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Atraumatic tooth extraction and immediate implant installation: advantages and specifications

Extração dentária atraumática e instalação imediata de implantes: vantagens e especificações

Extracción dental atraumática e instalación inmediata de implantes: ventajas y especificaciones

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ABSTRACT

Presently, in instances of single tooth loss in the esthetic area, simultaneous dental implant placement during tooth extraction has become the preferred method for enhancing the stability of the alveolar ridge. The advantages of immediate implant placement in fresh extraction sockets are that the total treatment time can be shortened, the number of invasive surgeries can be reduced, and patient discomfort can be reduced due to fewer surgeries and immediate placement has been reported to exhibit similar survival and success rates to delayed implant placement after socket healing. The atraumatic extractions and implant placement in the extracted tooth's socket are the best alternative to maintain the thickness and color of gingival tissue and are less costly. This study aims to debate the general concepts concerning atraumatic tooth extraction in association with immediate implant placement. 46 bibliographic articles published in English were analyzed. atraumatic extraction is a surgical technique that can present major clinical advantages in the outcome of prosthetic rehabilitation. It provides greater preservation of alveolar bone and adjacent soft tissue.

Keywords: Dental Implants; Oral Surgery; Oral Surgical Procedures.

RESUMO

Atualmente, em casos de perda de um único dente na área estética, a colocação simultânea de implantes dentários durante a extração dentária tornou-se o método preferido para aumentar a estabilidade da crista alveolar. As vantagens da colocação imediata de implantes em alvéolos de extração frescos são que o tempo total de tratamento pode ser encurtado, o número de cirurgias invasivas pode ser reduzido e o desconforto do paciente pode ser reduzido devido a menos cirurgias e a colocação imediata foi relatada como apresentando taxas de sobrevivência e sucesso semelhantes à colocação tardia do implante após a cicatrização do alvéolo. As extrações atraumáticas e a colocação do implante no alvéolo do dente extraído são a melhor alternativa para manter a espessura e a cor do tecido gengival e são menos dispendiosas. Este estudo visa debater os conceitos gerais sobre a extração dentária atraumática em associação com a colocação imediata do implante. Foram analisados 46 artigos bibliográficos publicados em inglês. A extração atraumática é uma técnica cirúrgica que pode apresentar grandes vantagens clínicas no resultado da reabilitação protética. Ela proporciona maior preservação do osso alveolar e do tecido mole adjacente.

Palavras-chave: Implantes Dentários; Cirurgia Bucal; Procedimentos Cirúrgicos Bucais.

RESUMEN

En la actualidad, en casos de pérdida de un solo diente en el área estética, la colocación simultánea de implantes dentales durante la extracción dental se ha convertido en el método preferido para mejorar la estabilidad del reborde alveolar. Las ventajas de la colocación inmediata de implantes en alvéolos frescos de extracción son que el tiempo total de tratamiento se puede acortar, el número de cirugías invasivas se puede reducir y la incomodidad del paciente se puede reducir debido a menos cirugías y se ha reportado que la colocación inmediata exhibe tasas de supervivencia y éxito similares a la colocación tardía de implantes después de la cicatrización del alvéolo. Las extracciones atraumáticas y la colocación de implantes en el alvéolo del diente extraído son la mejor alternativa para mantener el grosor y el color del tejido gingival y son menos costosas. Este estudio tiene como objetivo debatir los conceptos generales sobre la extracción dental atraumática en asociación con la colocación inmediata de implantes. Se analizaron 46 artículos bibliográficos publicados en inglés. La extracción atraumática es una técnica quirúrgica que puede presentar importantes ventajas clínicas en el resultado de la rehabilitación protésica. Proporciona una mayor preservación del hueso alveolar y el tejido blando adyacente.

Palabras clave: Implantes Dentales; Cirugía Bucal; Procedimientos Quirúrgicos Orales.

1. INTRODUCTION

The most common causes of loss of teeth are caries, periodontal and gingival diseases and fractures of teeth. When the teeth are lost especially in the anterior region, the apprehension and demand of patients increase dramatically because of aesthetic issues. Obtaining proper planning is crucial for meeting patient requirements and maintaining oral tissue health (Singla; Sharma, 2020; Lee, 2021). Dental implants were initially primarily utilized to attach complex poly-unit prostheses, but in recent years, single-tooth replacement, particularly in the esthetic region, has become quite successful in solving aesthetic situations (Ahamed *et al*., 2022).

After tooth extraction, there is a natural loss of bone around the extracted tooth socket and also there is a significant loss of the alveolar ridge both horizontally and vertically during the first 3 months. This loss can affect the shape and size of the jawbone. The decrease in bone can make it difficult to have functional and aesthetically pleasing dental treatments like dentures or dental implants (Singla; Sharma, 2020; Ghallab

et al., 2023). As reported by Ahamed et al., (2022) to obtain an implant's long life and clinical success, osseointegration is the foremost requirement.

Additionally, if the bone around the tooth is thin, there is a higher risk of immediate bone loss after extraction. This can be due to past inflammation, vertical root fractures, gum disease, or severe trauma before or during the extraction (Singla; Sharma, 2020; Ghallab *et al*., 2023).

In the case of anterior teeth, there is a reduction in gingival tissues and various aesthetic changes that make tooth rehabilitation challenging. This includes reduced gingival thickness at the margins, changes in gingival contour, and loss of the interdental papilla, resulting in the appearance of black spaces (Elaskary *et al*., 2020; Singla; Sharma, 2020).

In the late 1970s, a technique known as immediate dental implant (IDI) was developed to allow for the installation of a dental implant right after a tooth extraction procedure (Silva *et al*., 2022). Presently, in instances of single tooth loss in the esthetic area, simultaneous dental implant placement during tooth extraction has become the preferred method for enhancing the stability of the alveolar ridge (Lee, 2021; Silva *et al*., 2022; Ghallab *et al*., 2023; Salian; Durge; Dhadse, 2023).

The advantages of immediate implant placement/ immediate dental implant in fresh extraction sockets are that the total treatment time can be shortened, the number of invasive surgeries can be reduced, and patient discomfort can be reduced due to fewer surgeries and immediate placement has been reported to exhibit similar survival and success rates to delayed implant placement after socket healing (Lee, 2021; Ahamed *et al*., 2022; Salian; Durge; Dhadse, 2023). Finally, the recent research still discusses this issue and this study aims to debate the general concepts concerning atraumatic tooth extraction in association with immediate implant placement.

2. THEORETICAL FRAMEWORK

Tooth extraction or removal has continued to be a major and popular treatment option in general day-to-day dental practice (Ahamed *et al*., 2022). Nowadays, there is a tremendous demand for esthetics due to various factors such as development in lifestyle, increase in literacy rate, and increase in desire. Therefore, only tooth removal (extraction) is not enough, especially in the area of esthetics (anterior maxilla). The most crucial and pressing issue is replacement and rehabilitation. To replace lost teeth or teeth with a poor prognosis, dental implants have become the standard (Ahamed *et al*., 2022).

The atraumatic extractions, and implant placement in the socket of the extracted tooth are the best alternative to maintain the thickness and color of gingival tissue and are less costly. It also reduces the time

of treatment as we have waited for more than 3 months to get the socket healed and then place the implant (Singla; Sharma, 2020; Salian; Durge; Dhadse, 2023; Donker *et al*., 2024).

Since implant therapy has become one of the most important dental procedures, many techniques for implant placement and timing of implant installation have been studied and developed. Popular studies have centered on implant placement timing and immediate placement in fresh extraction sockets (Lee, 2021; Donker *et al*., 2024).

Ghallab *et al*., (2023) affirm that the extent of alveolar bone loss depends on different factors including the patient's general health condition, oral habits; tooth phenotype and location; preoperative condition of the socket; thickness of the buccal bone, and post-extraction treatment protocols. It is well established that the mode of extraction influences the extent of alveolar bone resorption. Conventional tooth extraction techniques, involving the use of elevators, luxators, and forceps, all share the concept of socket dimensional expansion (Salian; Durge; Dhadse, 2023).

This often leads to fracture or deformity of the interproximal bone with difficulty in maintaining the socket integrity in addition to traumatizing the socket-related soft tissues including the interdental papillae, thus, impeding successful implant placement and subsequently challenging future prosthetic replacement (Ghallab *et al*., 2023). Moreover, extraction of remaining roots or broken teeth with the margin located below the gingival levels can be challenging and emphasizes the priority of preserving the surrounding soft and hard tissues during tooth extraction (Elaskary *et al*., 2020; Lee, 2021).

In cases like this, the typical extraction approach may include reflecting a mucoperiosteal flap, often followed by removing bone, which causes further loss of alveolar bone. Therefore, it is important to minimize trauma during the extraction of a hopeless tooth to preserve the surrounding hard and soft tissue, as this has a significant impact on treatment planning, outcomes, and prognosis (Lee, 2021; Ghallab et al., 2023; Salian; Durge; Dhadse, 2023; Donker *et al*., 2024).

Furthermore, according to Lee (2021), in implant therapy, the waiting period for osseointegration has always been an issue. In cases of tooth extraction, additional time is required to place an implant after waiting for the alveolar ridge to heal normally, and efforts to reduce this waiting period have been studied.

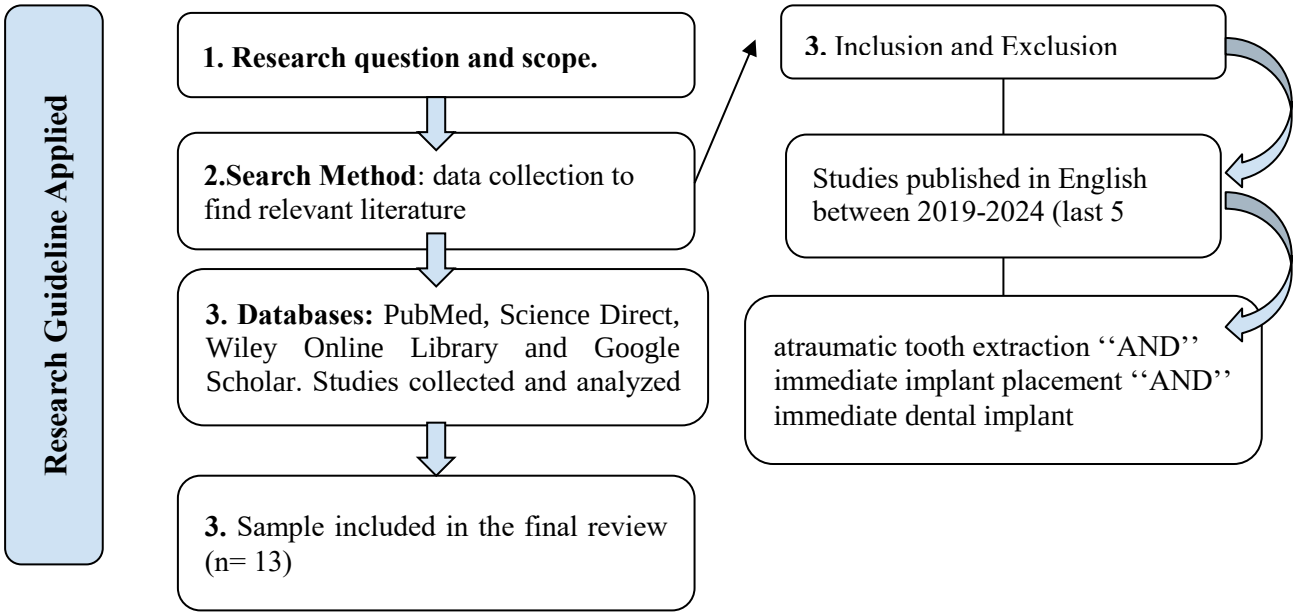
3. METHODOLOGY

Building your research on and relating it to existing knowledge is the structure block of all academic research activities, regardless of discipline (Jesus *et al*., 2024). During the research execution for an integrative review, methodological strategies were used to select previous data to simplify and filter the substantial content in the study. To compose an integrative literature/bibliographic review, 46 bibliographic

articles published in English from the following databases (PubMed, Science Direct, Wiley Online Library and Google Scholar) were analyzed previously and filtered.

The principal terms searched on databases were atraumatic tooth extraction ‘‘AND’’ immediate implant placement ‘‘AND’’ immediate dental implant. Only articles published between 2019 and 2024 were included (5 years as inclusion criteria). Any sample/study that did not follow the previously inclusion criteria defined was not included in this review. A total of 13 studies were included in this paper. **Flowchart 1** specifies the methodology applied, respectively:

Flowchart 1. Description of the methodology applied in this research.



Source: elaborated by the authors (2024).

4. RESULTS AND DISCUSSIONS

Dental implants have become an inseparable part of modern dentistry. Dentures and bridges were used before dental implants, but because of the procedure's proven track record of success, reliability, and relatively fewer complications, dental implants have become a highly popular alternative treatment option. By the end of 2023, the market for dental implants is projected to have grown to around 1,070,996,912.54 Indian rupees (Ahamed *et al*., 2022; Donker *et al*., 2024).

Recent studies have shown that the atraumatic technique is beneficial for improving implant placement protocols. However, Lee (2021) states that other systematic reviews and meta-analyses have reported lower survival rates for immediate implant placement in fresh extraction sockets compared to

delayed implant placement in healed sockets. The basic principles of immediate implant placement include atraumatic or minimally traumatic extraction, preservation of the septal bone in the molar, minimal flap elevation or flapless surgery, bone grafting the gap between the fixture surface and the inner wall of the extraction socket, and coverage with soft tissue or a membrane when possible (Lee, 2021; Salian; Durge; Dhadse, 2023). Board 1

Board 1. Evidence of the immediate implant placement technique (IIP) advantages.

Article's Name	Year	Main Findings
Atraumatic tooth extraction with immediate implant installation: case report	2022	Osseointegrated dental implants have shown good functionality and efficiency in their several treatments and atraumatic extraction along with immediate dental implant installation.
Atraumatic extraction and immediate implant installation	2020	If there is proper case selection and surgical planning then atraumatic extraction with the immediate installation of the implant is the best treatment option for the replacement of a broken tooth, root, or carious tooth. This method can help in the preservation of the alveolar bone.
A novel atraumatic extraction technique using vestibular socket therapy for immediate implant placement: a randomized controlled clinical trial	2023	Immediate placement of dental implants into fresh extraction sockets has proven to be a successful and predictable treatment option in class I sockets with thick buccal plates of bone and related soft tissues using different surgical and loading protocols. This investigation suggests that different studied techniques were successful in the atraumatic extraction of hopeless severely damaged teeth.
Immediate implant placement with or without connective tissue graft: A systematic review and meta-analysis	2020	Connective tissue graft contributes to mid-facial soft tissue stability following immediate implant placement.
Predictable immediate implant placement and restoration in the esthetic zone	2021	Immediate implant concept is expected to be revised and updated in the future to best serve the needs and expectations of our patients. Atraumatic tooth extraction is the first step of the surgical phase. Damaging the alveolar bone during tooth extraction can have severe consequences and cause unnecessary resorption.
Immediate implant placement in fresh extraction sockets	2021	Immediate dental implant has the advantage of reducing traumatic surgery for patients by placing implants during the same procedure as tooth extraction.
A Novel Method for Immediate Implant Placement in Defective Fresh Extraction Sites.	2020	The proposed technique provided a minimally invasive treatment with a predictable esthetic outcome allowing immediate implant placement in sockets with intact and deficient facial plates.
A Case Report of Atraumatic Tooth Extraction Followed by Ridge Preservation for Implant-Supported Prosthetic Rehabilitation Using an Alloplastic Bone Graft	2023	Atraumatic tooth extraction is a procedure used to delicately remove a tooth while upholding the fundamental principles of preserving the surrounding bone and gingival structure. This will ultimately maximize the success of implant placement in terms of appearance and functionality.

Source: elaborated by the authors (2024).

Several factors may potentially influence the healing process of the post-extraction alveolar socket. Some of these factors may influence only unassisted socket healing, and some may influence both unassisted socket healing and immediate implant placement. These factors can be local, surgical, or systemic (Liñares *et al*., 2023).

The placement of a dental implant immediately after a tooth extraction is a procedure that reduces the patient's discomfort and risks, as well as the number of interventions to which the patient would be submitted (Silva *et al*., 2022). This technique is a safe option in periodontal or endodontic infected sites, even when immediate implant loading is used. Despite this, a treatment plan should be carried out, assessing the patient's systemic conditions, and considering the risks and benefits (Silva *et al*., 2022).

The reported case by Silva *et al*., (2022) demonstrated an excellent result in an atraumatic extraction with the installation of an IDI, even in an area with suppuration. It is noteworthy that there is no consensus regarding the implant insertion time. Treatment with dental implants improves outcomes in healed sockets. However, patient satisfaction tends to be similar whether they receive immediate implants, especially with immediate loading (Silva *et al*., 2022).

In concordance with Singla & Sharma (2020), atraumatic extraction is a surgical technique that can present major clinical advantages in the outcome of prosthetic rehabilitation. It provides greater preservation of alveolar bone and adjacent soft tissue. Ghallab et al., (2023) confirm that the atraumatic technique in association with immediate implant offers superior esthetic and functional advantages as it shortens the treatment duration, reduces the number of surgical visits, preserves soft tissue and hard tissue architecture, and enhances the esthetic outcome.

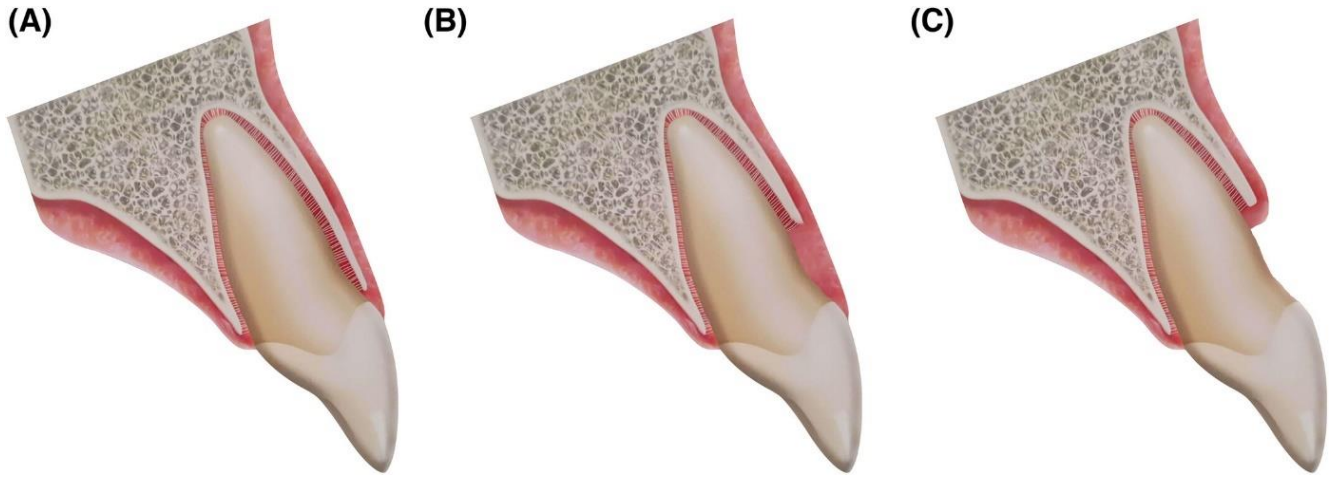
Conclusively, some studies also discuss the immediate implant placement protocol in association with graft tissue application, debating implant placement with or without connective tissue graft (Seyssens; De Lat; Cosyn, 2021). Other research developed by Lee (2021), discusses that in cases of extraction due to lesions such as chronic periodontitis or periapical lesions, the socket can become infected. Therefore, it is common to proceed with conventional implant placement after socket healing. Otherwise, the author explains that if the size of the lesion is not large or if the infection is properly controlled by antibiotics, an immediate dental implant is possible to be placed.

Lee (2021) also affirms that immediate implants can be performed after the inside of the infected socket is sufficiently curetted and irrigated profusely with saline. It is necessary to sufficiently explain to the patient the possibility of osseointegration failure due to an infected socket to obtain informed consent.

Different classifications for post-extraction sockets have been proposed and discussed by Liñares *et al*., (2023). One of the most important aspects of immediate implant placement is the assessment of buccal soft and hard tissues. The sockets can be categorized into three types based on the presence or absence of soft and hard tissues, respectively (Liñares *et al*., 2023):

- Type I: Buccal soft tissue and buccal bone plate at normal levels concerning the cementoenamel junction of the extracted tooth and remain intact post-extraction (**Figure 1A**) (Liñares *et al*., 2023).
- Type II: Facial soft tissue at normal level, but reduced buccal bone plate following tooth extraction (**Figure 1B**) (Liñares *et al*., 2023).
- Type III: Buccal gingival recession and buccal bone plate at a reduced level (**Figure 1C**) (Liñares *et al*., 2023).

Figure 1. Classification of alveolar sockets according to the presence or absence of buccal soft and hard tissues. (A) Type I socket. (B) Type II socket. (C) Type III socket.



Source: Liñares *et al*., (2023)

4.1 Technique Considerations

Dimensional changes in bone and gingival tissues right after a tooth extraction, promote functional and aesthetic alterations. In that regard, not only does the implant installation technique increase the success rate, but also the way the alveolus is treated after the extraction can maintain a degree of conservation and provide better bone support for prosthetic rehabilitation. Atraumatic extraction preserves bone tissue and reduces trauma to the patient, enabling treatment with osseointegrated implants (Silva *et al*., 2022).

It is shown as a safer method in situations of fine alveolar ridge and with greater chances of fractures. It aims to perform the extraction of the tooth in the vertical direction, preserving alveolar bone and having a minimum of bone expansion, considering that the amount of remaining alveolar bone cortices and healthy bone apically to the socket for anchoring the dental implant are important factors as a condition of an

adequate its initial stabilization and an alveolar repair process without major complications (Singla; Sharma, 2020; Silva *et al*., 2022).

Alveolar bone preservation during tooth extraction, achieving primary stability of the dental implant within the alveolar socket in the apical direction, carefully reflecting the flap, adapting the provisional crown on the implant, and maintaining the health of peri-implant tissues are major factors for successful treatment. Maintaining oral hygiene is a significant contributing factor to the success of immediate implant placement after atraumatic extraction (Singla; Sharma, 2020).

This method reduces the likelihood of losing thickness and contour of the gingival tissues, resulting in improved aesthetics. It also assists in preserving the alveolar bone. Various techniques, including the use of an Atraumatic extraction kit, have been suggested for this purpose. This method allows for the extraction of the tooth with minimal trauma while maintaining the integrity of the alveolar bone (Singla; Sharma, 2020).

Atraumatic extraction is performed when a tooth is fractured at the gingival level, particularly when there is thin bone tissue around the root. Implant installation is carried out immediately after the tooth root removal to prevent bone resorption and breakdown. Before using this technique, it's crucial to consider the prognosis of the implanted tooth, causes of tooth loss, and the width and depth of alveolar bone in the area to be implanted. In aesthetic areas, there should be a minimum of 5 mm distance from the alveolar crest to the contact point for papillae filling the interproximal space (Ghallab *et al*., 2023).

Atraumatic tooth extraction is the first step of the surgical phase. Damaging the alveolar bone during tooth extraction can have serious consequences and lead to unnecessary resorption. It is important to never force any instrument between the bone and the root. Similarly, pliers should not be used as they require forceful side-to-side movements, which can distort and damage the alveolar bone (Lee, 2021; Ghallab *et al*., 2023). Instead, extraction systems that involve screwing a post into the root and then pulling it out of the socket vertically with a lever arm system without touching the bone are recommended (Gamborena; Sasaki; Blatz, 2021). **Figure 2** shows a tooth being atraumatic extracted.

Figure 2. Atraumatic tooth extraction with a special extraction system.

Source: Gamborena; Sasaki; Blatz (2021).

Various techniques of atraumatic tooth extraction have been introduced to preserve bone and gingival architecture, allowing appropriate immediate implant placement using tools such as peristomes, piezo surgery, piezotome, and vertical extraction systems. Atraumatic extraction is especially recommended when there is a fracture at or below the gingival level and in cases with a thin bony plate to minimize changes in soft tissue contour and volume for satisfactory aesthetic results (Ghallab *et al*., 2023).

The main reason for performing extraction atraumatically is to preserve maximal bone quality and obtain initial stability. During IIP, bony support typically is obtained from apical or lateral bone, however is often obtained from septal bone in posterior extraction sockets. Atraumatic extraction can minimize gingival recession and marginal bone loss, which often result from extraction, leading to esthetic and functional advantages (Lee, 2021).

As mentioned by Liñares *et al*., (2023), advances in implant surface have shortened the period required for osseointegration, which suggests early bone healing at implant sites with adequate bone volume and studies on alveolar socket healing demonstrated that the alveolus is filled with newly formed bone after 3–4 months, and a dental implant can be placed with primary stability in this condition.

Nevertheless, there is a preference from patients for immediate or early treatment protocols rather than a delayed approach. Thus, in patients with esthetic demands, such as anterior teeth, reduced treatment time with implants placed into fresh extraction sockets is a valid treatment alternative (Lee, 2021; Liñares *et al*., 2023).

Immediate implant placement (IIP) does not require the healing time of the extraction socket, so the overall treatment period is shortened and by preserving the extraction socket as much as possible, IIP can be aesthetically pleasing when fabricating a prosthesis (Lee, 2021; Salian; Durge; Dhadse, 2023).

A classification for the timing of implant placement after tooth extraction was proposed at the Third ITI Consensus Conference (Liñares *et al*., 2023). This classification system is based on the desired clinical outcome of the wound healing process, rather than on descriptive terms or strict time frames following extraction (Liñares *et al*., 2023):

1. Type 1 refers to implant placement on the day and within the same surgical procedure of tooth extraction.
2. Type 2 refers to implant placement after soft tissue healing, but before a clinically significant bone formation in the socket.
3. Type 3 describes an implant placement following significant clinical and/or radiographic bone formation in the socket.
4. Type 4 refers to implant placement in a fully healed site.

Immediate placement of dental implants into fresh extraction sockets has been successful in class I sockets with thick buccal bone plates and related soft tissues, utilizing different surgical and loading protocols (Ghallab *et al*., 2023; Salian; Durge; Dhadse, 2023). Well-planned surgical and restorative procedures including atraumatic extraction, 3D implant planning for surgical guide fabrication and implant placement, can achieve high esthetic results in replacing a primary tooth in the esthetic zone (Villalobos-Tinoco *et al.*, 2024).

5. CONCLUSION

For successful treatment involving atraumatic extraction and immediate implant installation, it's essential to carefully select cases, plan the surgery, and plan for prosthodontic rehabilitation. Postoperative care is also crucial. Atraumatic extraction aims to preserve the original socket form, and the collapse of the socket can be minimized by using bone grafting in the gap. After the development of this research, it’s possible to conclude that the technique is successful when correctly indicated.

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