



Evaluation of Frontal Teeth Stabilization after Root Apex Resection among the Ukrainian Young People

Oksana Vasilyevna Klitynska¹, Pavel Olegovich Maystruk², Natalya Vladimirovna Hasiuk³, Yuri Alexandrovich Mochalov⁴

¹Professor and Head, Department of Dentistry of Childhood, Uzhgorod National University, Uzhgorod, Ukraine.

²Assistant Professor, Department of Dentistry of Childhood, Uzhgorod National University, Uzhgorod, Ukraine.

³Assistant Professor, Department of Therapeutic Dentistry, I. Horbachevsky Ternopil State Medical University, Ternopil, Ukraine.

⁴Assistant Professor, Department of Surgical Dentistry, Maxillofacial Surgery and Onco-Dentistry, Uzhgorod National University, Uzhgorod, Ukraine.

Author to whom correspondence should be addressed: Oksana V. Klitynska, Department of Dentistry of Childhood, Uzhgorod National University, Narodna Square, 3, 88000, Uzhgorod, Ukraine. Phone: +380 672364592. E-mail: klitinskaoksana@i.ua.

Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 05 July 2018 / Accepted: 08 October 2018 / Published: 18 October 2018

Abstract

Objective: To develop a protocol of improved stabilization of teeth after root apex resection among young people using endodonto-endoossal implants and assessing its effectiveness. **Material and Methods:** Thirty-six patients were previously selected and divided into Group 1 (without additional stabilization) and Group 2 (with additional stabilization). The efficacy of treatment in both clinical groups was estimated at 90, 180 and 360 days, respectively. The results were evaluated on the Miller scale in the Fleszar modification. Density of bone tissue was expressed in Hounsfield units. **Results:** The average mobility indices over 90 days indicate a significant lower mobility of teeth in patients in Group 2, where as an advanced method, the RTR with an additional filling of the bone marrow defect with an osteoplastic material was chosen as the method of treatment ($+ 18.0 \pm 0.21$ U.M. $10.0 \pm 0.8 \mu\text{m}$, $p < 0.05$). In Group 1, 90 and 180 days after surgery, the density of bone tissue in the defect area was 756.3 ± 2.45 HU and 880.1 ± 4.34 HU. In Group 2, these indices were insignificantly higher and amounted to 834.3 ± 4.35 HU and 880.4 ± 2.56 HU. After 360 days after treatment in the first clinical group the bone density index was 957.4 ± 2.45 HU, while in the second group - 1003.3 ± 4.38 HU. **Conclusion:** The mobility of teeth among patients on 90-th day corresponded to level 1, and on 360-th day corresponded to level 0, indicating the effectiveness of the proposed method. The biomechanical stabilization of the teeth was confirmed by the results of densitometry among patients of both groups, in particular, the recovery of bone density in the affected site was observed after 360 days.

Keywords: Endodontics; Tooth Root; Dental Implantation, Endosseous, Endodontic.

Introduction

According to high prevalence of dental caries and its complication on Ukraine an endodontic manipulations are very frequent therapeutical methods for dental practice [1,2]. An official information provided by Ministry of Health Care, National Academy of Medical Sciences, Association of Stomatologists of Ukraine and scientific reports of researching institutions confirm a high spread of dental caries and endodontic treatment methods among young population (children and teens too). A number of endodontic methods and tooth-saving surgery lead to introduction to practice of different special methods of esthetical and functional rehabilitation of upper frontal teeth lesions [3-5]. X-ray control diagnostic procedures confirm only 30-35% of successful results of endodontic interventions [6,7].

A significant prevalence of chronic apical periodontitis accompanied by alveolar bone tissue destruction leads to needs for surgical treatment in order to preserve the teeth. One of the common surgical interventions is a root apex resection, which is used in the treatment of the frontal group of teeth and also has a good aesthetic consequence as an element of life quality for young patient [1,7,8]. Usually, operation of root apex resection causes a sever decreasing of biomechanical stability of affected tooth what may be shown as a tooth mobility (and teeth loss) during the clinical examination [9,10].

One of the clinical treatment technologies for affected frontal teeth stabilization may be considered an endodonto-endoosseal dental implantation [9,10]. Despite the positive clinical experience, the method has not found widespread in dental practice due to its complexity and imperfection of endodonto-endoossal implantation protocol, the lack of clear indications for application, the short term of tooth functioning, complicated osteointegration of the implant, and bone tissue reaction [10,11]. However, in an amount of clinical cases, especially in frontal teeth among young people the usage of endodonto-endoossal implants after root apex resection is an alternative method of treatment with preservation of aesthetic and functional outcome in different periods of the postoperative period [8,12].

Improvement is needed both for surgical technique for frontal teeth with using of endodonto-endoossal implants in order to restore the full tooth-jaw system functioning and for establishing the clear indications for that method which will keep the tooth after surgical intervention and prevent alveolar atrophy as a complication.

The purpose of the study was to develop a protocol of an improved method for teeth stabilization after root apex resection among young people using endodonto-endoossal implants and to assess its effectiveness.

Material and Methods

Sampling

Among young people (16-24 years old), residents of the Transcarpathian region were formed two clinical groups of patients, depending on the choice of the method of stabilizing the teeth after root apex resection with an improved technique with the size of the defect in the bone upto 0.5 cm.

These patients needed to provide qualified dental care in the form of a series of measures aimed at eliminating the apex changes in surgical treatment – root apex resection with further reinforcement by advanced endodonto-endoossal implants without additional stabilization (Group 1: n = 20) or with it (Group 2: n = 16).

The efficacy of treatment in both clinical groups was estimated at 90, 180 and 360 days, respectively. The following indicators were used to measure the efficacy of the treatment in both clinical groups: the level of tooth mobility (reinforced by the endodontic endovascular implant) determined by periodontal test with device "Periotest-S" (Siemens AG, Bensheim, Germany) [7]. The results were evaluated on the Miller scale in the Fleszar modification [13]. Density of bone tissue where computer tomography was used was performed using the X-ray absorption scale (the Hounsfield scale) and was ultimately expressed in Hounsfield units [8,14-16].

Protocol

The basis of the protocol "Operative intervention for the establishment of endodonto-endoossal implant/s and perforated titanium plate as an additional fixative element in the bone tissue of the alveolar bone" was a classic method of resection of the root apex with the next improvements and stages:

- According to anatomy of the frontal teeth and a shape of root channel it was prepared using a turbine handpiece with water cooling and diamond bur "on the stalk" to extend the root channel upto a necessary size. An important aspect at this stage is the prevention of root wall perforation or tooth root fracture. In case of the one of the above-mentioned complications the affected tooth is to be a subject of urgent X-ray control and decision of further treatment tactic.
- Using instruments enter the sealing material, rub the walls. Glass-ionomer cement Fuji PLUS (GC Corp., Tokyo, Japan) is used for endodonto-endoossal implant fixation.
- Insert the implant into the lumen of the root channel using a quadruple nozzle to hold the implant along the entire length of the root channel by threading to the exit of the channel.
- Carry out the removal of the residual fill material that will be available in the defect of the bone tissue after passing the endodonto-endoossal implant through the lumen of the root canal of the tooth.
- Prepared titanium plate with perforation holes placed in the prepared cavity in the bone tissue of the alveolar part in a perpendicular direction in direct contact with the root channel lumen.
- Perform a fixation of the endodonto-endoossal implant in the perforation of the titanium plate.
- Verification of fixation of endodonto-endoossal implant complex and perforated titanium plate using Periotest. If necessary, adjust the edges of the perforated titanium plate by cutting with scissors.
- Cleaning the cavity of the defect from foreign particles (residual filling material from the lumen of the root channel, the remnants of the hard tissues of the tooth, particles of the perforated titanium plate in the case of correction of its edges, etc.) by washing with saline.

- In order to achieve a maximum stabilization of the endodonto-endoossal implant (EEI) an additional osteoplastic material is used to replace the alveolar bone defect which occurred after root apex resection. The wound on oral mucosa may be closed by polyamide (5/0) sutures.
- X-ray control is performed to visualize the correct placement of the EEI in the root canal, a presence or absence of cracks or root walls fractures, the uniformity of the layer of the filling material between the inner wall of the root channel and surface of EEI.
- Prescribing of a complex of antibiotic therapy, anti-inflammatory drugs during of 5-7 days.
- Next day, at the control check-up doctor has to note the presence or absence of signs of inflammation, complaints of pain in the tooth itself, or in jaw. During the visit, the temporary crowns / crown from the 2 KM Structure material (VOCO GmbH, Cuxhaven, Germany) are made for the patient.
- After 7 days doctor makes a re-examination and stitches removal. The same indicators are noted as visiting a day after surgical intervention must be examined.
- Data are being filled-in to the patient's card (file) (in "Doctor's Diary" part).

Statistical Analysis

Student's t-test was used to compare improvement after therapy in the two groups. The level of significance for the analysis was set at 5%. All calculations were performed on P - 100 in MS Excel 7 for the Windows XP operating system and using the standard statistical software "Statistica 6.0" and SPSS 14 (SPSS Inc, Chicago, IL, USA) [17].

Results

The average mobility indices over 90 days indicate a significant lower mobility of teeth among patients of Group 2, where as an advanced method, the root apex resection with an additional filling of the bone marrow defect with an osteoplastic material was chosen as the method of treatment ($+ 18.0 \pm 0.21$ U.M. to 10.0 ± 0.80 μ m; $p < 0.05$). After 360 days after treatment these values were $+ 10.9 \pm 0.11$ U.M. in Group 1, and $+ 2.0 \pm 0.01$ μ m ($p < 0.05$) in Group 2 (Table 1). These indices correspond to the first group of 1-2 levels of teeth mobility, and in the second group 0-1 levels of mobility.

Table 1. Indices of tooth mobility.

Period	Group 1 Mean (SD)	Group 2 Mean (SD)
90 day	$+18.0 \pm 0.21$	$+10.0 \pm 0.80$
180 day	$+16.0 \pm 0.21$	$+4.0 \pm 0.01$
360 day	$+10.9 \pm 0.11$	$+2.0 \pm 0.01$

Densitometry of bone was chosen for teeth mobility evaluation. In the first clinical group, after 90 and 180 days after surgery, the density of bone tissue in the defect area was 756.3 ± 2.45 HU and 880.1 ± 4.34 HU. In the second group these indices were insignificantly higher and amounted to

834.3 \pm 4.35 HU and 880.4 \pm 2.56 HU. After 360 days after treatment in the first clinical group the bone density index was 957.4 \pm 2.45 HU, while in the second group was 1003.3 \pm 4.38 HU (Table 2).

Table 2. Density of bone tissue in the defect zone.

Period	Group 1 Mean (SD)	Group 2 Mean (SD)
90 day	756.3 \pm 2.45	834.3 \pm 4.35
180 day	880.1 \pm 4.34	880.4 \pm 2.56
360 day	957.4 \pm 2.45	1003.3 \pm 4.38

Discussion

An increasing of incidence of degeneration and bone tissue destruction with precise contours (granulomatous apical periodontitis) of the frontal area among young people (treatment protocol this disease is complex, long-lasting and multi-stage) leads to the improvement of techniques for radical interventions to restore the structure and functioning of the tooth-jaw system [1,18,19].

A well-known method for improving the biomechanical parameters of dental stabilization after root apex resection is a tooth reinforcement by endodonto-endoossal implants [12,20]. Despite the positive clinical experience, above mentioned method has not found widespread among dental practitioners due to the complexity and imperfection of the method of endodonto-endoossal implantation itself, the lack of clear indications for its application, the short term of teeth functioning in the oral cavity, and to complications associated with osteointegration of the implant.

However, in a number of clinical cases especially of affected the frontal teeth among young people the usage of endodonto-endoossal implants according to the author's method of fixation without or with osteoplastic material placement is an effective method for stabilization of teeth after root apex resection which may provide good aesthetic and physiological parameters of white&pink aesthetics without additional surgical interventions (gum plasty) and functional results in the immediate and further periods of observation [9,11,17,21].

The proposed method of dental stabilization using endodonto-endoossal implantation according to the author's technique is less traumatic in comparison with existing analogues, a reliable reduction of postoperative complications frequency has been proved. Owing to the proposed method, better stabilization and osteointegration were achieved confirmed by the results of teeth mobility test ($p < 0.05$) and restoration of bone tissue density to healthy bone parameters ($p < 0.001$), which indicates on the effectiveness of the proposed method.

Conclusion

Application the proposed method of using the advanced method of endodonto-endoossal implantation the mobility of teeth among patients of the first and second clinical groups on 90-th day corresponded to level 1, and on 360-th day corresponded to level 0, indicating the effectiveness of the proposed method and the feasibility of its usage in practical surgical stomatology and serve as a method of choice. The biomechanical stabilization of the teeth was confirmed by the results of

densitometry among patients of both clinical groups, in particular, the recovery of bone density in the affected site to norm was observed among patients of the first and second study groups reliably on 360-th day.

According to the data obtained from the above-mentioned additional methods of examination, the X-ray examination in both clinical groups, the development of an extended and improved protocol for endodonto-endoossal implantation according to the author's technique, the choice of the treatment method, the data obtained during and after the treatment, and the performed evaluation of the effectiveness according to objective criteria established that the proposed advanced method of endodonto-endoossal implantation with/without osteoplastic material may be used as an alternative to existing and commonly used methods of conservative (endodontic) and surgical (root apex resection) treatment for the effective stabilization of the frontal teeth among young people based on the tooth-preserving principles of modern medicine development and in order to prevent complications by the maxillofacial apparatus.

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