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CASE REPORT

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Success of a tooth auto-transplant despite delayed endodontic treatment due to COVID-19 pandemic lock-down: a case report

Sucesso de um autotransplante dentário apesar do atraso no tratamento endodôntico devido ao confinamento da pandemia de COVID-19: relato de caso

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ABSTRACT

Auto-transplantation has been suggested to be a favourable treatment option in comparison to prosthodontic replacements. Studies have shown an average survival rate of 89.1% for auto-transplanted teeth. This article aims to report a successful third molar auto-transplantation, despite delayed endodontic treatment because of movement control order (MCO) imposition following COVID-19 out-break in Malaysia. A 22-year-old female patient's impacted lower left third molar (38) was used as a donor to replace her lower left second molar (37), which was deemed non-restorable due to caries and root resorption as a result of impinging pressure from the impacted adjacent third molar. Successful outcome and uneventful healing were achieved over a period of one year, despite delayed endodontic treatment following auto-transplantation. A favourable auto-transplant can be achieved despite delayed endodontic treatment post-transplantation, if the procedure is performed in a good aseptic environment and bacterial load is controlled at the site.

KEYWORDS

Covid-19; Dental pulp; Endodontics; Lockdown; Root canal therapy; Third molars.

RESUMO

O autotransplante tem sido sugerido como uma opção de tratamento favorável em comparação com as substituições protéticas. Estudos mostraram uma taxa de sobrevivência média de 89,1% para dentes autotransplantados. Este artigo tem como objetivo relatar um autotransplante de terceiro molar bem-sucedido, apesar do atraso no tratamento endodôntico devido à imposição da ordem de controle de movimento (MCO) após o surto de COVID-19 na Malásia. O terceiro molar inferior esquerdo impactado de uma paciente de 22 anos (38) foi usado como doador para substituir seu segundo molar inferior esquerdo (37), que foi considerado não restaurável devido à cárie e reabsorção radicular como resultado da pressão de impacto do terceiro molar adjacente impactado. Resultado bem sucedido e cicatrização sem intercorrências foram alcançados ao longo de um período de um ano, apesar do atraso no tratamento endodôntico após o autotransplante. Um autotransplante favorável pode ser alcançado apesar do atraso no tratamento endodôntico pós-transplante, se o procedimento for realizado em um ambiente asséptico e com carga bacteriana controlada no local.

PALAVRAS-CHAVE

Covid-19; Polpa dentária; Endodontia; Confinamento controlado; Canal radicular; Terceiro molar.

INTRODUCTION

A permanent posterior tooth is commonly lost due to caries or periodontal disease [1]. Some people might have one or more permanent teeth missing congenitally. In most circumstances, a missing tooth or teeth require replacement for adequate function, aesthetics or to prevent future problems such as tilting of adjacent teeth or over eruption of opposing teeth [2]. The replacement can be either by using prosthetic removable/ fixed partial dentures or implants as exogenous means [3]. Another endogenous method of replacing a lost tooth is auto-transplantation i.e., using a patient's own tooth that is not of much use in the dentition, such as an impacted third molar/permanent canine [4].

Not many cases have been reported on auto-transplantation of third molars with complete "rhizogenesis" [1]. Rhizogenesis can be defined as the completion of root formation of a tooth. Previously it was regarded that instances of successful auto-transplantation cases were due to incomplete rhizogenesis. But in respect to current reports, it is observed that even with complete mature root rhizogenesis, auto-transplantation has proven to be successful [1]. Tooth auto-transplantation with complete and incomplete rhizogenesis is reported to have a success rate of up to 90% [5]. In a recent meta-analysis, authors observed that there was an average survival rate of 89.1% for transplanted teeth, which was considered reliable and cost-effective [6].

During procedures such as auto-transplantation, prior radiological and ultrasound imaging techniques are very important in aiding for a good treatment plan, and later in providing a clear internal picture of proper healing. That said, it is of utmost importance to minimize radiation exposure for our patient's wellbeing. It is necessary to try to make an effort towards using radiation free diagnostic testing such as ultrasound whenever possible [7,8].

Due to the current pandemic of COVID-19 outbreak, dental care has not been easily available at all times to those seeking treatment. It has become of prime importance to take extra precautions and follow strict guidelines while treating patients undergoing long-term treatments such as auto-transplantation procedures and others [9]. Furthermore, one of the many reasons for pursuing treatment options like auto-transplantation in younger patient age groups is that the therapeutic properties of dental pulp stem cells, tend to be greater at younger ages [10].

This report aims to describe a case of successful third molar auto-transplantation with complete rhizogenesis in an adult female patient. The treatment outcome was successful despite delay in the patient's scheduled visits, for completion of endodontic treatment following auto-transplantation due to the recent COVID-19 outbreak and subsequent nationwide movement control order (MCO) in Malaysia.

CASE REPORT

A 22-year-old female patient presented with spontaneous, lingering dull pain in her left lower posterior teeth, at Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia. The patient complained of nocturnal pain in the aforementioned region. She also complained that she was unable to chew and bite from the left side.

A thorough medical and dental history was obtained. The patient did not have any allergies to drugs or other food items, also no contradictory conditions to performing dental treatment were noted.

On clinical evaluation it was observed that tooth 37 had a large occlusal amalgam restoration with secondary caries on the mesial aspect. A mesio-angularly impacted tooth 38 was also noted clinically. Using the cold test and percussion test, tooth 37 demonstrated a lingering painful response to cold test and was found to be tender to percussion. No mass was felt upon intra-oral and extra-oral palpation. No enlarged lymph nodes were noticed. Facial symmetry was also normal.

A sectional orthopantomogram was obtained, which revealed a periapical radiolucency associated with tooth 37 and horizontally impacted tooth 38. The horizontally impacted tooth 38 was causing distal root resorption on tooth 37 (Figure 1).

Tooth 37 was diagnosed to have symptomatic irreversible pulpitis with symptomatic apical periodontitis along with distal root resorption due to pressure from the horizontally impacted tooth 38. Tooth 37 was deemed unrestorable due to its badly broken-down crown, secondary caries under the restoration and distal root resorption.

Figure 1 - Sectional orthopantomogram of a 22-year-old female patient prior to starting treatment, obtained for assessment of teeth 37 and 38.

A contemporary approach was used in deciding the treatment to be provided by the restorative dentistry and oral surgery teams. Many treatment options were available such as, root canal treatment on tooth 37 followed by distal root resection or tooth hemi-section, and surgical removal of tooth 38. Another option was extraction of tooth 37 followed by auto-transplantation of tooth 38 in place of the tooth 37. Root resection and hemi-section have survival rates ranging from 40.3% to 100%, so these treatment modalities were ruled out, due to the controversial survival outcomes indicated from previous literature [11].

Since, the patient was young, chances of healing were expected to be good after auto-transplantation, and complete rhizogenesis had occurred for tooth 38. Hence, tooth auto-transplantation was opted as the final treatment option. The approach here was focussing entirely on the fact that our patient was young, and we had to provide a treatment option with long-term survival rates which would be most suited in the current scenario. CBCT imaging and examination revealed both teeth 37 and 38 were not in contact with the inferior alveolar nerve (IAN). Atraumatic extraction of teeth 37 and 38 was possible without any further complication to the IAN.

Local anaesthetic (2% Scandonest, Septodont, USA) was used to give an IAN block on the lower left side and the patient was asked to rinse her mouth with a 0.2% chlorhexidine (HUSM pharmacy, Malaysia) mouthwash in order to have a decreased bacterial load around the procedural area. Tooth 37 was extracted atraumatically using a straight elevator and lower molar forceps, giving space for extraction of 38. A triangular flap was raised right behind tooth 37, which provided good access and visibility for the extraction of 38.

Keeping in mind the considerable alveolar ridge reduction post extraction, an atraumatic approach is necessary [12]. Atraumatic extraction of 38 was carried out using a periotome and straight elevator initially to break contacts of the connective tissue fibers and luxate tooth 38 sufficiently. Precautions were taken to avoid fracturing the buccal and lingual bony plates as well as preserving the periodontal membrane from severance. Once tooth 38 was luxated properly, it was pulled out smoothly into the space created after extraction of tooth 37, with the help of lower molar forceps. Curettage was performed at the site of tooth 37 socket, to ensure no granulomatous tissue was left behind. Rudimentary bony chips from the site of extraction were also collected for bone grafting at the recipient socket site. Tooth 38 was stored for four minutes in pasteurized milk until the preparation of recipient socket. Once the recipient site was ready and thoroughly irrigated with normal saline, tooth 38 was auto-transplanted into the socket (Figure 2a), followed by addition of bony chips distally and buccally. Finally, proper soft tissue closure was achieved (Figure 2b) and the newly auto-transplanted tooth 38 was immobilized using composite resin and a stainless-steel 0.7mm wire as a splint starting from tooth 38 to 35. Tooth 38 was positioned below the occlusal level to ensure safety from biting and chewing pressures post-operatively.

Patient was advised to take a soft diet for 3 days and continue brushing her teeth normally while taking care not to brush the sutured area and injure it. The patient was prescribed Amoxicillin capsule 500mg thrice a day for 5 days, 200mg Metronidazole tablet twice daily for 5 days and 300mg Celecoxib capsule twice a day for 3 days.

Two weeks following auto-transplantation when reviewed by the oral surgeon, the healing was uneventful, and the tooth mobility of 38 was within normal limits according to Miller's classification (Figure 3). Hence, composite wire

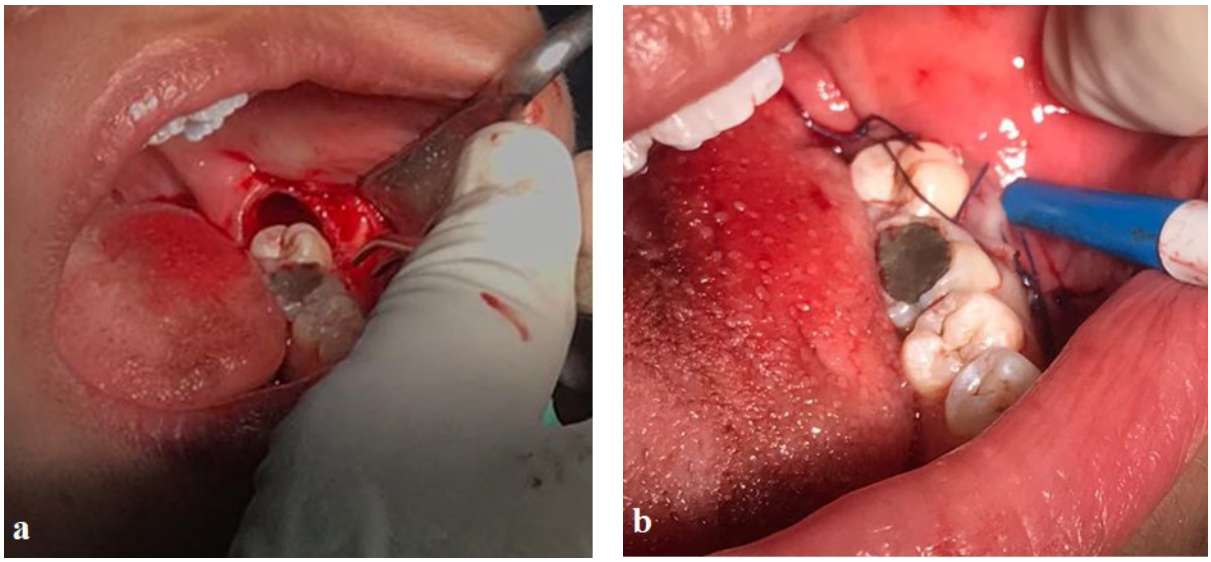

Figure 2 - Surgical procedure involving auto-transplantation of donor tooth 38; a) tooth 38 transplanted at the prepared site of tooth 37 as its replacement; b) surgical closure and suturing of surrounding soft tissue around the auto-transplanted tooth 38.

Figure 3 - Intraoral picture taken at post-op 2 weeks review – uneventful healing noted.

Figure 4 - Periapical radiograph obtained 2 weeks post-op auto-transplantation, prior to endodontic treatment. Radiograph obtained for baseline assessment of surrounding hard tissue and evaluation of apical area of tooth 38.

splints were removed, and the patient was scheduled for endodontic treatment of tooth 38 with an endodontist. A periapical radiograph of tooth 38 was obtained to serve as a baseline pre-operative radiograph for endodontic treatment (Figure 4).

Due to the Covid-19 outbreak in Malaysia, a nationwide MCO was implemented in March 2020. All non-essential services were suspended, including non-emergency elective dental procedures, hence the endodontic treatment of tooth 38 had to be postponed indefinitely. Three months after the MCO was imposed, when the Covid-19 situation was considered to be under control, dental clinics fully equipped with the necessary precautionary measures were allowed to operate. Hence, the patient was scheduled and endodontic treatment of tooth 38 was carried out. Tooth 38 was isolated with rubber dam and accessed. Since, the tooth was completely sound before endodontic treatment, a conservative cavity was prepared to access the root canals for endodontic treatment [13,14]. Root canals were then cleaned and shaped using XP shaper (FKG, Switzerland) rotary endodontic files. Sodium hypochlorite (5.25%, HUSM pharmacy, Malaysia) was used as an irrigant during shaping, followed by a final rinse with 17% EDTA (Dentonic Inc., USA). Finally, the canals were obturated with gutta percha and iRoot SP sealer (Innovative

BioCeramix Inc., Canada) using warm vertical condensation technique (Figure 5).

The tooth was then temporarily restored due to time constraints. The patient was recalled the next day for a permanent restoration. Since, no marginal ridges were lost as a result of caries or access cavity preparation, only an amalgam restoration was placed as the final restoration. Furthermore, keeping in mind the application of minimally invasive dentistry concepts in endodontics, no crown or onlay was planned [15,16]. The patient was recalled 6 months after the endodontic treatment (9 months after auto-transplantation) to review the healing following endodontic treatment. Extra-orally there was no swelling/redness and intra-orally, tooth 38 showed absence of swelling, tenderness and tooth mobility (only physiologic/normal tooth movement was present). Also, periodontal probing was carried out around tooth 38, which revealed that clinical probing depth was within normal limits. Radiographic examination showed progressive healing of bony structure surrounding the periapical area of tooth 38 (Figure 6).

Figure 5 - Periapical radiograph immediately after obturation of tooth 38.

Furthermore, when questioned, the patient denied of having any discomfort or pain on tooth 38 upon chewing or biting or in general. The patient was then scheduled for regular follow-up and monitoring after six months and then yearly. According to recommendations for monitoring of re-implanted teeth, guidelines suggest that the patient should be called post-operatively at 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter for another five years, for clinical and radiographic monitoring [17-20].

After one year following auto-transplantation, there was proper gingival healing, absence of tooth mobility and pain; and radiographically absence of ankylosis and deep periodontal sulcus. Hence, satisfactory healing was noted both clinically and radiographically around tooth 38 even though the endodontic treatment following auto-transplantation was delayed for almost more than 3 months, due to the Covid-19 outbreak.

DISCUSSION

Auto-transplantation is a multi-disciplinary treatment, targeting to restore the normal

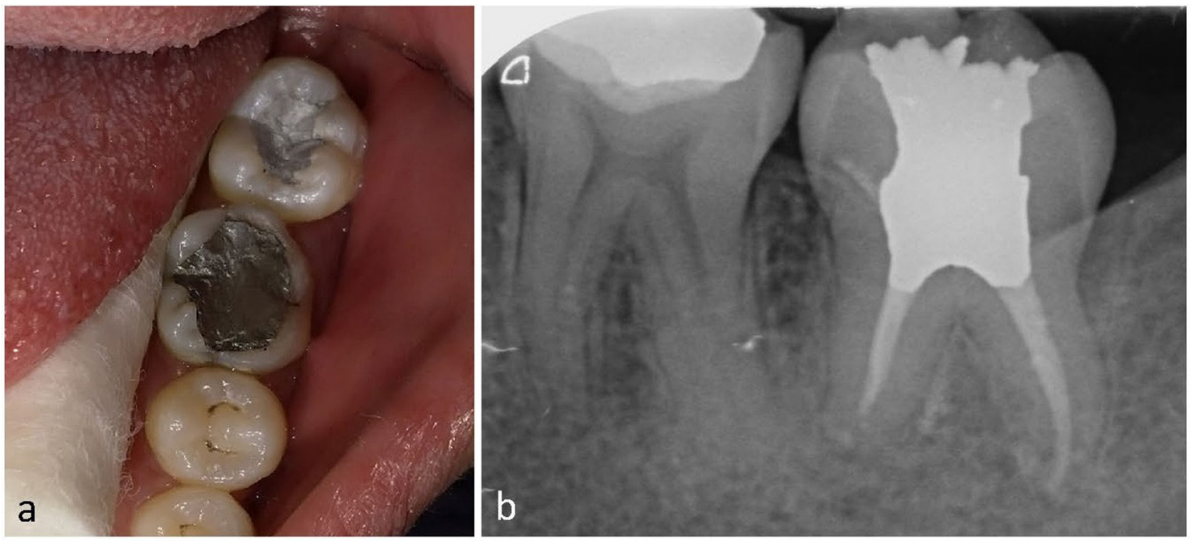

Figure 6 - Clinical and radiographic assessment of the auto-transplanted tooth 38; a) Intraoral picture showing successfully auto-transplanted tooth 38 one year following auto-transplantation; b) Periapical radiograph of tooth 38 showing complete healing one year following auto-transplantation.

permanent dentition without foreign transplants in the oral cavity [21]. It tends to provide compensation of dentition defects by making use of ones' own existing dentition [2,22-24].

The prognosis of this procedure is variable due to many factors. Not only, does it require a high level of expertise in the field by the operator, proper clinical and radiological investigation but also, patient factors such as age, dental hygiene and underlying illnesses play an essential role in treatment success [22,25]. It is extremely essential that an atraumatic extraction should be carried out from both, the donor and recipient site of auto-transplantation, to preserve the surrounding periodontium, especially the bone of the socket and periodontal ligament fibers attached to it [24,26].

CBCT imaging also plays a vital role in case selection. It allows us to visualize a 3D construct of the operation site which can aid in providing a better surgical approach prior to the actual surgery [27,28]. In the current case, it helped by depicting the position and proximity of the inferior alveolar nerve (IAN) from 37 and 38. Since the IAN was not in close proximity to both these teeth, atraumatic extraction was performed successfully.

In terms of the periodontium surrounding the auto-transplanted third molar, it is a complete necessity to have adequate bone density and support around the implanted tooth [29]. Also part of the periodontium, is the attached keratinized tissue which aids in proper stability of the auto-transplanted tooth at the recipient site, presence of which is as important as surrounding bone [30]. This attached keratinized tissue should be free of infection to allow for proper soft tissue healing. In the current case, guided bone regeneration was performed at the recipient socket site by using autogenous bone graft obtained from the third molar extraction site. Proper suturing of soft tissue around the auto-transplanted tooth was performed to ensure satisfactory soft tissue healing and presence of adequate attached keratinized tissue later [29].

Following an atraumatic extraction, the sockets should be thoroughly irrigated with sterile saline and donor tooth should be ideally kept in Hank's balanced salt solution (HBSS) [31]. Due to unavailability of HBSS, pasteurized milk was used instead for tooth 38 until, the socket was prepared for transplantation of tooth 38. Pasteurized milk has advantages over normal saline of having a physiological pH and possesses growth factors and nutrients that help in maintaining osmolality of the cells attached to the root (PDL fibers and cells) surface of donor tooth [31].

Previous studies have reported that endodontic treatment was performed on donor third molars prior to auto-transplanting it into the oral cavity [32]. Performing endodontic treatment post auto-transplantation is necessary in teeth with complete rhizogensis, to avoid spread of pulpal infection to the periapical region which may in turn cause pathological root resorption, resulting in failure of treatment [33,34]. Performing endodontic treatment on the transplanted tooth extra-orally will not only, damage the root surface and hinder in proper seating of the donor tooth (third molar) in the prepared socket, but also, increase time of the procedure [4]. Also, the anatomy of the third molars does not always allow a simple intraoral devitalization, in addition to the position of the tooth, which is certainly more complex to manage. Apical retrograde treatment extra-orally, can also be a viable option. But a very important prognostic factor which may affect the success of an auto-transplant, is the amount of time the donor tooth is kept extra-orally prior to transplantation. The extra-oral time should be kept as minimum as possible and not exceed more than 15 minutes [34-36]. If the extra-oral time increases, the chances of necrosis of the PDL fibers increases, which in turn may result in inflammatory root resorption later [37]. Hence, in the current case, endodontic treatment was performed after the donor tooth had been implanted at the prepared site and had fully recovered, after removal of the mobility control splint.

Two weeks following auto-transplantation, the patient was called for a follow-up. The stainless-steel wire splint was removed, and the patient scheduled for endodontic treatment of tooth 38 the next day with an endodontist. However, due to the outbreak of COVID-19 pandemic, endodontic treatment was delayed. Ideally, an auto-transplanted tooth should undergo endodontic treatment 1 to 2 weeks post transplantation, to avoid infections, internal/external root resorption or ankylosis [37,38]. In a meta-analysis on auto-transplantation of teeth with complete rhizogenesis by Chung et al., they reported that the chances of auto-transplant failure due to inflammatory root resorption were twice

more in donor teeth that underwent endodontic treatment 2-weeks after transplantation in comparison to those that underwent endodontic treatment within 2-weeks [39]. However, in the current scenario, endodontic treatment was delayed by more than three months instead of within 2-weeks, which is the normal reported time for endodontic treatment [37]. Surprisingly, the transplant was uneventful and did not fail since it was performed in a very well-kept, surgical environment and the bacterial load was kept low by proper oral hygiene maintenance on the patient's part [24]. Also, another possible reason could be the absence of a pre-existing infection within the root canals [2].

At one year follow up, there were no eventful findings, satisfactory soft and hard tissue healing was observed, even though the endodontic treatment following auto-transplantation was delayed. It is important to be aware of important prognostic factors while performing a chair-side auto-transplantation procedure by general dental practitioners. These include, atraumatic extraction of donor tooth, duration of extra-oral time of the donor tooth (should be less), the health of the surrounding PDL fiber cells, bone and soft tissue healing surrounding the donor tooth and lastly, maintenance of patients' oral hygiene. For an auto-transplantation to be successful, it is indeed a two-way road. Satisfactory outcomes cannot be achieved without the patients' efforts at maintaining good oral hygiene.

CONCLUSION

Auto-transplantation of teeth with complete rhizogenesis can be successful even if the root canal treatment is delayed, when careful case selection together with a meticulous surgical procedure is carried out. A favourable outcome was achieved in this case, since the procedure was performed in a good aseptic environment, with atraumatic extraction and careful extraoral handling of the tooth being transplanted. Auto-transplantation can serve as a valuable treatment option for replacing non-restorable teeth, especially in young patients.

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Authors' Contributions

MM: Assisted in management of the patient during surgical removal of third molar and auto-transplantation, as well as during root canal treatment; assisted and photographed during follow up visits; writing the case report. JAA: Performed surgical removal of 2nd and third molars as well as auto-transplantation; patient follow ups; splint removal; supervising, reviewing and proof reading the case-report. TYN: Performed root canal treatment of auto-transplanted molar; follow ups; writing the case report.

Conflict of Interest

The authors have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of: Hospital Universiti Sains, Malaysia. Ethical approval (USM/JEPeM/18070330) and informed consent were obtained from all individual participants included in the article, as well as from the hospital administration, in accordance with the Declaration of the World Medical Association of Helsinki.

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