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"Immediate Implant Placement in the Esthetic Zone Using the Partial Extraction Therapy Protocol: A Systematic Review"

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Abstract:

The implant-supported rehabilitation of teeth positioned in the frontal sector is considered one of the most difficult surgical and prosthetic procedures to handle for both the general dentist and the specialist in oral surgery. Several parameters have to be considered in order to reach the aesthetic success. The main ones are ''white'' aesthetic regarding color and morphology of teeth and those defined as ''red'' aesthetic, relative to the form, color and features of the adjacent gingiva. Such challenges are evident after the insertion of the postextractive implants, due to the volumetric changes that occur after the remodeling processes. In 2010 Hürzler and colleagues introduce a new approach for immediate implantation in extraction sockets of teeth with healthy periodontal tissues. By retention of the buccal root fragment of the extracted tooth far more promising results are achieved on the buccal crest bone. The aim of this study is to review the literature regarding the soft and hard tissue changes that occur following immediate implant placement in the esthetic zone using the partial extraction therapy protocol. Concerning the Hard tissue changes in the three studies there was a statistical significance between the test groups and the control groups in all the studies concerning the crestal bone loss, labial plate of bone thickness, vertical bone level, horizontal bone level and labial crest height. Only in the

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labial plate of bone height in one study (Bissar 2017) there was no statistical significance between the groups. Concerning the soft tissue changes there was statistical significance in all three studies concerning the Pink Aesthetic Score, Soft tissue volume and pocket depth.

Introduction:

There is a strong relationship between alveolar bone formation and the eruption of teeth, which explains the remodeling reaction in the healing process of a socket after tooth loss. This leads to significant horizontal bone changes as well as vertical height loss, which affects the covering soft tissue as well. [1,2]

The buccal bone resorbs more significantly than the lingual bone. [2,3,4] This is explained by the decreased thickness of the buccal bone compared to the palatal or lingual bone. Anatomically the buccal bone has less trabeculae and the bundle bone depends mainly on the vasculature of the periodontal membrane of the tooth, which is lost after tooth extraction and leads to more buccal than lingual or palatal bone resorption. [4,5,6]

Post extraction period without intervention affects the degree of resorption in both arches. [7,8,9] Most of the resorption occurs mainly in the first 6 months. [2,10,11] Moreover resorption is more significant in the mandible as the maxilla has greater blood supply. [12]

One should expect more bone resorption after extraction with flap utilization, presence of thinner covering soft tissue or large prominent roots in the anterior maxilla. [13,14] Extraction of a tooth with a prominent root and a delicate thin buccal bone leads to damage to the buccal plate. [15,16,17]

Several treatment approaches to avoid the buccal bone resorption are available. Atraumatic extraction and socket augmentation are such options.[6,18]

Another option to preserve the buccal bone is immediate implant placement in fresh extraction sockets, [19] or the combination with guided bone regeneration. [20]

The root submerged technique (RST) by retaining decoronated vital or endodontically treated roots preserves the periodontium and prevents buccal bone resorption. [21-25]

Recently, an intentionally retained buccal section of the root is left in the socket and an implant is placed in close proximity or in contact with it.

This was described by Hurzeler et al as "Socket Shield Technique", where the buccal fragment of the root maintained the buccal bone and prevented its resorption. An animal study done by them showed the formation of cementum on the surface of the implant which were in contact with the root fragment.[26]

The technique was later modified by other researchers to preserve the proximal bone and the crestal bone.[27-30]

Methods:

The full search was conducted until the 25th of January 2019 as described in Search methods for identification of studies.

Criteria for considering studies for this review:

Types of Studies

- Only Randomized controlled trials were included.
- Types of Participants
- Patients who need to extract a non-restorable tooth in the esthetic zone and be replaced by an immediate implant.

Types of Interventions

- Immediate implant placement in the esthetic zone using partial extraction therapy protocol (socket shield technique) versus conventional immediate implant placement with or without grafting methods.

Types of Outcome measures

Primary outcomes

Hard tissue changes of alveolar crest after a minimum of 6 months of implant placement.

Secondary outcomes

1. Implant Survival rate after a minimum of 6 months of implant placement

2. Soft Tissue changes

Search Methods for Identification of Studies:

We searched the: 1. Cochrane oral health Group's Trials Register.

2. PubMed

A systematic search was performed in PubMed-Medline and Cochrane starting from 2010 to 2019. A systematic search using various combinations with Boolean operators 'AND' and 'OR' with no restrictions of language or document type using searching terms 'socket-shield', 'root membrane technique', 'partial extraction therapy' and 'implant implant'. A manual search of references obtained from the articles was performed as well.

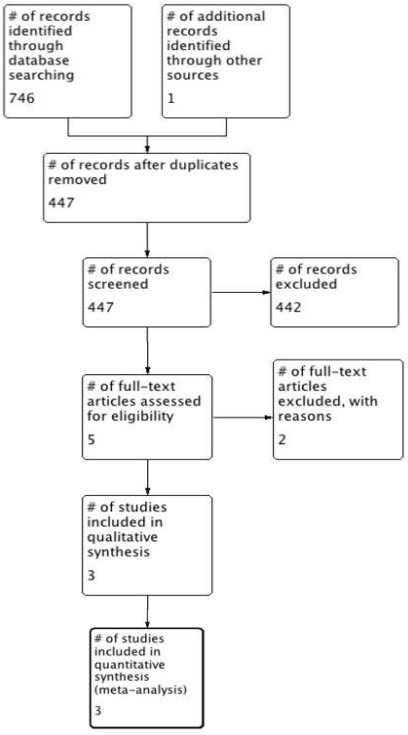

Figure 1: PRISMA flow diagram

Results:

1-Results of the Search

The full search was used to construct the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart.

Seven hundred and forty-six (746) were identified through searches (from electronic databases and other sources) and one study through searching the library of Ain shams university. Screened four hundred and forty-seven (447) records after removing the duplicates. After discarding four hundred and forty-two (442) records as irrelevant. Five (5) studies were eligible for our study, however two of them were excluded as they were ongoing studies. The remaining three (3) studies, full-text articles were assessed and considered as potentially eligible for our systematic review Bramanti 2018, Bissar 2017 and Ali 2018.

The detailed search is depicted in PRISMA flow diagram (Figure 1).

2-Risk of Bias in Included Studies

Detailed descriptions of the risk of bias in the included studies in the Risk of bias is in graph and summary (Figure 2).

2.1. Allocation (selection bias)

In the 3 included studies (Bramanti 2018; Bissar 2017; Ali 2016), two study (Bramanti 2018 and Ali 2016) noted adequate sequence generation but only one study of them (Bramanti 2018) described the use for allocation concealment, and the remaining one study (Bissar 2017) did not provide a description of the method of sequence generation and did not mention if it used allocation concealment.

2.2. Blinding (performance bias and detection bias)

In the 3 included studies (Bramanti 2018; Bissar 2017; Ali 2016) it was not mentioned if the participants, personnel or outcome assessors were blinded.

2.3.Incomplete Outcome Data (attrition bias)

For attrition bias of the 3 included studies, all three studies did not report any missing data (Bramanti 2018; Bissar 2017; Ali 2016).

2.4. Selective Reporting (reporting bias)

In two included studies (Bissar 2017; Ali 2016) the protocol was available and all of the study's prespecified outcomes and all expected outcomes of interest to review have been reported, while for one study (Bramanti 2018) no study protocol was available and selective reporting bias was 'unclear'.

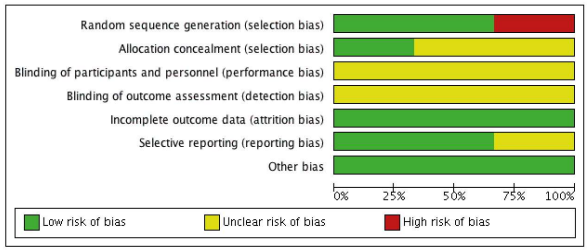

Figure 2: Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Conclusions and Recommendations:

1. Concerning the Hard tissue changes in the three studies there was a statistical significance between the test groups and the control groups in all the studies concerning the crestal bone loss, labial plate of bone thickness, vertical bone level, horizontal bone level and labial crest height.
2. Only in the labial plate of bone height in one study (Bissar 2017) there was no statistical significance between the groups.
3. Concerning the soft tissue changes there was statistical significance in all three studies concerning the Pink Aesthetic Score, Soft tissue volume and pocket depth.
4. It is recommended to conduct a research with long-term follow up period to test the fate of that root fragment.
5. Histological study to know the exact nature of tissue between the implant and the root fragment.
6. Further investigation on whether to lock the implant in the root fragment or leaving space between them.
7. Further investigation on whether to augment the space between the implant and root fragment or not.

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