Biocompatibility and osseointegration health and social care essay

1. IntroductionExtraction of a tooth can be due to various causes indicated as advanced periodontitis marginalis, persistent periodontitis apicalis, untreatable deep subgingival caries or a vertical root fracture. When to extraction of a tooth in the maxillary incisors is passed, this can lead to functional and aesthetic problems and must replace lost teeth prosthetic be replaced by taking minimal risks to the nearby hard and soft tissues. 1The display area for prosthetics on implants has increased in recent years. Conditions for the successful application of an implant are an ideal position and full integration into the alveolar bone and a suitable contour of the surrounding hard and soft tissues. 2 To these conditions to satisfy a sufficient width and height of the existing alveolar bone is required. Unfortunately, however, occurs frequently loss of alveolar bone which can be attributed to factors such as periapical pathology, periodontal disease, trauma, and the improper extraction of the tooth. 3, the loss of alveolar bone, however, is also a physiological effect that occurs after extraction of a dental element. This loss of height and width occurs particularly at the buccal bone wall located, also called the buccal botlamel. 2Another said condition for successful implantation is complete integration of the implant into the alveolar bone. This process is called " osseointegration" called. Given the high success rates in recent years by implanting be achieved, attention is nowadays more and more towards the aesthetics when replacing a tooth in the frontal region of the maxilla. 4. 6 For a good aesthetic result to be achieved must the implant is in an optimum position in the alveolar bone to be placed and the implant-supported restoration the appearance of the natural tooth as much as possible to approach. A crucial factor is the condition of the implant located

gingiva. Given the support function of the alveolar bone on the gingiva leads the physiological resorption of the alveolar bone to the recession of the implant located gingiva which can lead to a 'long tongue' and hence a reduced aesthetic result. Conclusion would maintain height and width of the alveolar bone should provide a good starting point for successful implantation and a good aesthetic result. To the physiological absorption of the buccal botlamel to prevent proposed in the literature the fresh extraction cavity can be filled with a biomaterial. Favorable dimensions of the alveolar bone should in this way can be preserved. 2. Biocompatibility and osseointegrationRoot Dental Implants are manufactured from titanium. Titanium or titanium alloys are highly biocompatible metals. These metals oxidize spontaneously. It is this oxide layer on the surface ofthe implant which defines the biocompatibliteit of the implant. For a good anchoring of the implant into the alveolar bone is necessary to optimize the interaction between the livingbone tissue and the titanium implant. This integration into the bone 'osseointegration' called. Osseointegration of an implant leads to a direct connection between the implant surface and the alveolar bone (Figure 1). This compound differs from the compound with a natural tooth. Where a natural tooth is surrounded by a peri-radicular space with a width of approximately 0. 2 millimeters in which the collagen fibers of the periodontal ligament are osseogeïntegreerd will implant in direct contact with the bone. Depending on the surface properties of the tooth root implant and the local bone quality, the percentage of direct bone contact with the implant surface, from 40% to 75%. 7How does the osseointegration of the implant in the alveolar bone instead? To answer this question, the three successive phases that occur in healing of bone fractures need to be

considered: The inflammatory phaseAfter the fracture fills the resulting space is a blood clot. An acute inflammatory response is the result, leading to vasodilation and infiltration of inflammatory cells. The repair phaseThe present blood clot is gradually replaced by granulation tissue. Necrotic bone destruction by osteoclasts. Depending on certain environmental factors at the site of the defect differentiate mesenchymal cells from the periosteum of bone or cartilage forming cells. This leads to formation of callus, a fibrous, cartilaginous tissue. This callus is gradually replaced by plexiform bone in which the collagen fibers in all directions lie in a spatial mesh. This bone is mechanically weak due to the irregular structure. The remodeling phaseAfter the formation of the Plexiform bone remodeling takes place in which is formed lamellar bone, primarily bone tissue that is mechanically strong and resistant to stress. Bone remodeling is an ongoing process that continues throughout life. Implanting at a lesion occurs in the bone tissue which results in the formation of a blood clot and the start of the ignition phase. Directly to the implant located bone dies and is degraded by osteoclasts. In the resulting nascent space between the bone and the implant surface, the callus formed. Remodeling of the subsequently formed plexi multiforme bone biomechanical fragile to lamellar bone biomechanical strong causes the secretion of bone that a good resistance to masticatory forces. After the implantation, however, can also be a different reaction to occur wherein the implant is surrounded by a layer of connective tissue. This fibrous capsule around the implant does not biomechanical fixation of the implant into the alveolar bone which leads to clinical failure of the implant. 7Since the sixties, in Brånemark showed that screw-shaped implant with a good clinical results were to be obtained in the course of the years various types and brands of

implants on the market. There are clear differences between the various implant systems, but factors such as shape, roughness, chemical composition and surface tension play an important role in all manufacturers. Geometry and surface structure of the implant are crucial for the success in the short and long term. 8 The surface structure can best be described as the roughness of the implant surface. This roughness can be divided at the macro level, the micro level and at the nano level. The roughness at the macro level is a geometry of the implant, whereby screw windings provide a surface roughness that leads to a better immediate fixation, and mechanical stability in the alveolar bone, the so-called primary stability of the implant, then in the case of smooth implant surfaces. The surface roughness on a micro level optimizes the interaction between the alveolar bone and the implant surface. Thirdly, the surface roughness plays an important role at the nano level in the adsorption of proteins and adhesion of cells to the implant surface. These surface properties of the tooth root implant ensure the best conditions for a quick osseointegration and biomechanical fixation in the alveolar bone. 83 Process of bone remodeling3. 1 Pulmonary alveolar boneTo make the process of bone resorption after extraction of a tooth can be properly understood must first attention paid to the alveolar bone surrounding a natural tooth. The alveolar process is the part of the jaw in which the alveolar ridge, the alveoli, are included. The alveolar process consists of a layer firmly cortical bone on the outside, the bony coating on the inside of the alveoli, and cancellous bone in-between the central location (Figure 2). The cortical bone plate and the walls of the alveoli are one to two millimeters below the enamel-cement border together and form the crestal bone. The crestal bone has a wavy course and follows the contour of the

enamel cement border of the dental elements. The alveolar process develops during the growth and development of the teeth especially during the eruption. The walls of the alveoli are about 0. 1 to 0. 4 millimeters thick. On the inside, the collagen fibers of the periodontal ligament, the fibers of Sharpey, anchored. The bone on the inside of the alveolewand is often coated with thin layers of fibrous bone, translated into English as bundle bone (Figure 3). Here are periodically deposited bone tissue layers arranged parallel to each other. 7The buccal and lingual cortical bone plates of the alveolar process differ from place to place in compactness and thickness. Thus, the buccal cortical bone plate in the premolar-molar region of the mandible thicker than the lingual bone plate, the upper jaw is also the buccal bone plate in thefrontal region thinner than the palatal bone plate in the region (Figure 4). In many places in the dentition is also little or no cancellous bone is present between the outer cortical wall and the alveolar wall. This is related to the position of the tooth in the jaw. Dehiscenties, involving an incomplete covering of the tooth root with bone tissue, often develop on the thin buccal aspect of the maxillary incisors. 73. 2 Dimensional changes after extractionHealing of the fresh extraction cavity is characterized by a range of internal changes that lead to the formation of bone in the alveolus and a range of external changes that lead to loss of height and width of the alveolar bone. 2Internal changesWhen a tooth is extracted a blood clot forms in the fresh extraction socket after an inflammatory response is triggered. This inflammation stimulates cells to form granulation tissue from the base of the alveolus. 2-3After a week the blood clot completely replaced by granulation tissue. In this phase is already non-mineralized bone tissue, the osteoid is present at the base of the

socket. In the next three to four weeks starting this present osteoid from the base of the alveolus up to mineralize. Simultaneous find coverage of the alveolus with epithelium place some six weeks after the extraction alveolus is completely covered. Approximately one hundred days after the extraction of the tooth, the newly formed bone density reaches its maximum. This newly formed bone will never go on the height of the adjacent bone, complete filling of the alveolus with bone takes place does not. 2External changesAraújo and colleagues 9 demonstrated by studies in dogs that during the first eight weeks after extraction of a tooth there is an increased osteoclast activity leading to resorption of the buccal and lingual botlamel. The reduction in height was particularly present at the location of the buccal botlamel; in both bone lamellae, there was loss of width, but also here was a greater loss observed on the buccal side. A recent clinical study 10 on the effect of extraction of a premolar or molar on the healing of bone and changes that occur in the soft tissues showed that major changes occur in the first twelve months after extraction with an average of fifty percent reduction in the width of the alveolar botlamel. Two-thirds of these changes in the width occurred in the first three months after extraction with an average of between five and seven millimeters bone loss. This loss appeared to occur regardless of the location of the alveolus. As a result of these changes would be the placement of implants in these locations is very unfavorable. The authors concluded that it would be highly advantageous if alveolar bone loss could be prevented. 3. 3 Loss of alveolar boneWhat process ensures that this loss of alveolar bone height and especially botbreedteoccurs? Recent animal studies showed that resorption of the buccal and lingualbotwanden after extraction of a tooth occurs in two

overlapping phases. 9 During phase one, the bundle bone, after extraction of the tooth has lost its function, resorbed and replaced by new woven bone. Since the buccal botcrista bundle as a whole is composed of bone (Figure 5) resulted in this remodeling in a substantial vertical reduction of the buccal botcrista. In phase two absorption takes place on the outside of both the buccal and the lingual botwanden. The cause ofThis type of alveolar bone loss is probably caused by the elevation of a mucoperiosteal flap that often precedes the extraction of a tooth. As a result of this flap surgery, the blood vessels to the alveolar bone through cut which could lead to a reduced supply of blood and as a consequence local necrosis of the alveolar bone. During phase two, this destroyed judicata alveolar bone by osteoclasts present gradually resorbed. Since the botlamel is thinner than the buccal lingual botlamel horizontal bone loss, this would lead to an additional loss in height of the buccal botlamel. Given that dimensional changes also occur if no flap elevation is performed will also be other factors must play a role in the remodeling of the alveolar bone, such as adjustment of the alveolar bone after losing his job by extraction of teeth or by any genetic factors . 9Loss of height and width of the buccal botlamel was also confirmed in studies of Covani and colleagues. They showed that the buccal botlamel lingually / palatally shifts after extraction of a tooth. The researchers found that this process the bone wall up to two thirds lingually / palatally could move relative to the original buccal position. This process was seen by the investigators attributed to the deposition of new bone in the alveolus and empty the simultaneous occurrence of resorption on the outside of the buccal and lingual botlamel. 113. 4 Preservation of alveolar boneSchropp and colleagues 10 concluded already that it would be highly advantageous if

alveolar bone loss after extraction of a tooth could be prevented. Darby and colleagues 5 advised that preservation of alveolar bone, in particular, of interest is at a thickness of the buccal botlamel of less than two millimeters. This is almost always the case in the maxillary incisors. 2 If the time tension between extraction of a tooth and placement of a dental root implant prolonged leads to such a loss of height and width of the buccal botlamel that build the alveolar bone is necessary with a unpredictable treatment outcome results. Most critical is the loss of height of the alveolar bone as it is harder alveolar bone height to recover and this greater impact on the gingiva. 1The changes that occur after extraction of a tooth called for the prevention of alveolar bone resorption, especially in cases where it is an incisor and implant placement should be postponed for six months or longer. It was suggested that the immediaat placing an implant immediately after extraction of a tooth resorption of the buccal botlamel possible decrease. Recent studies indicate that in addition to directly placed implant resorption of the buccal botlamel place. 12-15 Deferring placing an implant is required for alveolar botwanden with limited bone height (eg after large periapical periodontitis or defects) a morphology of the alveolus that placement of an implant in the desired position impossible, in young patients still growing subject, in cases of financial limitations or medical conditions involving placement of an implant is contraindicated. 5 If resorption of the buccal botlamel can be prevented at a later stage would build up of alveolar bone is not required and it would be the placement of implants at a later time, simplify and make more predictable. Procedures which are aimed at preserving the buccal botlamel must be carried out at the time of or subsequent to the extraction of a tooth, and are designed toexternal

resorption of the alveolar bone wall to minimize and bone formation in the alveolus tomaximize. 2 In addition to the extraction of a tooth without causing damage to the buccal botlamel (Figure 6), the additional application of biomaterials in the fresh extraction cavity to these procedures counted, and it is suggested that these materials are possible, the dimensions of the alveolar bone retained. However, there is doubt about the application of biomaterials, in the long-termbecause of possible interference with the natural healing process, since the materials would not completely resorb and so parts of the material would remain behind in the alveolus. 164 Biomaterials4. 1 Autologous boneAn autologous bone graft is a bone graft from the patient himself. Autologous bone is the reconstructive surgery as the gold standard. 1-2, 17-21 This means that the patient is optimally treated if using the patient's own bone. Besides the great advantage that there is no risk of an immune response, autologous bone also possesses important properties. Autologous bone grafts are in fact osteogenic, osteoinductive and osteoconductive. 1, 19-20, 22 Osteogenic is to say that the graft themselves lead to production of bone provided by bone-forming cells in the bone marrow of the transplant are present. Osteoinductive means that the bone graft is able to recruit mesenchymal cells from the local area, or from the circulation, and then to turn into bone-forming cellsdifferentiate. 1, 19, 22 This process takes place particularly under the influence of bone morphogenetic proteins, a major growth factor for bone formation. Osteoconductive is to say, that the three-dimensional structure of the graft and provides an opportunity to bone-forming cells in order to repair area to infiltrate. It acts as a scaffold to support new bone formation. 1, 22 Autologous bone can intraorally from the chin, the mandibular ramus or

tuber maxillae be removed (Figure 7) or extra-orally from the iliac crest are harvested. This is alsoimmediately the biggest drawback of the autologous bone graft, namely that a surgical procedure is required which leads to morbidity at the location of the donor site. 1-3, 17, 19, 21-22 Given this negative feature is the recent decades looked for alternatives. 4. 2 Allogeneic boneAn allogeneic bone graft is bone from donors which can be obtained through botbanken. 1, 17, 22 Allogeneic bone by botbanken pretreated to prevent an immune response of the recipient. This is done by irradiation, lyophilization (freeze-dried bone allograft, FDBA), freeze-drying and demineralization (demineralised freeze-dried bone allograft, DFDBA) or by chemical processing. Due to this pre-treatment, however, change the physical properties of the graft which the osteoinductivity and negatively affects the quality in relation to autologous bone is reduced. Allogeneic bone also has a number of advantages compared to autologous bone. The need for an additional operation is negated, which morbidity at the donor site isAppearance. Allogeneic bone also has good osteoconductive properties and is relatively unlimited quantities. 4. 3 xenogeneic boneA xenogenic bone graft is bone from animals, including varkensbot, bovine bone (Figure 8) and paardenbot. 1, 3, 19-20 xenogeneic bone also has its limitations. First calls a xenogenic bone graft an immune response. This is then be reduced by chemical pre-treatment, but also removes the osteoinductive properties of the material. Another factor in xenogeneic bone concerns about potential disease transmission an important role, notably Creutzfeldt-Jakob disease. Another disadvantage of xenogenic bone is the slow healing process which is accompanied by fibrous encapsulation of the botpartikels that slowly resorb. Xenogeneic bone does however after preprocessing a porous calcium

phosphate skeleton excellent osteoconductive properties. It acts as a kind of biocompatible scaffold for bone-forming cells. 14. 4 Synthetic biomaterialsSynthetic biomaterials provide an alternative to autologous, allogeneic and xenogeneic bone grafts. Synthetic biomaterials have good osteoconductive properties and are available in unlimited quantities. These materials are, however, neither osteogenic or osteoinductive and osteoconductive thus only, with the exception of bioactive glass, which is also an osteoinductive function. The synthetic biomaterials can be divided into three different categories: hydroxyapatite, ceramics and polymers. HydroxylapatiteThe synthetic hydroxylapatite (Ca 5 (PO 4) 3 (OH)) is in various forms on the market, as it is or non-absorbable and is or is not porous. The temperature at which the material is manufactured determines the final biological properties. At high temperatures, results in a non-resorbable hydroxyapatite with large crystals. Non-resorbable, porous hydroxyapatite can be obtained by hydrothermal conversion of the calcium carbonate from natural coral skeleton. This creates a pore size of two hundred micrometer, which is enough to promote ingrowth of bone tissue to achieve. Resorbable hydroxyapatite at low temperatures is obtained by a precipitate to manufacture. Due to the nature resorbable osteoconductive properties seem to be the better in comparison with non-resorbable hydroxyapatite. 1CeramicTricalcium phosphate (Ca 3 (PO 4) 2) and calcium phosphate (Ca (H 2 PO 4) 2 are resorbable synthetic bone substitutes. These materials are biocompatible and biodegradable. Both materials, however, show a different degree of resorption and resorption are not always accompanied with new bone formation. 1 Biphasic calcium phosphates consisting of hydroxyapatite and bètatricalciumfosfaat can contrast

completely resorb and be replaced by regenerated bone where it slowly resorbable hydroxyapatite acts as a scaffold for new bone formation 17. Bioactive glass (CaO, Na 2 O, SiO 2, P 2 O 5) has excellent osteoconductive properties and the ability mesenchymal cells to differentiate into osteoblasts to induce. However, the prolonged and incomplete resorption remains the greatest limitation of this material for widespread application. 1 Bioactive glass has excellent osteoconductive and osteoinductive properties. The prolonged and incomplete resorption remains the biggest limitation for extended application of this biomaterial. PolymersResorbable polymers have a osteoconductive effect and act as a scaffold for the attachment and proliferation of bone-forming cells. Polymers are large organic macromolecules, composed of monomers that are located in a regular pattern. They can fill up defects of different sizes, have good mechanical properties and the degradation products are biocompatible. Polymers can be divided into natural polymers such as collagen, and synthetic polymers such as polylactide-polylactidezuur and polyglycolidezuur. The synthetic polymers can also be used as a matrix for the supply of Bone Morphogenetic Proteins, which polymers may also have a function to give osteoinductive. 234. 5 Application of membranesIn addition to the use of natural and synthetic biomaterials, it is also possible to cover with the fresh extractiealveole a diaphragm, optionally in combination with a biomaterial, for optimal bone ingrowth and bone healing. The operation of a membrane is based on the formation of a separation between the bone and the soft tissue overlying after extraction of a tooth. This gives the bone-forming cells time and freedom from the clot the bone defect withosteoid to fill, because the fast growing connective tissue and epithelial cells outside the bone defect to

be held. 22, 24 This process is also called guided bone regeneration(guided bone regeneration, GBR) called. Possible application of a biomaterial under the membrane in this process is used to support the membrane and as a space maintainer. There are two types of membranes 24 are available, namely, resorbable and non-resorbable membranes. Non-resorbable membranes are manufactured from expanded polytetrafluoroethylene (ePTFE, Figure 9) and have the advantage that they are resistant to deformation - possibly additionally reinforced with titanium - and therefore not always incombination with a supporting bone substitute need not be used. 1 The problem with the application of these membranes, however, is the risk of premature exposure of the membrane to the oral environment, which leads to bacterial colonization of the membrane, and the need for premature removal. 25 a non-resorbable membrane should preferably only after a period of six months will be removed. Resorbable membranes are made from collagen, demineralized freeze-dried bone, cellulose or polymers. Resorbable membranes do not in principle be removed. These membranes, however, have two major disadvantages. The absorption is always accompanied by a cellular response of the surrounding tissue which acts negatively on the regeneration process. In addition, resorbable membranes less firm and its supporting bone substitutes therefore indicated to prevent sagging of the membrane. 1

Problem

The major problem that occurs after extraction of a tooth in the maxillary anterior is the physiological resorption of the buccal botlamel. This ensures that the buccal to palatal botlamel are going to move, and also loss in height

of the alveolar bone on the buccal side effects. Implanting at a later point in time is used by this process is almost impossible because the implant is no longer in its correct three-dimensional position can be placed. Concessions are necessary and then lead to an unsatisfactory aesthetic result. It is suggested that application of biomaterials in the fresh extraction cavity, whether or not in combination with a membrane, allows for preservation of height and width of the alveolar bone in the long term. This is beneficial if placement of an implant should be postponed. The problem leads to the following question: ensures application of a biomaterial into the alveolus immediately after extraction of a tooth in the aesthetic region of the upper jaw, whether or not in combination with a membrane, for the preservation of the alveolar botdimensies for future implant placement in comparison with the natural healing of extractiealveole?

Research Hypothesis

H 0: application of a biomaterial into the alveolus immediately after extraction of a tooth in the aesthetic region of the upper jaw, whether or not in combination with a membrane, does not ensure a reduced vertical resorption of the buccal botlamel, or to a reduced horizontal resorption of the alveolar bone. H 1: application of a biomaterial into the alveolus immediately after extraction of a tooth inthe aesthetic region of the upper jaw, whether or not in combination with a membrane, ensures a reduced vertical botlamel buccal absorption of the horizontal and reduced resorption of the alveolar bone.

Research Purpose

The purpose of this systematic review is to, on the basis of the literature available to investigate whether the application of a biomaterial into the alveolus immediately after extraction of a tooth in the aesthetic region of the upper jaw, whether or not in combination with a membrane, ensures for a reduced vertical botlamel buccal absorption of the horizontal and reduced resorption of the alveolar bone in comparison with the physiological bone resorption that occurs in the natural healing of a extractiealveole. Secondary also looks at the extent of absorption of the different biomaterials in combination with new bone formation in the alveolus and whether a judgment can be made about a preference for a particular biomaterial or a particular technique. http://www. gstatic. com/translate/infowindow/iws_n. pnghttp://www. gstatic. com/translate/infowindow/iws_w. pnghttp://www. gstatic. com/translate/infowindow/iws_e. pnghttp://www. gstatic. com/translate/infowindow/iws_s. pnghttp://www. gstatic. com/translate/infowindow/iws_c. pnghttp://www. gstatic. com/translate/infowindow/iw_n. pnghttp://www. gstatic. com/translate/infowindow/iw_n. pnghttp://www. gstatic. com/translate/infowindow/iw_w. pnghttp://www. gstatic. com/translate/infowindow/iw_e. pnghttp://www. gstatic. com/translate/infowindow/iw_s0. pnghttp://www. gstatic. com/translate/infowindow/iw_s0. pnghttp://www. gstatic. com/translate/infowindow/iw_c. png