; ME 11.3)		±0.95; ME 5.3)	±9.44; ME 9.5	±4.34; ME 9.2)		±6.32; ME 9.0)	±0.88; ME 11.4)	±4.98; ME 7.9)	±3.39; ME 7.0)	

Note. Peri- implant Probing Depth for Immediate Loading of single, threaded, root form implants and Zirconia Abutment & All ceramic crowns. Sulcus Bleeding for Immediate Loading of single, threaded, root form implants, Zirconia abutment with all ceramic crown, ti Abutment and alumina abutment. [A] Titanium Abutment and metal ceramic crown; [B] Titanium Abutment and All Ceramic crown for second group.

Table XI - Peri-Implant Probing Depth According to Site

Author		Zirconia abutment & All ceramic crown		
1	Bittencourt et al. [29]	**Site**	3M (SD)	5M (SD)
		Buccal	3.16 (± 1.46)	3.00 (± 1.09)
		Mesiobuccal	4.92 (± 1.52)	4.48 (± 1.51)
		DistoBuccal	4.76 (± 1.64)	5.20 (± 1.32)
		Palatal	4.36 (± 1.25)	4.48 (± 1.19)
		MesioPalatal	5.20 (± 1.55)	4.92 (± 1.26)

Note. Peri-Implant Probing Depth According to site for only one study comparing zirconia abutment and all ceramic crown.

CONCLUSION

Within the limits of the present work and due to the heterogeneity of the included studies and different modalities of imaging technique. It could be concluded that all ceramic implant superstructure is versatile treatment option with higher esthetic patient satisfaction and better color of peri-implant mucous especially in patient having thin biotype. On the other hand there was no significant difference in marginal bone loss, peri-implant probing depth and bleeding on probing compared to other conventional implant superstructure. More randomized controlled clinical trials with bigger samples are needed to confirm our findings and with standardized imaging technique.

Benefits to the health professional:

All ceramic restorations is the best treatment option in restoring missing teeth in the esthetic zone, especially for the patients that have thin biotype. On the other hand all ceramic restorations is more expensive treatment option due to higher laboratory cost in comparison to porcelain fused to metal restorations. The operator have to have the knowledge of different system of all ceramic restoration and abutment available in each implant system in order to be able to choose the proper type of all ceramic restoration that will give the best esthetic outcome.

On the other hand there is no significant difference in the peri-implant tissue success between the all ceramic restoration and porcelain fused to metal restorations.

Benefits to the patients

All ceramic restorations have the best esthetic and it is recommended to the patients that are concerned with high

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Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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Regulatory Statement

This systematic review was conducted through computer search strategy for the following electronic databases: PubMed/ MEDLINE and Cochrane Library. The search was limited to studies involving human subjects, published in English, further manual search was performed.

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