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CLINICAL SUBSTANTIATION FOR MAKING AN OPTION OF THE MODE TO OPEN AN IMPACTED TOOTH

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Summary: Impacted teeth are thought to be quite a prevalent pathology affecting young people and requiring an accurate and deliberate approach for the diagnosing and making an option of the way of treatment. However, an adequate management of such patients results in positive outcome providing the restoration of the dentitions' integrity and adequately to the utmost esthetics as well as the dental maxillary apparatus functioning. A complex treatment involves surgical, orthodontic and combined one. The most efficient result of the management in the long-term perspective is achieved if to apply highly-energetic laser radiation to create an access with further orthodontic treatment.

Key words: impacted teeth, orthodontic treatment, highly-energetic laser radiation, surgical access, diathermocoagulation.

The teeth which partially or completely remain in the osseous tissue or beneath the mucous membrane two years after physiological eruption term are called impacted ones in the literature sources [2], the prevalence of such pathology exceeds 20%. Accordingly, an alternative of the access mode to impacted teeth with follow up orthodontic treatment represents a substantial scientific practical interest. [1-7, 23-25].

In accordance with the literature data, a couple of approaches to solve the traction problem of impacted teeth has been determined: a temporary tooth extraction that allows a permanent tooth to erupt spontaneously; the removal of an impacted tooth with further implantation or orthodontic closure of this free space; orthodontic traction of an impacted tooth with or without necessity of performing previous surgical intervention; autotransplantation of the impacted tooth [26] .

Traditionally, two surgical accesses (open and closed) are employed, although their application depends on the range of factors: the depth of the impacted tooth location; the anatomy of the area of the temporary tooth location, the sort of orthodontic forces that will be applied. Closed method is an option which is recommended to be applied in case when an impacted tooth is located on the middle third of the alveolus or above within the area of the anterior nasal axis. This variant of access reflects the physiological direction of dental eruption providing better esthetic and periodontal outcome. [8-12, 26].

To obtain a desirable result of complex treatment of impacted teeth it is necessary to choose the appropriate and correct method of management depending on the established algorithm due to examination findings. The mode option of creating surgical access to the impacted tooth plays a key role.

The objective of investigation: clinical efficacy evaluation of application of various methods of surgical access to impacted teeth in the complex orthodontic treatment.

Subject and methods of investigation. 109 patients aged 12-30 years with impacted teeth were studied. They were being treated in the dental medical center of the National O. Bohomolets Medical University during the period of 2017-2019.

All patients were exposed to general dental methods of examination underwent by the center staff. Additional methods of investigation included dental intraoral radiography, orthopantomography, computed tomography that were performed according to standard techniques and recommendations. In case when the diagnosis needed to be made more accurate, the examination was performed by means of 3D computed tomographic scanner SkyView 9" (MyRay, Italy).

All patients were divided into three groups depending on the technique of access creation to the impacted tooth. The first group involved 35 patients the access to whom was created by open surgery. The second group included 53 patients whose access was configured with the help of highly-energetic laser radiation system (FONAlazer Germany); creation of an access to the third group comprising 21 patients was conducted by diathermocoagulator (Svarog).

Prior to the onset of treatment all patients (or their official representatives) signed the informed agreement for examination and making a plan of management. Moreover, separate agreements were signed for giving anesthesia and operative intervention to make an access for the impacted tooth. Pain relief of the area to be involved was performed using local anesthesia depending on the localization and signs.

Laser surgery was performed at the dental laser surgery office of the Dental medical center of the NMU named after O.Bohomolets taking into account all the requirements of laser safety; semiconductor laser radiation by laser system «FONALaser, Germany with the wave length of 970 hm, in non-stop regime (CW) of 1,5-3 Wt power, influence energy of 300 MJ was employed.

Postoperative period of patients' condition was evaluated by the following indices: the severity degree of pain syndrome taking into consideration subjective pain sensations of the patient in accordance with digital rating scale(Visual Analog Scale, VAS); the state of the postoperative wound and soft tissues by the degree of collateral edema, hyperemia, infiltration; operative wound healing with the change of orthogonal projection square of a sizeable figure to the plane, granulation tissue development (by the color, bleeding, appearance terms) as well as epithelization. All results were registered on the third, seventh and fourteenth days after surgery and were filled into the accounting card.

Statistical processing of the results was carried out by means of program package SPSS 11, 0. Correlation analysis was done using correlation (r) by Spirmen. To assess qualitative indices, range criteria of Mann-Whitney and Kruskal-Wallis were used. The reliability of differences was seen as denominators providing that $p < 0, 05$.

Findings and their discussion. In some cases it is necessary to remove the minor part of osseous tissue around the crown of the impacted tooth for the exposure of its crown section, to fix the orthodontic traction clip. To avoid the location of the impacted tooth in the high gingival position, we need to perform traction from the palatine site applying light and slow orthodontic forces to move it into the correct posture. For the impacted tooth located in the labial position, three types of surgical approaches are used depending on the dental location in relation to mucogingival junction: gingivectomy, apical rotation of the flap, closed surgical way that means creation of access to the crown, traction clip fixation and the immediate wound closure. Corticotomy of the alveolar process is sometimes applied for the tooth located in the labial position. [13-18, 30-32].

The use of surgical guiding putty indices for much safer extraction of impacted multiple teeth in accordance with CAD/CAM technologies [19, 31] is considered to be efficient enough.Two surgical techniques described that are employed to cure central incisors retention of the upper jaw are closed(CEST) and open (OEST). Closed one foresees complete shift of mucus – periosteal flap to its initial position after fixation of traction clip; open technique lies in closed suture of the flap beginning from the apical part and ending with the incisor crown base, so that the labial portion of the crown remains open. It was proved that the application of CEST technique in combination with orthodontic traction arrest on the dental eruption stage facilitates the epithelial junction providing that the tooth erupts from beneath the gums (2^{nd} phase). It provides cement fixation with gingival tissue due to supracrest fibers) of the impacted tooth contributing much to physiological dental eruption and at the same time it reduces or prevents gingival recession [20-24] .

It has been established that the application of closed technique accelerates healing period of the wound, alleviates postoperative pain and improves general health status. The drawbacks of closed method encompass poor visualization of the tooth during orthodontic traction and prolonged durability of the procedure in complete contrast to open technique. It means a direct contact between the enamel and the bone that can lead to necrosis and alveolar defect; however, for prevention, it is necessary to make a resection of the bone during eruption. Furthermore, the duration of the orthodontic therapy depends much more on the depth of retention than the method or technique of treatment. In 75% of cases, patients with impacted teeth were observed to have some discoloration of the teeth contrary to adjacent ones resulted from closed technique application.

An expander fixed on the maxilla has proved its efficacy facilitating therapy effectiveness abreast 65,7% against 13,6%. The use of transplantation is of great interest in case when a patient objects orthodontic appliances or the degree of teeth displacement does not allow to use it. The percentage of integration while performing such procedure is approaching 90%. Implantation is effective as far as some scientists believe, that it makes possible to reach osseous tissue resorption percentage not exceeding 0, 49 mm during twelve months period in complete osteointegration. One should note that closed technique improves esthetic look and periodontal tissue condition during 4-14 years after therapy [19, 29, 30] .

Laser energy will act initially as the mode of dissection, excision and ablation. The tip of laser hand piece is hold too close to the tissue surface. It enables laser energy to impact the incision and minimizes the accumulation of coagulant on the tip that is likely to result in unfavorable thermal damage to tissue. Excessive set up of capacity can lead to thermal injury to the periosteum and osseous tissue of the alveolar process. Damage to these structures can be avoided using appropriate (lower) capacities, following regular intervals of radiation to provide sufficient cooling of tissues [28]. To achieve a desirable clinical effect laser radiation must be absorbed by tissue. The interaction of tissue with laser depends on the characteristics of laser used, the length of its wave, its effective capacity, radiation forms such as radiation intensity and durability of processing as well as peculiarities of the tissue and the amount of water, hemoglobin and pigments that it contains.

The effect of laser surgery is reached if the energy of laser beam is absorbed by tissues causing such phenomena as ablation, evaporation, amputation, coagulation, photodynamics and biostimulation. The onset of impact is characterized by tissue heating, denaturation of protein and dehydration followed by charring and burning of tissues. Owing to this, a physician is able to control and examine the area of intervention well that enables to minimize the duration and bulk of manipulation. As far as laser provides biostimulating action, the healing process is faster than in traditional surgical methods. Diode laser of 970hm wave length goes through the epithelium and penetrates into the tissue in the depth of 2-6mm. During laser surgery minor blood and lymphatic vessels are sealed due to general heat reduction or arresting of bleeding and edema. Denaturated proteins inside the tissue and plasma are the source of the layer, so-called “coagulator” made up in the result of laser action; it protects the wound from bactericidal or friction effect. Clinically, within the period of 48-72 hours after operation this layer becomes hydrated by saliva, it swells and breaks down gradually to reveal early rudiment of new tissue afterwards [20].

The results of pain syndrome severity while using a variety of modes to create surgical access to the impacted tooth are represented in table 1.

Table 1

Severity of pain syndrome and collateral edema in patients of clinical groups in the dynamics of observation

Parameters / Groups	The term of observation (day)	Severity of pain syndrome and collateral edema					
		Absence of pain and edema		Slightly marked		Gradually marked	
		abs	%	abs	%	abs	%
First (n=35)	3-d	-	-	7	20,0	28	80,0
	7-th	5	14,3	24	68,6	6	17,1
	14-th	30	85,7	5	14,3	-	-
Second (n=53)	3-d	20	37,7	33	62,3	-	-
	7-th	38	71,7	15	28,3	-	-
	14-th	53	100	-	-	-	-
Third (n=21)	3-d	-	-	3	14,3	18	85,7
	7-th	1	4,8	15	71,4	5	23,8
	14-th	12	57,1	9	42,9	-	-
Total (n=109)	3-th	20	18,3	43	39,4	46	42,3
	7-th	44	40,4	54	49,5	11	10,1
	14-th	95	87,2	14	The 12,8	-	-

The analysis of pain syndrome severity and collateral edema in patients who were performed surgical intervention to open the impacted tooth using various ways established relevant difference while applying a range of methods; absence of pain sensations and collateral edema were seen in patients of the second group, access to whom was made up by means of highly-energetic laser radiation, on the third day constituted 37,7%- 20 patients, on the seventh day in 71,7%-38 patients and the fourteenth one in 100%-53 patients. Moderately severe pain syndrome and collateral edema were absolutely unremarkable during the total term of observation.

While applying a classical method 7patients -20% were seen to have a slight pain and swelling on the third day, 28 patients -80% experienced painful sensations and edema. On the seventh day of study one could see the prevalence of slightly expressed pain syndrome and collateral edema (68,6%-24patients), moderately expressed (17,1%- 6 patients) and complete absence of pain and edema did not differ greatly (14,3%-5 patients)($p>0,05$). 14 days after intervention, 85,7% -30 patients had no pain and edema, however, a small number of patients 5-14,3% complained of slight pronounced pain sensations and collateral edema.

The patients of the third group who were created access with the use of diathermocoagulator experienced prevalent moderate pain and collateral edema(85,7%-18 patients) three days later; (71,4%-15 patients) had slight marked pain seven days after, while 14 days later unreliable differentiation between pain absence and edema and slight pain and edema (57,1%;42,9%;$p>0,05$) was noted.

The analysis results of pain syndrome severity were confirmed by the presence and evidence of collateral edema in the monitoring dynamics of clinical groups' patients.

The benefits of laser surgery involve avoidance of bleeding during intervention, sterility of working field and rapid healing, edema absence and avoiding of placing sutures. Surgical operations with the use of laser instead of scalpel become bloodless, their duration gets shortened and penetration of infection into the wound is shut out. The patients were noted to have far less pain during the postoperative period and virtually there was no postoperative edema.

Conclusions. Laser Technologies as the way to get to the impacted tooth provide hemostasis, operative wound disinfection, intensity reduction of pain syndrome and collateral edema after an operation, risk of development of inflammatory complications and shortening of temporary disability terms.Creation of access to the impacted tooth using laser does require antibacterial therapy; although , making up of the coagulation layer on the wound surface by means of lasers deprives of necessity to close it with an iodoform swab. There is no granulation phase in the process of epithelization.

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