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Innovation Approach to Caries Treatment Among the Children Based on Algorithmic Diagnostics

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Abstract. It is very important and purposeful to use cone bean CT in planning teeth treatment with a root perforation in order to reveal anatomic-physiological factures of the tooth and factors conducting, It is development and to evaluate foci of inflammation in periapical tissues.

Keywords. *Tissue, teeth caries, algorithmic diagnostics, children, teeth treatment, periostitis, filling all root channe.*

I.INTRODUCTION.

In current infant restorative dentistry, caries complications treatment considering to be as one of the most complicated part [23].In connection with that, the fundamental meaning should be paid to the quality of endodontic treatment, which is defining the positive prediction in the context of long tooth performance [2].

The errors within the treatment of caries complications may occur at all stages: from opening of tooth cavity to root channels system obturation and lead to кoccurrence of a number of serious complications in allied anatomic-topographic parts of maxilla-facial area[27]. Even within the ideal root cavity filling endodontic complications may occur minimum, in 5% of cases, due to root perforation, over extraction of filling material, instrument in the channel fragmentation, top root resorption [28]. The frequency of all complication is15-60% [3, 9-11], at that, in molars - 96% [4]. Good are filling all root channel just in,4-13,4%of teeth [18]. In effective and with poor quality the primary endodontic dental treatment could be a reason of teeth extraction in 6% of patients with chronic dental periostitis [13].

The perforations of teeth hard tissues are from 3% to 12% of all complications of therapeutic pulpitis treatment and dental periostitis and frequently occur within the mechanical treatment of tooth cavity and root channels [12, 16, 20]. In USA annually recording up to 2400000 cases of endodontic perforations [1, 15, 16]. emergedfistulabetweendentalcapsuleandtoothcavityconsideringtobeareasonofinflammatoryprocessoccurrenceintheareaofperforationand leads to pathological hard tissues lesions of dental capsule on account of root channels system seal failure and bacterial invasion with the way of communication between endodontic area and mouth, and this is resulting to in 85,3% of teeth desorption of bony tissue and cement[22], and in long dates leads to tooth loss[19]. That is why the perforations should be considered as an important factor, limiting the chances of endodontic treatment and significantly worsen its prediction [11],but still is not considering as the direct indication for teeth extraction with caries complications. However in stomatology often with no any good reason recourse to teeth extraction within the tooth hard tissue perforation [21, 22]. Till now there is no uniform standardized approach to methodology of its treatment, there are no clear indications for perforations filling, and still need to be discussed the issue about the selection of obturation material.

II.LITERATURE REVIEW.

Thus, the high caries complications prevalence among the dental diseases, sometimes not successful endodontic treatment, due to low and poor perforation holes filling, lack of or absence of clear indications in terms of options of

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perforations filling and algorithms of their elimination, as well as complexity of rehabilitation process for patients with such pathology, became an argument for its further research.

The purpose of research is in development and improvement of endodontic treatment of caries complications among the children with the way of development and algorithm implementation to choose the methods and tools teeth hard tissues perforations filling.

III.MATERIALS AND RESEARCH METHODS.

This research included few successive steps:

1. To reveal negative effects of endodontic treatment as well as its reasons based on examination results and tests of X-ray research methods.
2. Studying of topography special features and etiology of teeth hard tissue root perforations.
3. Retrospective study analysis of cases of repeated endodontic teeth treatment with the hard tissues perforations and development of prediction criteria to evaluate the outcome of endodontic teeth treatment with perforations.
4. Perforations classification correction of hard tissues teeth for clinic use, creation of algorithms to select the perforation holes filling methods of teeth hard tissue and repeated endodontic tooth perforation treatment.
5. Definitionofclinicefficiencyintermsofendodonticrootsperforationtreatmentbasedonproposedalgorithms. For different stages of research the following material was used: computer tomograms, aiming oral images of 1000 teeth, where hasbeenesteemedthequalityoffillingbasedoncomputertomograms,teethwiththehardtissueperforation, and where have been studied the specifications of localization and etiology of perforation holes, medical history sheets of dental patients and records there in terms of root perforations treatment, teeth with the diagnosisK04.5(62,7) dental periostitis and hard tissues perforations, where have been presented quality assement of treatment for further short term and long term,teeth with the diagnosisK04.5(62,7) –chronic apicaldental periostitits, complicated by the root perforation, which were under the treatment according to developed algorithms with the filling of perforation holes and with the next medical examination.

At the clinical stage the following objects of research were: 66 patientsintheageoffrom10 to 18years old - girls and 27 boys) with no intense general pathology with the diagnosis dental periostitis – K04.5(62,7), which were in need of repeated endodontic treatment due to the presence of tooth hard tissue defect as root perforation. The conditions of teeth sampling to research groups have been summarized according to diagnosis, perforation hole level, its size and size of bony tissue destruction focus, that allows to consider the results obtained as comparable. Totally the repeated endodontic treatment with the perforation filling have been done for 72 teeth.

Teeth research grouping with root perforation is executed depending on the treatment methods to be applied (Table 1).

Table 1

Research on teeth grouping

№ group	The treatment was conducted according to:	Кол-во
Group 1	Algorithms developed	18
Group2	algorithms, but with no tools of optical magnification	18
Group 3	algorithms, but with no periodontal matrix	18
Group 4	algorithms, but with no activation of irrigation solution by ultrasound	18

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Used: X-ray, analytical, clinical, statistic – methods of research.

The perforations have been classified based on developed and adapted for clinical use and result prediction, «integrated clinical classification of teeth hard tissues».

Quality evaluation of repeated endodontic treatment have been done in few stages: directly after treatment, in short term perspective and long term dates with the help of criteria. Estimation test: availability of X-ray contrast material in terms of shape and size agree with the form and size of perforation and not going beyond the teeth outline. In earliest dates –based on symptoms presence, clinical symptoms in the periods: directly after treatment and in 2 weeks. In long dates the X-ray of each recovered tooth was provided in 6, 12 and18 months.

IV.RESEARCH RESULTS AND DEBATES.

The absence of uniform definition of the term «tooth hard tissues perforation» allowed to use the following interpretation: tooth hard tissues perforation– is the pathological (iatrogenic or restorative) communication of dental cavity or rood channel system with mouth or dental capsule.

At the first stage of research has been detected the significant number of defects and deficiency of endodontic treatment, promoting the dental periostitis development. Based on results obtained, the qualitative endodontic treatment occurs less than in 42% cases. Moreover, the endodontic treatment quality is significantly less among the teeth with complicated anatomy –first molars of upper and low chap (16,67-32,82% cases of qualitative treatment), compare to teeth, having simple anatomic structure–facing tools and first pre-molars of low chap (73,33-78,48%).

There are effective endodontic treatment in 10,89% of cases served the perforations of teeth hard tissues (Table 2), that definitely confirm the actuality of next research steps, due to high frequency of such complication and not always successful result of its elimination. The perforations frequently occurred in first molars of low and upper chap as well as on eyes teeth, and that correlates with the total defects distribution and deficiencies.

Table 2

Structure of defects and deficiencies of caries complications among the all teeth groups

Type of error	**Total number %**
Non tight restoration	23,94%
Obturation of root channel not reaching the physiological nick	23,87%
Non-obturating root channel	12,37%
Tooth hard tissues perforation	10,89%
Defects of endodontic treatment were not detected	10,40%
Elimination of filling material out of apical hole	9,71%
Not passed root channel step	3,89%
Root channels obturation low density	2,

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	93%
Not by passed tool fragment	1, 17%
Non obturating large branch of main root channel	0, 83%

In 47,78% of cases the perforations haven't been detected early. The huge amount of apical resorption cases required repeated endodontic treatment - 46,84% of all perforations, as well as over expansion of apical hole – 19,30%. The teeth hard tissue perforation structure was presented in Fig. 1

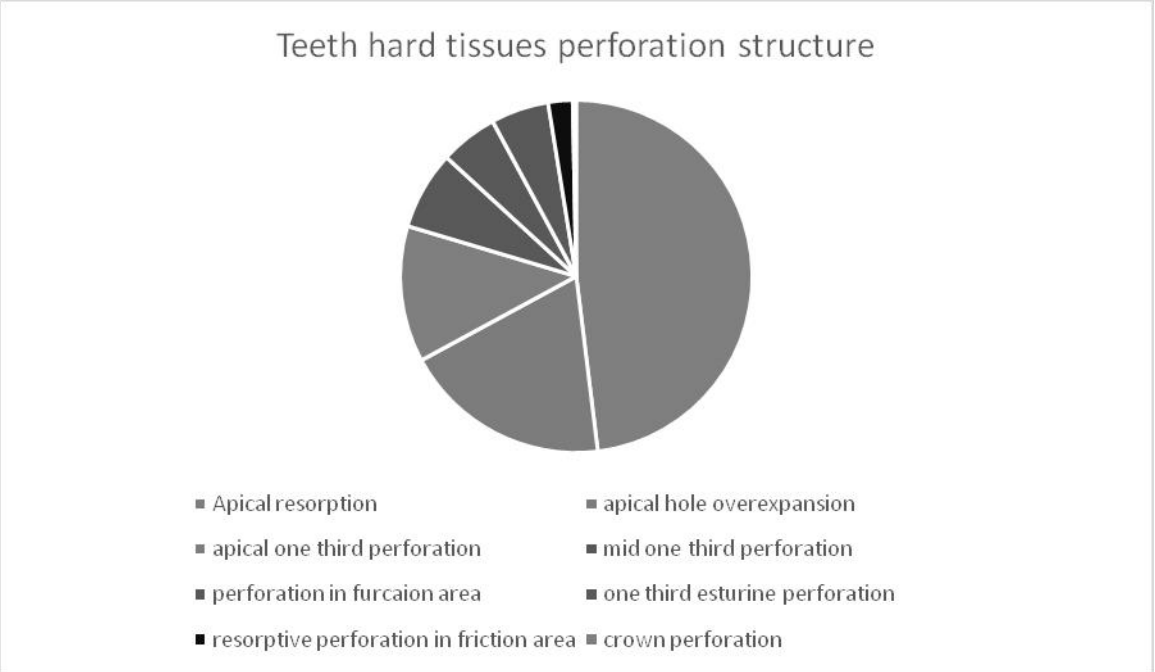

Fig. 1.Teeth hard tissues perforation structure

Thus, despitetheperforationspercentageintotalstructureofnegativeresultsistoosmall, in major cases the presence of perforation hole in tooth hard tissues promote the occurrence of negative results in long dates.

Atthesecondstagehavebeenrevealedthefactors, instigate the formation of teeth hard tissues perforations,and have been learnt the special features of its topography.

Over70% ofperforationsofrootchannelwallshavebeenrevealed on maxilla, while the over expansion of apical hole frequently occurred in first molars of submaxilla – 37%,and in maxilla – 20%.

In order to define and develop the adequate treatment planit's necessary to consider revealed perforations topographical features. One of such features is presence in more than 70% cases, wrong channel to perforation hole. Theresearchresultsindicatetheroleofcurveofrootchannel,as one of the perforation etiological factor, thus in 83% of casesthe perforation is linked with root channel curve. Moreover, thebiggestperforationpartisformingeitherbeforeoronthecurve of root channel: in third esturine – 93% of cases, in mid esturine – 85% of cases, in third apical – 61% of perforation holes are locating next to curve.

Besidesrootchannelcurve, forfactorspromotingcreationperforationsmaybereferredsuchconditions, troublingendodonticaccess, andin a particular: presence of dentinal, rooted core, rooted channel outfall obliteration, which frequently lead to perforations occurrence in third and mid entrance; presence of tool fragmentand hard material in the channel, that frequently promote formations of perforation holes in mid and apical third.

Alongwiththat,thereisclearrelationof perforation holes localizationwith the direction and channel bend angle. Thespecificlocalizationofperforationswastheareaofrootedchannelscurveswiththeangle, for mesial curves - over 22º, for

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distal andvestibular curves - over 26-30º and forthe oral curves - over 30º,that is rather related to the complexity of an access in such directions. Thelargemajorityofallperforations(81%) fulfilled along the external channel curve.

Thus, teethhardtissuesperforationsshouldbeconsideredascomplication, closely connected with the errors onto endodontic receipt, both for primary, and secondary treatment. Theanatomic-topographicpatternsofrootedchannelsstructuresystemareconsidering to be as one of an etiological perforation factors and define their localization, shape and dimensions. Atthethirdstagewasstudiedtheefficiencyofcurrently using methods of chronic dental periostitis treatment, complicated by teeth hard tissues perforation.

Inresearchprocesshasbeenrevealedlowpercentageof endodontic treatment successful results - 46,23% perforation. Dependingonperforationlocalizationthepercentage of success was from 38% to 69% of casesв; or resorptive perforations – 58,06%, for iatrogenic – 52,00%. According to thedataobtainedforpositiveoutcome, thesignificantimpactinfluencedthelocalizationfactorsandperforationdiagnostics: location of CPbefore bend, rooted channel treatment depth of rooted channel, perforation hole size; and treatment factors and obturation: cofferdam use, optical magnification, obliquity access, sodium hypochlorite, use of US activation of irrigation solutions. Theperforationholesizeimpactstheintensity of phenomenon of pain. Withitsdiameterlessthan1 mm, theclinicalsymptomcameoutdirectlyafter a treatment in 45% of cases, with the size 1-2 mm – in 17,39% of cases, over 2 mm patients noticed discomfort elimination soon after perforation filling in 66,67% of cases.

Dataobtainedindicated, thatusebydoctorsofmodernmaterials, methodsandtechnologiesduring the endodontic teeth treatment with the perforationscontribute to the quickest elimination of clinical symptoms.

Bonytissuedestructioncentersrecoveredwith different speed when the various level perforations are presented. Thebonytissuerecoveredslow, henoverexpansionofapicalholeandchannel walls perforationsin third mid, with the dates prevalency 6-12 months. Thefullrestorationwasobservedintheup to 6 months 50-57% cases for the rest localizations. Atthat, iniatrogenicperforations,atlarge, thebony picture recovered faster compare to resorptive, for which the dates more than 18 years are more specific. Alongwiththat,intermsofrehabilitation dates, the bony tissue destruction focus size impact the dates of rehabilitation. Withthedefectbonytissuesizeincrease, and the holeperforation size it's observing the tendency for increasing dates rehabilitation. However,theuseofcofferdam, USirrigationsolutionsactivation, opticalmagnification, thehugeobliquity tools, sodium hypochlorite, interim obturation positively impacted the bony picture recovery dates.

Basedonlongexperiencedentaldiseasestreatmentandresearchresultswe developed and proved the diagnostic algorithm of such disease like caries (fig.2).

Onecomparedclinicalresultsandretrospectiveresearchresults and established, thatthe using of proposed algorithm increase the efficiency of teeth rooted perforation treatment in 48,21%. In 2, 3 and 4 groupsofresearchwaspresentedmoreefficacy of treatment, compare to retrospective research.

Conclusion and outcomes. The **quality ana**

lysisofendodonticcariescomplicationstreatmentdemonstratedhighpercentageofnegativeresults (58,35%), more frequently occur among the teeth with complex anatomy (in molars of upper (maxilla) and molars of **sub maxilla**).

Teethhardtissueperforationofvariousetiologyandlocalizationis10,89% outofnegativeresultsand frequently occur among the teeth3.6, 4.6 (33,86%), 1.6, 2.6 (20,89%), and also among the teeth 1.3, 2.3 (20,89%).

Inthestructureofperforationstherearealotofresorptioncases of apical hole (46,84% out of all perforations), **required repeated** endodontic treatment. Theanatomic-topographicrootedchannelsstructuresystemspecificationsconsidering to be as one of the etiological factors of perforation and define their localization, size and shape. Atthattherewerедefinedanumberofetiologicalfactors, the most impact the perforation origin: rooted channel curve, the presence of dentinal shoulder, root core, filling material or tool fragment to RC, RC obliteration RCor pulper cell. Revealedspecificationsofperforationtopographyofteethhardtissue, nontitle list of existing classification, it's necessary to consider when one selects methods and manner of its filling.

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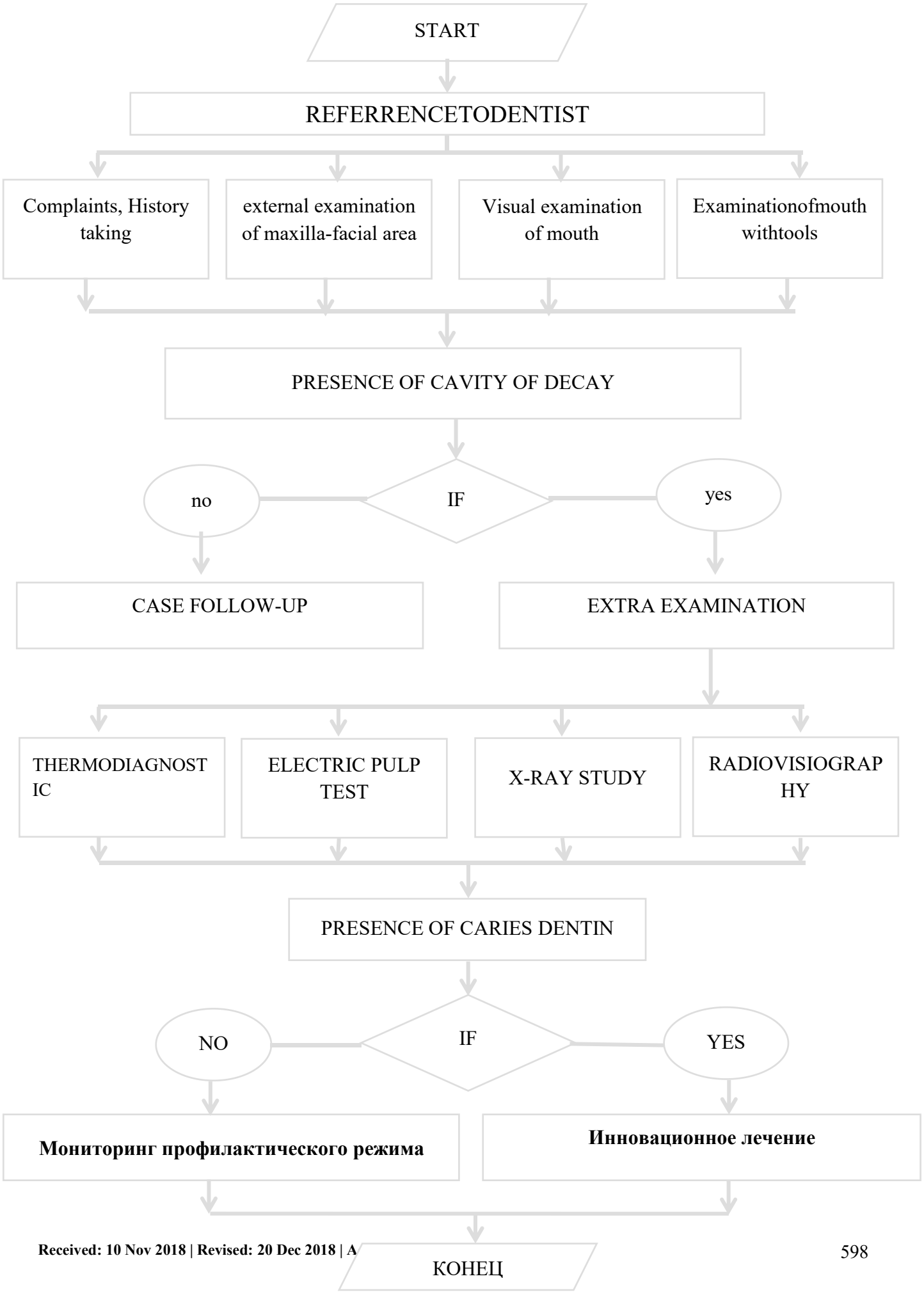

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Useofdevelopedalgorithmfordiagnostics allows toimprove the efficiency of teeth treatment with the hard tissues perforation.

Thepracticalrecommendationsarein,
whenyoudefinetoothhardtissuesperforationit'snecessarytodefinethefollowingparameters: perforation level, the main rooted channel treatments, the presence of flume previous to perforation hole, type of access to perforation, perforation hole size, perforation etiology, infection degree

Withintheplanningoftoothtreatmentwithrootedperforation, tospecify its anatomic-morphologic features, to reveal the factors,promoting its occurrence, inflammation centers assessment in periapical tissues is reasonably to apply algorithm disease diagnostics.

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