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Tooth Autotransplantation

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1. Introduction

Teeth autotransplantation is an alternative treatment for single tooth oral rehabilitation, and it is possible that it becomes more frequent if the technique respects protocol. It is important to choose patients with prognostic factors that may provide a favorable condition for success. (Tsukiboshi 2001) The main reason for failure of this technique is a bad selection of patients, and this can be overpast by previous planning and the knowledge of all prognostic factors that are a part of the process.

Follow-up studies for 3 to 14 years indicate that either the transplantation is placed in a natural or artificial alveolus, teeth vitality is preserved in 90-96% of all cases. (Donado 2007) (Ahlberg, Bystedt et al. 1983) The ideal condition for success, according to the literature seems to be a donor tooth with 3/4s of root development, with open apex. (Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005; Donado 2007)

When planning a surgery such as this, it is important to study the patient's age, the existence of a natural alveolus and the root development. (Tsukiboshi 2001) It seems well defined by the literature that the preference for selection of clinical cases is young and cooperative patients, without any systemic diseases. (Tsukiboshi 2001) It is also shown that in teeth with incomplete root formation, vitality is preserved in 90-96% of all cases in 3-14 year follow-up studies, and the preference is also for natural alveolus. (Ahlberg, Bystedt et al. 1983; Donado 2007) The best case scenario seems to be when root formation is in its 3/4s, with open apex. (Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Tsukiboshi 2001; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005; Donado 2007)

The success rate must be detached from the survival rate in tooth autotransplantation. The survival rate refers to the presence of the transplanted tooth, even if its function, esthetics or development, are compromised. (Aslan, Ucuncu et al. 2010) On the other hand, to say that success has been achieved, there must be good esthetics and positioning, ability to chew without restrictions, pulpar vitality, and good dentofacial development. (Aslan, Ucuncu et al. 2010) This success rate is influenced by surgical technique, experience of the surgeon, the patient's age or root development. (Aslan, Ucuncu et al. 2010)

According to Andreasen et al, in 1990, survival rate of transplanted teeth after 13 year follow-up is 95-98%. (Aslan, Ucuncu et al. 2010) In 1999, Josefsson found a 82% survival rate after shorter follow-up time - 4 years follow up (Josefsson, Brattstrom et al. 1999). The main reason for high rates is case selection. It is important to note that literature shows higher

percentage of survival rate for immature teeth, in adolescents with natural alveolus. (Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005; Donado 2007)

Literature also tells us that if the tooth is transplanted to an artificial alveolus, it lowers survival rates more than in natural alveolus. (Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005; Donado 2007) Even so, Ahlberg et al tell us that maxillary canines transplanted into artificial alveolus may have similar survival rates than those transplanted into natural alveolus. (Ahlberg, Bystedt et al. 1983; Donado 2007) That is, artificial alveolus normally have worse prognosis than natural ones. At best, survival rates may be equal in both types of alveolus.

Cases submitted to orthodontic treatment are an indicator that transplanted teeth may be a viable solution and the most natural one for replacing missing teeth. These teeth can even be moved and serve as anchorage in orthodontic treatment and still allow bone remodeling around them. (Andreasen, Paulsen et al. 1990; Paulsen 2001)

To achieve the complete root formation, it is important that during the surgery, periodontal ligament is preserved as much as possible, and it needs to be a technique as little invasive as possible, because that may compromise root development, leading to ankylosis or root reabsorptions. (Thomas, Turner et al. 1998; Aslan, Ucuncu et al. 2010) Most authors conclude that immature teeth are preferable for better outcomes. (Andreasen, Paulsen et al. 1990; Paulsen, Andreasen et al. 1995; Paulsen 2001; Paulsen, Shi et al. 2001) On the other hand, the fact that a considerable percentage of teeth completed root formation indicates an important factor of normal and physiological process. (Paulsen, Shi et al. 2001) Root development can go on with no impediments, but even so, it may end with an unfavorable crown-root relation. (Aslan, Ucuncu et al. 2010) The root may close its apex, but may not continue to grow apically. According to Andreasen, if the root development is very low when the tooth is transplanted, that is, less than 3/4s of its complete formation, the root growth is also inferior, and may end-up with closed apices, but with small length. (Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Northway 2002; Tsukiboshi 2002; Aslan, Ucuncu et al. 2010)

Andreasen also reveals a higher incidence of pulpar necrosis in teeth with completed root development at the time of the transplant, but claims that, with adequate root canal treatment, survival rates may be assured, and, in some cases, endodontic treatment may even be unnecessary, because of partial pulpar obliteration that may be present in teeth with pulpar regeneration and healing. (Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Czochrowska, Stenvik et al. 2000; Jonsson and Sigurdsson 2004)

In sum, vital teeth are most frequent in immature teeth transplanted. Tooth with complete root formation, normally present endodontic treatment and may achieve some success if there is an adequate root canal treatment.

Predicting the prognosis for tooth autotransplantation is important to evaluate the ability of this technique for replacing a missing tooth. A large number of cases are needed to predict the prognosis before surgery and to eliminate most doubts. Literature shows us that having this knowledge allows the clinician to select transplanted teeth cases very carefully and with a high level of stringency.

2. History in a glance

Teeth autotransplantation have been considered, since the middle of the 20th century, as viable rehabilitation alternatives, and have been usually a part of treatment planning. In several occasions, good results were obtained and registered, with clinical viability, either esthetics or functional. (Ahlberg, Bystedt et al. 1983; Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005) However, a considerable percentage seemed to develop complications, turning this option into a controversial one. (Ahlberg, Bystedt et al. 1983; Czochrowska, Stenvik et al. 2002; Kim, Jung et al. 2005)

Teeth autotransplantation technique is well supported by documentation. According to historic evidence, populations from over 1000 years back have used it, reaching a more frequent use during the middle ages. They would use animal, ivory, bone or even human teeth extracted from corpses, but the problem was that, because of discoloration, bad odor and lack of resistance, it didn't achieve a good public opinion. (Magheri, Grandini et al. 2001; Tsukiboshi 2001)

The first known documented reference of this surgical procedure is in Ambroise Paré's work (1561), a Renaissance French Surgeon that describes a noble woman in who, after extracting a tooth, was placed another tooth that belonged to one of hers maid, stating that after some time, the lady could chew perfectly. Two centuries later, Pierre Fauchard (1725), the founder of Modern Medicine, wrote about re-implants and dental transplantation, claiming that they could be performed in the same individual, or between 2 individuals. John Hunter (1728-1793), in England, described a vascular and periodontal regeneration after a transplantation of animal or human teeth in crests of cocks, therefore preserving the tooth vitality, and if a painful tooth was to be extracted, it could be boiled and re-implanted. These were the first laboratory investigations towards teeth transplantations. (Marzola 1968; Tsukiboshi 2001)

The same investigator, however, also introduces the problem of diseases' transmission, such as syphilis. In 1827, Emile Blaise Gardette recorded the impossibility of teeth autotransplantation success if case selection was not taken as an important issue. This author studied the results of 170 transplants in function for only 1 or 2 years, analyzing that good results were only obtained with careful selection of cases.

In 1935, the microscopic investigation started, with Lundquist. Apfel, in 1950, advised the use of the tooth transplantation technique, but only according to rules he described, such as planning according to the patients' age, donor tooth germ size, and good intra-oral x-rays. He also presents the surgical technique, in which he maintains the pericoronal sac and the gum that covers it. This technique was later abandoned by Marzola in 1988, claiming it was unnecessary to preserve the gum that covered the pericoronal sac. (Marzola 1968) But it was only in 1956, with Fong, Apfel and Miller that scientific relevance was achieved, with 50% success rates, justifying the not successful cases with lack of root development and presence of external and internal root reabsorptions. (Magheri, Grandini et al. 2001) During that same year, a world symposium defined specific rules for the tooth transplantation success:

- Lack of discomfort of the patient,
- soft and hard tissue regeneration and
- Functional retention for at least 2 years.

Ten years later, Metro presented a variation from the previous surgical technique, with simultaneous bilateral teeth transplantation, and stated that he was not in favor of teeth

splinting, because of the food accumulation, because of difficulties in hygiene, and because of epithelial adherence inhibition as a result. He reported using simple sutures of the dental papillae, placing the tooth germ in occlusion and instructed that no chewing in the first 3 days should exist, just liquid diet. This would allow total success. (Marzola 1968) In the 70s of the 20th century, this technique was re-evaluated by Andreasen and his works on biological principles, the causes of failure and the periodontal healing after tooth transplantation. (Kim, Jung et al. 2005) This was a major reference for tooth transplantations. Immunological research has also been reported and documented. However, this field still needs more investigation. In the meantime, several works are presented regularly, showing the success rates of this technique, its precise indications and follow-up periods.

3. Concepts

Teeth autotransplantation can be defined as the placement of a tooth or tooth germ, with or without vitality, in a natural alveolus corresponding to another tooth, or in an artificially created alveolus for this end. (Escoda 1999; Donado 2007)

A natural alveolus is already physiologically formed, and previously occupied by another tooth. On the other hand, an artificial one is created by the surgeon, that is, in a place where a tooth was not present at the time of, or previously to the transplantation. (Escoda 1999; Donado 2007)

The main purpose of this specific technique is to substitute a tooth, that has been lost or that has indication for extraction, because of a bad prognosis, by another tooth that presents more advantages for being in the receptor area, and/or that has no function in its primary location. (Czochrowska, Stenvik et al. 2000; Donado 2007)

It can be considered, in a wider concept of tooth autotransplantation for some authors such as Tsukiboshi, 3 distinct situations: First, when a tooth is extracted from a location and reimplanted in a different one, which is named tooth transplantation; Second, when a tooth is repositioned in its own alveolus, as in verticalization of 3rd molars or surgical extrusion of a tooth; Third, and finally, when an extracted or avulsed tooth is treated and reimplanted in its own location sometimes as an alternative to periapical surgery. (Tsukiboshi 2001) This is a more global concept including intra-alveolar transplantation and intentional reimplantation, because all are characterized by a similar healing process. (Aslan, Ucuncu et al. 2010)

Autotransplantation of teeth are an alternative as any other and should be considered when planning a treatment. This technique can give some advantages, such as a possibility for a fixed bridge (where before it would only be possible to place a dental implant or removable prothodontics), the reposition of teeth without orthodontics, the use in helping to solve agenesis problems and the surgical extrusion of fractured teeth (to allow dentistry/fixed crowns). (Aslan, Ucuncu et al. 2010)

This technique usually requires one surgery. Besides all this advantages, one of the biggest is the fact that the patient regains a proprioceptive feeling in the transplanted tooth, with normal periodontal healing, allowing a natural feel during chewing. (Aslan, Ucuncu et al. 2010) But the main advantage is the use in children and adolescents, because of its continuous induction on the alveolar bone, and therefore allowing for the normal physiological alveolar growth. (Aslan, Ucuncu et al. 2010)

It also presents some disadvantages, such as being less predictable when using teeth with complete root development, the possibility of pulpar necrosis, and the need for endodontic

treatment, very frequently. It also demands a strong collaboration and motivation from the patient. If this does not happen, the success rate falls abruptly.

4. Prognostic factors

The first and most important prognostic factor is case selections. Therefore, indications and counter-indications are of major relevance to achieve success.

The main indication is the existence of a risk/benefit more favorable than for any other kind of treatment, when a tooth must be maintained for esthetics and functional demands. (Josefsson, Brattstrom et al. 1999; Kallu, Vinckier et al. 2005) The best patients for this treatment are motivated youngsters, with impossibility to be subjected to dental implants. (Aslan, Ucuncu et al. 2010)

The 3rd molar when used to substitute a 1st or 2nd molar, the use of an extracted premolar for orthodontic reasons to substitute a central incisor or the placement of a retained canine in its correct position are the most frequent situations for teeth transplantations. (Paulsen, Andreasen et al. 1995; Escoda 1999; Donado 2007) It is also common to use this technique in trauma patients, with avulsed teeth that can be re-placed in their own location. (Aslan, Ucuncu et al. 2010)

For all this, it is essential to obtain a complete and thorough clinical history, a detailed x-ray exam, to measure the donor tooth and the receptor location, and to determine the root form.

The counterindications are the ones that all surgical intervention are subjected to, but the lack of bone in the reception area, and complicated extractions for donor teeth can also lead to non-successful cases. (Ahlberg, Bystedt et al. 1983; Escoda 1999) Compromised teeth with periodontal disease, in which epithelial adherence is lost in more than one 3rd of the root should be considered as inadequate as donor teeth for autotransplantation because of the lack of periodontal ligament. This characteristic favors ankylosis and root reabsorptions. (Tsukiboshi 2001)

Literature shows that a tooth autotransplantation has better prognosis when performed in younger patients, with immature donor teeth. Follow-up studies of 3 to 14 years report that pulpar vitality is preserved in 90 to 96% of immature donor teeth cases. Although it has also been shown that teeth transplantation works at any age, and even with artificially created alveolus, the ideal situation, and with the best prognosis, seems to be when the transplanted tooth has 3/4s of root development, and an open apex. (Akiyama, Fukuda et al. 1998; Josefsson, Brattstrom et al. 1999; Czochrowska, Stenvik et al. 2002; Kallu, Vinckier et al. 2005; Donado 2007)

The technique success has been presented throughout the years, approaching different factors. Fleming, back in 1956 suggested that, for a transplanted tooth to be considered successful, it should:

- Have no inflammatory reaction in the alveolus,
- the dental germ should be maintained in its new position,
- the periodontium should be preserved,
- There should be no root reabsorption,
- the color of the transplanted tooth should suffer no changes, and
- it should maintain its vitality. (Fleming 1956)

The success rate seems to vary with the surgical technique, the experience and capability of the surgeon, and several pre and post operative factors, such as age of the patient, root development, the type of transplanted tooth, the extra-oral time, the placement of the donor

tooth and the receptor location. (Kallu, Vinckier et al. 2005; Aslan, Ucuncu et al. 2010) Besides all this, we should be careful with the amount of space needed, the occlusion and the size and shape of the donor tooth. (Aslan, Ucuncu et al. 2010)

The surgical technique must be as non-traumatic as possible, with minimum handling of the donor tooth in order to preserve the periodontal ligament and maintain the Hertwig Epithelial Sheath, so that root development is not compromised, avoiding ankylosis, root reabsorptions and loss of epithelial adherence. (Thomas, Turner et al. 1998; Aslan, Ucuncu et al. 2010)

The transplanted tooth can be placed in the receptor location and maintained only by simple sutures or by a crossed suture over the crown, or even by a non rigid splint. It seems clear that a prolonged rigid splitting of the transplanted tooth has adverse effects in pulpar and periodontal healing, and that there should be a relative immobilization period of 2 weeks to 2 months, depending on the accommodation of the donor tooth in the receptor alveolus. (Aslan, Ucuncu et al. 2010)

The ideal receptor alveolus must have sufficient height and width to shelter the donor tooth, and it can be improved increasing its measurements surgically, for example, with a non-traumatic sinus lift, similar to the technique used in dental implants placement. (Tsukiboshi 2001) In the specific case of 3rd molars transplanted to the contiguous 2nd molar alveolus, the prognosis is worse when the wisdom tooth is positioned more apically according to the 2nd molar, becoming harder to achieve epithelial adherence in the distal surface of the transplanted tooth. (Tsukiboshi 2001) The donor tooth must be placed, according to the literature, slightly under the occlusal plan, but not forced into the alveolus, with no pressure on the apexes, to allow root development. (Aslan, Ucuncu et al. 2010)

The root development of the transplanted tooth can, therefore, continue with no impediment, but may also be disrupted leading to a unfavorable crown/root relation. (Aslan, Ucuncu et al. 2010) Andreasen showed that although they have higher success rates, more immature roots present less root growth after transplant, than immature but in a more advanced growth stage roots. (Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990) This is the reason why the literature shows that the ideal stage for tooth transplant is when the root has 3/4s of its development, and an open apex of more than 1 mm. (Northway 2002; Tsukiboshi 2002)

The periodontal healing is normally achieved after 2 months, in most cases, (Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990) and it is characterized by no root reabsorption and the x-ray presence of lamina dura. (Aslan, Ucuncu et al. 2010) In x-rays, the periodontium shows himself as a continuous space throughout the root surface. (Cohen, Shen et al. 1995; Akiyama, Fukuda et al. 1998) The root reabsorption by substitution, that is, ankylosis, happens in teeth with injured cement, which suggests the importance of this structure for the periodontal regeneration. (Akiyama, Fukuda et al. 1998) Ankylosis is normally diagnosed in the 1st year, in x-rays, or clinically by a metallic percussion sound, and after 1 year, it is usually seen external root reabsorption, that may also appear, according to Andreasen, because of lack of oral hygiene. (Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Andreasen, Paulsen et al. 1990; Thomas, Turner et al. 1998)

Revascularization normally occurs 4 days after the surgery, and advances in a 0.1mm/day rate. Immature teeth most often do not need endodontic treatment, and normally finish their root development and maintain vitality. One of the main factors for revascularization is the extra-oral time of the donor tooth and its handling during surgery. Teeth re-implants are

more likely to be successful if performed immediately after tooth lost or up to 30 minutes of extra-oral time. The extra-oral time of the donor tooth is also consensual to be of no more than 7-8 minutes, but there hasn't been no relation between this factor and root reabsorptions or ankylosis. (Kim, Jung et al. 2005)

5. Treatment sequence

The sequence for an autotransplantation, in an ideal and complete version, implicates thorough clinical and radiographic exams, treatment plan, surgical procedure, endodontic treatment, if needed, rehabilitation treatment if needed and follow-up. (Tsukiboshi 2002)

As in any surgical intervention, protocol must begin with clinical data collection, with the patient's age, medical and dental history, and with a clinical examination and radiographic study of the donor tooth, its root development, and finally with the clinical and radiographic examination of the receptor location. This clinical exam allows the identification of the periodontal biotype, important to predict gingival retractions, for example, and more importantly, the measurement of the available space in the receptor area. On the other hand, the radiographic study, with a panoramic x-ray, periapical and occlusal x-rays, make it possible to determine the shape of the donor tooth and the receptor location, root development, the alveolar bone, the position and placement of the tooth, the degree of inclination and the relationship with nearby noble anatomic structures. (Tsukiboshi 2002)

If we find 2 teeth that are suitable to be used as donors, the choice should be made looking at the tooth's crown, because 3rd mandibular molars are more similar to 1st and 2nd mandibular molars, and the same happens for 3rd maxillary molars, that are similar to the neighbor teeth. (Tsukiboshi 2001)

The treatment plan is all about case study and selection, so that the best time for tooth transplantation is chosen. For example, if a tooth in the receptor area needs to be extracted, the transplantation must be done within 2-6 weeks after, to avoid extended bone reabsorption. (Tsukiboshi 2002) If possible, the tooth transplantations is best when performed immediately after extraction in the receptor area, and if there is predictable need for endodontic treatment, based on root development grade, it can be done before transplantation is complete, extra-orally, or it can be started within 2 weeks after surgical intervention. (Tsukiboshi 2002) Transplanted teeth restorations should take in account the preference to avoid tooth reduction, that is, there is no absolute indication for fixed prosthodontics after tooth transplantation. (Tsukiboshi 2002)

The treatment plan also needs good radiographic study, and the image of the donor tooth must be measured mesio-distally at the crown and at the roots, and the root length must also be evaluated. (Tsukiboshi 2002)

5.1 Surgical technique – Fase 1

The surgical technique is perfectly accepted and present in the literature, with references to some important particularities, with some different points of view.

The surgical material needed is:

- Intra-oral mirror
- probe
- Dissection tweezers

- Carpule
- Disposable needles
- Local anesthetics
- N.er 12 and n.er 15 blade
- Retractors
- Levers
- Forceps
- Curette
- Bone file
- Hand piece
- Surgical drills
- Supramide suture 3/0 and 4/0
- Needle holders
- Scissors

To lower the risk of infection of the operative field, the patient should first perform mouth rinse with chlorhexidine before surgery. Secondly, the peri-oral structures should be cleansed with chlorhexidine and some authors suggest starting taking systemic antibiotics orally a few hours before surgery. (Tsukiboshi 2002)

5.2 Surgical technique – Fase 2

The anesthetics technique is conventional, with loco-regional blockage complemented with suprabone infiltrative anesthetic buccally and lingually, using if possible, anesthetic with adrenaline to potentiate the effect in the donor tooth area. In the receptor region, it usually is enough to anesthetize with suprabone infiltrative anesthetic buccally and lingually.

The incision on the donor tooth can include vertical release if needed because of the difficulty degree for extracting it. If not needed, an intrasulcular incision should be enough. Mucoperiosteum retraction starts in the interdental papillae, following to the gingiva, releasing the soft tissues and preserving the periosteum membrane integrity, for better posterior regeneration.

The donor tooth luxation should be controlled, allowing the tooth to stay in the alveolus, but also making it possible for an easy and fast extraction. Sometimes, osteotomy with bone drills is necessary to expose the donor tooth and to allow a support surface for the elevator. Just then, the elevator can leave the tooth in the alveolus but with mobility and small retention forces. Some authors suggest an intra-crevicular incision before luxation, to preserve as much as possible, the periodontium of the root. (Tsukiboshi 2002)

Some also defend the donor tooth extraction before the receptor location is prepared, to confirm anatomy, size and periodontal ligament condition. They then suggest replacement of the donor tooth in the original alveolus, while the receptor site is being prepared. (Tsukiboshi 2002) If a delay is predicted on the preparation of the receptor site, the tooth should be placed according to a few authors, in a saline Hank solution, to maintain periodontal ligament cells viability, and never be placed in water, because of its hypotonic characteristic that would implicate having no viability that is needed for the periodontal ligament regeneration. (Tsukiboshi 2002)

The receptor site preparation, with the extraction of the tooth, if present, should also include removal of the inter-root septum, and all the inflammatory tissue that may be present. If possible, it is better to extract without using curettes at the end, because it allows

periodontal ligament cells to be maintained. If there is no tooth present, a surgical bone drill should be used to create or adapt an artificial alveolus for the donor tooth, with slightly more than enough space vertically, mesio-distally, and bucal-lingually. A saline solution embed compress should be placed in the alveolus. (Tsukiboshi 2002)

5.3 Surgical technique – Fase 3

The previously luxated donor tooth is now extracted, removing the pericoronal sac. The transplant is then performed, verifying the adaptation to the receptor site, without forcing its entry so that there is no apical pressure in any way. Obstacles in the alveolus are removed if found. The perfect adaptation needs a similar biologic space to the one in a normally erupted tooth.

The donor tooth needs at this time, to be maintained on the chosen position. Literature seems to show that the semi-rigid technique for keeping the tooth in position is the best. A rigid fixation of the tooth can originate dental tissue reabsorption and ankylosis, and some mobility stimulates periodontal ligament cells to regenerate. So, a crossed suture over the crown of the tooth slightly in infra-occlusion, allows good adaptation of the wound and protects the clot, and, on the other hand, avoids entrance of bacteria. (Tsukiboshi 2002) Some authors recommend simple papillae suture before the placement of the donor tooth, so that a better adaptation of the tooth in the alveolus and marginal gingiva is achievable, especially in those cases where a 3rd molar is placed in the contiguous 2nd molar place and there is no distal bone structure for perfect adaptation. (Tsukiboshi 2002) Literature also reveals an important detail: 2 loose ends in the mesial and distal sutures should be left free, so that those ends are tied over the crown of the transplanted tooth. (Tsukiboshi 2002) In some cases, a thin orthodontic wire can be used to splint the tooth, with no rigidity, but allowing to release pressure from the root apex. Occlusion must be “spot on”.

At this time, an x-ray should be taken to evaluate the position of the donor tooth and to have a perspective to compare with future controls.

Some authors use surgical cement for 2-3 days after surgery.

At the end of the surgery, a revision and suture of the donor tooth original area has to be performed, to be possible to eliminate bone fragments and regularize bone edges. Suture has to allow repositioning of soft tissues.

5.4 Surgical technique – Fase 4

After the surgery, the patient must be advised to do soft and cold feeding for 1 week. He must apply ice locally to reduce swelling and pain, and avoid intense physical exercise for 2-3 days.

A systemic antibiotic via orally for 1 week, an AINE's and an analgesic must be considered. Clorohexidine must also be advised in gel and mouthrinse.

The transplanted tooth should be controlled clinically and radiographically after 2 days, 1 week, 1 month, 3 months, 6 months and annually, and suture removal should be on the 10th day after surgery. These controls allow a close monitoring of the tooth's position, the oral hygiene of the patient and the occlusion.

If needed, endodontic treatment is to be started after 2 weeks of the surgery. If the tooth is immature, with open root apexes, it is normally not necessary because of the high possibility of revascularization of the pulp. In those cases, it should be controlled by cold and hot tests, to identify pulpar necrosis. (Tsukiboshi 2001)

If the case is a re-implant, the process is similar:

- Localization of the tooth, if it is retained
- Osteotomy if needed
- Luxation of the tooth and placement on the correct position
- Endodontic treatment if there is pulpar necrosis 7-14 days after surgery
- Non rigid fixation with suture and/or orthodontic wire
- X-ray control

6. Tooth autotransplantation vs. dental implants

Dental implants have been gaining use in Oral rehabilitation, with very high survival rates, and teeth autotransplantations have been set aside because of its higher technical demands, and its slightly lower success rates that leave some doubts towards its prognostic. (Tsukiboshi 2001) Implants and bone regeneration techniques have shown a high predictability, and that is why autotransplantations have lost their value as a rehabilitation alternative. (Magheri, Grandini et al. 2001)

Evolution still continues in implant and bone regeneration industry, but, at this time and besides all their high success rates, both have advantages and disadvantages that cannot be forgotten or set aside. (Tsukiboshi 2001)

The decision on the rehabilitation option should come from the informed patient, together with the clinician, considering the factors such as the patient's age, the possible donor tooth and the receptor location condition, and, of course, considering the possibility of long term function and esthetics. (Tsukiboshi 2001)

The young age of a patient is the main reason to consider not using dental implants. (Aslan, Ucuncu et al. 2010) Due to facial residual growth in young patients, infra-occlusion of the dental implant may occur, because it is normally ankylosed to the alveolar bone, named osteointegration.

However, dental implants can also be an alternative to autotransplantation disadvantages, such as the higher and more complex surgical needs on the latter, the higher prognostic difficulties, possible root reabsorptions complications or loss of epithelial adherence that may lead to autotransplanted tooth loss, and the possibility to have to perform endodontic treatment few days after the intervention. (Tsukiboshi 2001)

So, implants are more likely to be a first choice in oral rehabilitation than autotransplantations, in those cases where patients have extended edentulous areas, if they do not present a donor tooth or if its extraction seems to be complicated, if there is a limit of space, if there is tooth avulsion history and the tooth cannot be re-implanted by any reason, or if the patient is not motivated to have a tooth autotransplant, among other options. (Tsukiboshi 2001)

On the other hand, teeth autotransplantation should become the first option if all the requirements previously discussed are fulfilled, having in mind that the more prognostic factors are respected, the higher the success rate can be achieved. (Tsukiboshi 2001) Implants also have limitations when compared to autotransplantation. The placement of an implant does not induce alveolar bone formation, the gingival papillae has to be created or manipulated if possible, passive eruption is not achievable, dental implant cannot be moved orthodontically, it is confined to adults or young adults with finished bone growth, and it is more expensive to the patient. (Tsukiboshi 2001)

So, both dental implants and tooth transplantation have their specific indications, and must be considered has treatment options, not overcoming one another but complementing each other on the clinician rehabilitation treatment plan.

7. Conclusion

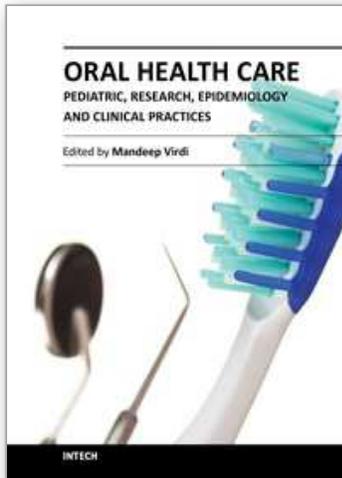
Tooth autotransplantation has a very long history, with numerous non-successful cases, but also many good results are described. As all surgical techniques, it is hard to predict, and needs thorough case studying. But, in a general point of view, literature shows that it should be in the oral surgeon's long rehabilitation list of solutions to present to patients in need. Sometimes, the technique is forgotten, but should be reawaked and even investigated again, using more modern investigation techniques to improve the work that we do on our patients.

8. References

- Ahlberg, K., H. Bystedt, et al. (1983). Long-term evaluation of autotransplanted maxillary canines with completed root formation. *Acta Odontol Scand* 41(1): 23-31.
- Akiyama, Y., H. Fukuda, et al. (1998). A clinical and radiographic study of 25 autotransplanted third molars. *J Oral Rehabil* 25(8): 640-644.
- Andreasen, J. O., H. U. Paulsen, et al. (1990). A long-term study of 370 autotransplanted premolars. Part I. Surgical procedures and standardized techniques for monitoring healing. *Eur J Orthod* 12(1): 3-13.
- Andreasen, J. O., H. U. Paulsen, et al. (1990). A long-term study of 370 autotransplanted premolars. Part IV. Root development subsequent to transplantation. *Eur J Orthod* 12(1): 38-50.
- Andreasen, J. O., H. U. Paulsen, et al. (1990). A long-term study of 370 autotransplanted premolars. Part II. Tooth survival and pulp healing subsequent to transplantation. *Eur J Orthod* 12(1): 14-24.
- Andreasen, J. O., H. U. Paulsen, et al. (1990). A long-term study of 370 autotransplanted premolars. Part III. Periodontal healing subsequent to transplantation. *Eur J Orthod* 12(1): 25-37.
- Aslan, B. I., N. Ucuncu, et al. (2010). Long-term follow-up of a patient with multiple congenitally missing teeth treated with autotransplantation and orthodontics. *Angle Orthod* 80(2): 396-404.
- Cohen, A. S., T. C. Shen, et al. (1995). Transplanting teeth successfully: autografts and allografts that work. *J Am Dent Assoc* 126(4): 481-485; quiz 500.
- Czochrowska, E. M., A. Stenvik, et al. (2000). Autotransplantation of premolars to replace maxillary incisors: a comparison with natural incisors. *Am J Orthod Dentofacial Orthop* 118(6): 592-600.
- Czochrowska, E. M., A. Stenvik, et al. (2002). Outcome of tooth transplantation: survival and success rates 17-41 years posttreatment. *Am J Orthod Dentofacial Orthop* 121(2): 110-119; quiz 193.
- Donado, M., Ed. (2007). *Cirugia Bucal*, Masson.
- Escoda, G., Ed. (1999). *Cirugía Bucal*. Madrid, Ediciones Ergon, S.A.
- Fleming, H. S. (1956). Experimental transplantation of teeth in lower animals. *Oral Surg Oral Med Oral Pathol* 9(1): 3-17.

- Jonsson, T. and T. J. Sigurdsson (2004). Autotransplantation of premolars to premolar sites. A long-term follow-up study of 40 consecutive patients. *Am J Orthod Dentofacial Orthop* 125(6): 668-675.
- Josefsson, E., V. Brattstrom, et al. (1999). Treatment of lower second premolar agenesis by autotransplantation: four-year evaluation of eighty patients. *Acta Odontol Scand* 57(2): 111-115.
- Kallu, R., F. Vinckier, et al. (2005). Tooth transplantations: a descriptive retrospective study. *Int J Oral Maxillofac Surg* 34(7): 745-755.
- Kim, E., J. Y. Jung, et al. (2005). Evaluation of the prognosis and causes of failure in 182 cases of autogenous tooth transplantation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 100(1): 112-119.
- Magheri, P., R. Grandini, et al. (2001). Autogenous dental transplants: description of a clinical case. *Int J Periodontics Restorative Dent* 21(4): 367-371.
- Marzola, C. (1968). [Dental reimplantation. Surgical, clinical and radiographic considerations]. *Rev Bras Odontol* 25(153): 254-269.
- Northway, W. (2002). Autogenic dental transplants. *Am J Orthod Dentofacial Orthop* 121(6): 592-593.
- Paulsen, H. U. (2001). Autotransplantation of teeth in orthodontic treatment. *Am J Orthod Dentofacial Orthop* 119(4): 336-337.
- Paulsen, H. U., J. O. Andreasen, et al. (1995). Pulp and periodontal healing, root development and root resorption subsequent to transplantation and orthodontic rotation: a long-term study of autotransplanted premolars. *Am J Orthod Dentofacial Orthop* 108(6): 630-640.
- Paulsen, H. U., X. Q. Shi, et al. (2001). Eruption pattern of autotransplanted premolars visualized by radiographic color-coding. *Am J Orthod Dentofacial Orthop* 119(4): 338-345.
- Thomas, S., S. R. Turner, et al. (1998). Autotransplantation of teeth: is there a role? *Br J Orthod* 25(4): 275-282.
- Tsukiboshi, M., Ed. (2001). *Autotransplantation of teeth*.
- Tsukiboshi, M. (2002). Autotransplantation of teeth: requirements for predictable success. *Dent Traumatol* 18(4): 157-180.

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Oral health care in pediatric dentistry deals with complete oral health, including preventive aspects for children right from their conception to adolescence, encompassing all the spheres of dentistry including various specialties. It also includes planning a preventive program at individual and community levels. The current research interests in oral health care include studies regarding the role of stem cells, tissue culture, and other ground-breaking technologies available to the scientific community in addition to traditional fields such as anatomy, physiology, and pharmaceuticals etc of the oral cavity. Public health and epidemiology in oral health care is about the monitoring of the general oral health of a community, general afflictions they are suffering from, and an overall approach for care and correction of the same. The oral health care-giver undertakes evaluation of conditions affecting individuals for infections, developmental anomalies, habits, etc. and provides corrective action in clinical conditions. The present work is a compendium of articles by internationally renowned and reputed specialists about the current developments in various fields of oral health care.

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