






# The Use of Autogenous Tooth Bone Graft Block (ABTB) in Post-extraction Socket of Dental Implant Treatment Procedure: A Literature Review

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**Keywords:** Bone graft, Dental implant; Autogenous Tooth Bone Graft Block.

**Abstract:** The success in making dentures was supported by adjustments to the anatomical condition of the oral cavity and the prominent ridge that can be achieved after tooth extraction. Post-extraction conditions of the teeth may cause inflammation, alveolar ridge resorption which becomes narrow and shortened, and the presence of jaw bone atrophy. The use of implant dentures as a substitute for missing teeth serves to prevent or slow down bone resorption that occurs by channeling the burden of chewing to the bone. A dental implant is an alternative to artificial teeth that make patients comfortable because they last a long time. The ideal dental implant must have strong alveolar bone support. Strong alveolar bone support can be obtained from using a bone graft. This study shows the potential of Autogenous Tooth Bone Graft Block (ABTB) or teeth that have been extracted. The use of Autogenous Tooth Bone Graft Block (ABTB) has the potential as an autograft biomaterial material in the treatment of post-extraction sockets and bone regeneration processes as a foundation in implant placement.


## 1 INTRODUCTION


Tooth loss is one of the problems that need to be considered because it requires replacement, by using the denture (Ananda et al., 2017). The condition of tooth loss will affect the loss of bone tissue, nerves, receptors, and muscles so that the orofacial function will be reduced. Tooth loss will disturb the oral cavity conditions such as reduced chewing, phonetic, and aesthetic functions to restore the function it is necessary (Mardiyantoro & Pratiwi, 2017).


Success in making the denture is supported by adjusting the anatomical conditions of the oral cavity, called prominent ridge that can be achieved after tooth extraction. A prominent alveolar ridge is a condition of protrusion of alveolar bone support that is useful for achieving retention of dentures. Post-


extraction conditions cause inflammation, resorption of the alveolar ridge so that it becomes narrow and shortened and there is jaw bone atrophy. Bone resorption is influenced by the activation of cells of osteoclasts. Osteoclasts and osteoblasts can regulate the process of bone formation dynamically (Yustina et al., 2012). If a tooth loss is not using the denture immediately, it will affect the process of making the denture, including the lack of retention of the denture so that the denture is not fit when it is attached to the patient (Lindhe et al., 2003).


Dental implants are an alternative surgical treatment to replace dentures that are implanted into the soft tissue or the jaw bone. The implant placement procedure is recommended to be carried out as quickly as possible to prevent serious bone resorption (Kim et al., 2014). Dental implants can be a comfortable treatment because it has well function

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and long-lasting with the support of the condition of the alveolar bone that serves as a buffer against the implant. The stability of dental implants can be disrupted due to a lack of alveolar bone support (Saptaswari, 2017).

Alveolar bone support in the dental implant placement process can be handled by using a procedure for making the bone graft. Bone regeneration is a process of regeneration or reformation of bone to accelerate the recovery process of bone damaged due to inflammation (Ferdiansyah Mahyudin, 2018). Indications for the use of bone regeneration are to form new bone around the tooth socket that will be used as a location for implant placement after tooth extraction.

A bone graft is a material that can function to restore the function of a bone tissue that has been lost or has been damaged. Osteoconduction and osteoinduction properties in bone graft function to support and stimulate new bone growth (Soepribadi, 2013). Important criteria that must be fulfilled by bone graft are that it is well-accepted by the body (biocompatible) and functions well in the process of osteoconduction, osteoinduction, and bone osteogenesis (Fauzia et al., 2019).

A bone graft is classified into four types, such as autograft, allograft, xenograft, and alloplast. Autograft is bone tissue material originating from the same individual. An allograft is bone tissue material originating from one individual to another individual with different genetic construction but in one species. A xenograft is bone tissue originating from one individual to a different species. Alloplastic graft is material derived from synthetic or artificial bone. Autograft is the type of graft most often used (Smeets et al., 2016). Autograft has become a gold standard for good regenerative procedures because it can support osteogenic, osteoconduction, and osteoinduction properties associated with prosteoblastic cells in the graft (Park et al., 2012). Mesenchymal stem cells, osteogenic precursor cells, and osteoblasts will stimulate the occurrence of osteogenesis. These cells will synthesize new bone in the recipient area where the bone graft is placed.

Osteoinductive is the ability of the bone graft to help the process of proliferation and differentiation of mesenchymal stem cells or progenitor cells into bone-forming cells (osteoblasts) that produce bone formation with normal mineralization. Osteoconductive nature is the passive process of bone-forming cells (osteoblasts) from recipients into the bone graft and slowly replace it with new bone (Ferdiansyah Mahyudin, 2018).

Autogenous Tooth Bone Graft Block (ABTB) is one of the types of autograph which is derived from extracted tooth bones (Smeets et al., 2016). The tooth can be used as the material of bone graft because dentin and cementum contain the same protein as bone, such as osteocalcin, osteopontin, bone sialoprotein, protein, matrix of dentin, and collagen type I (Handschin et al., 2006). Based on weight and volume, dentin and bone have the same percentage, called collagen and hydroxyapatite, and contain some growth factors, there are bone-morphogenetic protein 2 (BMP-2) and transformation growth factor (TGF) which being an important role in bone tissue regeneration (Kim et al., 2010). Disadvantages in using ABTB are limited availability, requiring the addition of surgical points, patient morbidity, and also the patient's clinical condition (Fauzia et al., 2019).

The dental implant placement must be accompanied by strong bone support of the bone graft. The use of Autogenous Tooth Bone Graft Block (ABTB) as a material has not been well developed in Indonesia. The ABTB method was first introduced by the Korea Tooth Bank R&D Center and has been shown good results (Kim et al., 2010). The purpose of making this study is to further discuss the use of ABTB as the bone-graft material to support bone regeneration in the process of dental implant placement.

## 2 MATERIALS AND METHODS

This research using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) methods. This PRISMA method doing systematically following the correct stages or research protocols. The procedure of this systematic review consists of several steps, namely 1) Preparation of background and purpose, 2) Formulation of problems, 3) Searching for literature, 4) Selecting, 5) Collecting Data, 6) Analysis, 7) Conclusions. This research was conducted in March-June 2020. The search for research articles relevant to this research was carried out using keywords of implants, bone graft, ABTB, and other types of various bone graft obtained from national or international indexed and reputable journals and also the google scholar.

## 3 RESULTS

### 3.1 Dental Implant Treatment

Dental implants are an option for the treatment of partial or complete tooth loss. Dental implant treatment is useful to be able to restore the function of mastication, aesthetics, and speech function (Smeets et al., 2016; Tetelepta & Machmud, 2015). The form of dental implants consists of various kinds of boot form, blade form, ramus, and subperiosteal implant. Dental implants that are often used are dental implants in the form of root teeth. A root-form implant shaped like a screw is used to replace the root of a missing tooth. Dental implants in general are mostly made of metal, titanium. Titanium metal can be accepted by the body and can blend with the patient's jawbone (Ramadhan, 2010).

Clinical dental implant treatment can be successfully seen from the clinical function, aesthetics, patient satisfaction, prosthetic stability, peri-implant soft tissue infection, there are luctation and no pain (Al-Sabbagh & Bhavsar, 2015). Dental implants can function well if biologically suitable placement. The 3-dimensional position of the implant (fasiolingual, mesio-distal, apico-coronal) is essential for successful treatment. The key factor for implant placement is the availability of alveolar bone in the area. The inadequate height, width, and quality of the alveolar bone will determine the outcome of the treatment received. Soft tissue profile is also influenced by bone height and width. The ideal implant placement must correct the placement location and size of the implant, then it affects the overall aesthetics.

The successful dental implant histologically is characterized by new bone growth with the surface of the implant called osseointegration (Utami et al., 2019). Alveolar bone serves as a buffer for the dental implant. The dimension of alveolar bone that decreases both vertically and horizontally will affect the stability and comfort retention of the denture. The risk of a fail dental implant under conditions of less alveolar bone support (Kamadajaja, 2016)

### 3.2 Bone Graft

Bone grafting is a surgical procedure to replace the bone loss with bone material that comes from the patient's own body, artificially or naturally. Bone tissue can regenerate properly if space is provided for the bone to grow. Natural bone that grows generally replaces the graft material and produces a new fully integrated bone region. A bone graft consists of

autograft, allograft, xenograft, and alloplast. a. autograft, bone material from the same individual; b. allograft, bone material from one individual to another different from the genetic constitution but in one species c. xenograft, bone material from one individual to a different species, for example from animals to humans. d. alloplastic grafts, bone material that uses bone synthesis, such as hydroxylapatite, phosphoric calcium ceramics, and oily calcium hydroxide in a cream form (Smeets et al., 2016).

The most commonly used type of graft is the free autogenous bone graft. Free autogenous bone graft is bone material originating from the same patient so that it may not be able to bring a rejection response from the patient's immune system. This graft is usually obtained from the maxilla, mandible, cranium, tibia bone, iliac crest, and ribs. The bone graft serves for the reformation of the jawbone, the transfer of tissue free from microvascular, and the reformation of alveolar cleft (Smeets et al., 2016). An ideal bone graft must have the potential to keep cells alive, not cause an immunological reaction, be easily obtained and provide strength to the area around the bone and not spread disease (Purnomo & Adji, 2012). In general, the greater the genetic difference between the graft and its receptors, the greater the rejection reaction which arises. The material that is often used in biomedical applications as bone graft material is hydroxyapatite. Hydroxyapatite (HA) with the chemical formula  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$  is an inorganic compound that makes up hard human tissues such as bones and teeth.

## 4 DISCUSSION

The success of implant treatment is reviewed based on the ability of the graft material to integrate well in the surrounding environment. Successful transplants must meet basic requirements, namely, the size of the recipient area must be as strong as the support of a good alveolar process. The recipient area can easily receive transplants by directly being carried out into the former tooth extraction chamber. In patients with the early loss of molar teeth or premolar different conditions can be found which are characterized by the alveolar process atrophy. These conditions require additional surgical procedures to obtain a recipient area that is as bone autograft or splitting osteotomy of the alveolar process. The ideal bone graft material must have the potential point to keep cells alive, not cause an immunological reaction, be easily obtained and provide strength to the area around the bone and not spread disease (Purnomo & Adji, 2012).

In general, the genetic difference between the graft and its recipient, so then the greater reaction rejection arising. The three case reports that have been reported that the treatment plan is to use postextraction dental treatment by implanting the dental implant accompanied by an autograft type bone graft. The selection of material, in this case, uses Autogenous Tooth Bone Graft Block (ABTB) which is bone graft material derived from extracted teeth. The extracted tooth root has been used as a block for alveolar bone augmentation. The tooth has the potential to be an alternative autograft and functions structurally and biologically to be used as a foundation for implant placement (implant osseointegration). The rejection response of the patient's immune system is unlikely to arise if using a graft that comes from the same patient (Smeets et al., 2016).

An evaluation of the clinical condition showed that the bones formed to the new bone regeneration at the post-extraction socket. Bone volume is maintained which is then successfully used for implant placement. Soft tissue also undergoes healing without any signs of inflammation. Dentin is a graphite material that can maintain the structure of collagen. It shows that dentin and cementum particles (ABTB) can be used as an autogenous biomaterial for socket treatment and new bone regeneration (Cardaropoli et al., 2019).

The advantage of using ABTB as a bone graft material is because of its similarity to human bones and the use of this autograft source has been tried by many researchers around the world. Similarities between bones and teeth show a similar biochemical composition consisting mainly of organic and inorganic. Alveolar bone consists of 65% inorganic and 35% organic with a percentage comparable to dentin (inorganic 65-70% and organic 30-35%) and cementum (inorganic 45-50% and organic 50-55%) (Kim et al., 2013).

Dentin and cementum have collagen type I, collagen type III and several growth factors including bone morphogenic protein (BMP), growth factors such as insulin-II (IGF-II), and growth factor- $\beta$  (TGF- $\beta$ ) as the role major in bone remodeling. The majority of proteins found such as osteopontin (OPN), osteocalcin (OC), sialoprotein (BSP), osterix, collagen type I, and Cbfa1 (Runx2) are also found in dentin, which can be used for materials used for bone material available (Khanijou et al., 2019). Previous studies by Kim et al. performed to compare the traditional implantation materials and autogenous teeth which showed using XRD the crystal structure of autogenous teeth had a pattern similar to the

autogenous bone. SEM tests have also proven that after the use of autogenous teeth, dentine tubules and solid collagen matrix are mostly homogeneous and well-formed (Kim et al., 2014). Previous studies have shown that material converted into bone grafting material is quite efficient requiring a long process because of wasting time in demineralization technique (Um et al., 2017). Many dentists and researchers around the world who use this ABTB material because it only becomes dental fuel have been used as an affordable autogenous alternative as several commercially available graft materials.

Some deficiencies in the use of Autogenous Tooth Bone Graft Block (ABTB) are deficiencies in its form ingredients (Khanijou et al., 2019). Another disadvantage is that the indications are limited and also related to the manufacturing process which is quite complicated and more wasting time. Several studies have begun to find various alternative sources such as allograft teeth, but the risk of disease development cannot be ignored so the use of autograft is more recommended (Khanijou et al., 2019).

## 5 CONCLUSIONS

The success of implant treatment is reviewed based on the ability of the graft material to integrate well in the surrounding environment. The use of Autogenous Tooth Bone Graft Block (ABTB) has the potential as an autograft biomaterial material in the treatment of post-extraction sockets and bone regeneration processes. Artificial dentin material derived from extracted teeth is successfully used for bone regeneration and the gradual placement of the osseointegration implant. The ideal bone graft material must have the potential to keep cells alive, not cause an immunological reaction, be easily obtained and provide strength to the area around the bone and not spread disease. Future technological advances make the use of ABTB recommended as an effective bone graft material that can be more easily accessed and successfully developed further.

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