

Morphological Peculiarities of Periodontal Soft Tissues after Influence of Photo-polymerizing Ionomeric Cement "Perma Flow"

*Lia Sanodze**, *Marina Mamaladze**, *Omar Khardzeishvili***,
*Otar Kevlishvili****

*Stomatological Clinic of Tbilisi State Medical University,
The Georgian-German-Spanish Clinic "Unident-Rossi" of Stomatology and Medical Esthetics;
**Department of Pathological Anatomy, Tbilisi State Medical University;
***Scientific-Research Institute of Experimental and Clinical Medicine of Tbilisi State Medical University, Georgia

Abstract

Have been investigated different dental materials for successful filling of perforations with various locations. Among suggested preparations: Dyract (Dentsplay), Ultracal XS, Colapan the Photo-polymerizing ionomer cement "Perma flow" (Ultradent) was selected, whose composition includes and reveals the features of compositional mass and ionomer cements. Experiment has been carried out on 10 rabbits. Perforation was reproduced in different areas of the dental crown region with the use of metal burs. After filing of perforation with "Perma flow", morphological preparations for further investigations were prepared. The results of our investigations have shown that investigated preparation did not provoke inflammatory reaction of immunologic type in soft tissues. Morphological investigations revealed fibrotic changes of tissues that are logical protective reaction of the whole organism. The aforesaid substantiates farther clinical application of investigated preparation in stomatological practice.

Keywords: *perforation, dental root, dental preparation, endodontic treatment, caries (artificial), periodontal reaction, "Perma flow"*

Introduction

One of the frequent complications in dental caries treatment is the perforation of dental cavity wall, bottom and root. In clinical practice such kind of complications may develop as a result of incorrect directional drilling of dental cavity, insufficient knowledge in topography of dental cavity bottom, attempt to widen mechanically curved and hardly penetrable dental canals or during preparation of dental canals crown portion 1/3 for orthopedic sticks and inclusions [1.2.4].

Gofung E. and Entin D (1938) thought that incorrect directional processing of canals belongs to reasons

leading to development of dental roots' perforation [3]. According to data suggested by Borovski E. (1999) roots' perforation constitutes to about 9% of all complications in endodontic treatment [1]. I. Kvinnsland et al., (1989) described dental perforations of upper jaw three times more frequently (74,5%) than in case of lower jaw (25,5%) [8].

For a long time, silver amalgam has been considered as one of the traditional agent for treatment of dental cavity bottom's perforation. In the late years along with that, composites and glass ionomer cements have been displayed.

The treatment tactics of dental perforations depends on its location. According to the method suggested by Gafung E. and Entin D. (1938) perforation of pulpal cavity wall was covered with golden or tin foils [3]. The large is the perforation the difficult is the treatment that increases probability of unfavorable outcome. In case of chronic or chronic recurrent periodontic teeth, or when it is an old perforation, treatment prognosis in most cases is poor that may lead to dental extraction.

Considering all of the aforesaid, elaboration of preventive and treatment measures remains as a greatest and topical problem in therapeutic stomatology.

The aim of our investigations was selection of suggested filling materials for perforations, detection and revealing of clinically reliable material and to offer recommendations for its practical usage.

Material and Methods

Investigations have been performed using the following dental materials: "Dyract" (Dentsplay) - compomere, comprising features of hybrid and glass ionomer cements, characterized by stability and adhesiveness. The great advantages of compomeres' [5.6] are the absence of acidic engraving phase, paste's mono-component consistence, and system's ability to excrete fluorides for a long time. [9] "Perma flow" (Ultradent) - Photo-polymerizing ionomer cement, characterized by the high adhesiveness to the dentine and cements. Colapan - granules for regeneration of bony structures made on the hydroxyapatite basis, supporting optimal course of reparative regeneration processes in the bone wounds. "Ultracal XS" - calcium hydroxide. It is characterized by alkaline reaction (pH 8-10) thereby revealing antibacterial effect. The calcium hydroxide paste contains 35% of calcium hydroxide. It is X-ray-contrast and contains calcium hydroxyapatite. Calcium hydroxide is considered as an antibacterial agent due to its high pH level. It has potential for restoration of calcium structure as well.

During the process of our experimental investigations we chose and used the "Perma flow".

Experiments have been performed at the Scientific-Research Institute of Experimental and Clinical Medicine of TSMU and Department of Pathological

Experimental animals were pre-medicated using the intramuscular injections of thiopental. The artificial perforations were created in incisors of upper jaw of each animal. With the use of diamond dental drill, opening of dental cavity, extirpation of pulp, mechanical and medicament processing, and canal filling were performed. Using the selected filling material, process of dental cavity perforation fillings was analogical.

Permanent filling restored anatomic shape of tooth. For morphological investigations, after decapitation extirpation of upper jaw incisors' region was performed.

Animals were divided into four groups. In the control group I (2 animals), the artificial perforation was made by the drill as follows: after opening of the tooth cavity, the wall of dental cavity was perforated by laterally directed drill. The pulp extirpation was followed by the canal obturation, using the temporary filling material. Temporary filling restored tooth anatomic integrity.

Experimental animals were divided into three major groups II, III, and IV - (8 animal). The artificial perforation was created in incisors of upper jaw. After opening of the tooth cavity and pulp extirpation, the canal was filled with Siler and the perforation's hole - with "Perma flow".

For morphological investigations an experimental material from the group II animals were obtained on the 3rd day of experiment, from the group III - on the 7th day, and from the group IV - a month later.

The material (fragment of alveolar process with upper jaw incisors) was fixed in 12% neutral formalin during 48-72 hour. After fixation and decalcification, material was prepared in such way, that both, perforated incisor and soft and bony tissues of tooth-bed were placed in one object. After appropriate processing the material were placed in homogenous paraffin. The paraffin blocks were cut using the rotation microtome obtaining the 3-4 micron thick sections. They were stained with the hematoxylin and eosin, and with the picrofuchsin as well - the method of Vangizon.

Micropreparations were observed and assessed with the use of light microscope (under various magnification). During the microscopic observations, the major criterions upon which the assessment was based are: the level of filling material's passage into the periodontal ligament, nature of passage disorders and extent of reactive changes, expression peculiarities of reparative and eliminative processes.

Results and Discussion

The results of investigation have shown:

In control group animals, the dental cavities are filled with a soft-granular homogenous and eosinophylic masses. The dentin's peripheral zone on the dental root's outer surface transfers into the non-cellular cement's thin zone. Directly from the mentioned zone begins the periodontal ligament tissue. It consists of wide bundles of collagen fibrils. Fibrils in both sides are sunk into the firm tissue and are directed between the blood vessels as waves. They reach the bony tissue of alveolar process and go through them as so-called the bundles of Sharpee. Between the bundles, fibroblasts,

fibrocytes and rarely lymphocyte-like cells as single exemplars are observed.

On the third day of experiment artificial defects of incisors, crown and root portion cavities of the pulp and the hole's lumen of the perforation are filled with the pink colored homogenous granular filling mass. The mentioned mass is passed into the periodontal ligament tissue. In this region tissue undergo destruction; edema, plethora and stasis develop. From the cellular components, the segmented nuclear lymphocytes are not detected. Concentration of macrophages and lymphocyte groups are manifested. Collagen bundles, immediately at the adjacent region of the filling material undergo mucoid imbibition. The bone tissue of alveolar process immediately at the adjacent region of the ligament is fragmented.

On the 7th day of experiment, artificial caries defects of incisors, the crown and root portion cavities of the pulp and the hole of the perforation are filled with small-granular homogenous mass of the filling. The mentioned mass comprises adjacent tissue of the ligament and partly is embedded between the alveolar bony structures. Plethora, stasis and edema are sharply reduced. Around the filling material macrophages, rarely lymphocytes and activated fibroblasts with large and light nuclei are detected. The mitotic figures, among them disorderly placed picrinophilic and fuchsinophilic collagen bundles are encountered rarely. In the cytoplasm of single giant-like macrophages, the phagocitized masses of filling material are detected.

On the 30th day of experiment, the artificial caries defects of incisors, the crown and root portion cavities of the pulp and the hole of the perforation are filled with filling material. Extradentally, the filling mass volume in the periodontal ligament tissue is reduced and increase in number of fuchsinophilic collagen bundles around

them is revealed. The connecting tissue encapsulates the filling material. The cellular reactions almost are not detected if not take into account the presence of single macrophages and lymphocytes. Hemorrhages, plethora and edema are not detected.

Conclusion

Thus, according to our investigations the influence of "Perma flow" (Ultradent) on the periodontal tissue has been detected. The effect of the "Perma flow" on the periodontal ligament tissue was revealed by the mild inflammatory changes. The inflammatory reaction develops at the early period of filling material's exposure to the tissue, which was mainly expressed by the lymphocyte-macrophage reactions and hemodiscirculatory changes. Infiltration with segmented leukocytes, characteristic for acute inflammation was not manifested. Presence of macrophages predominantly, and few immunocytes indicates that suggested filling material does not include the immunogenic and allergic features. Therefore, developed reaction is not immune or "transplant rejection" type, but fibrotic process, which is usual and common reaction of organism against foreign bodies when phagocytosis is unable to perform the lysis and utilize the agent. Moreover, encapsulation of filling material by the fibrotic tissue could be considered as an additional fixative mechanism for devitalized tooth in alveolar bed.

Proceeding from the aforesaid, formation of artificial perforations of dental cavity and filling material's passage in periodont via these perforations might be useful for the better fixation of devitalized tooth in alveolar bed.

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Воздействие светоотверждаемого иономерного цемента на морфологические особенности мягких тканей периодонта

*Лиа Санодзе**, *Марина Мамаладзе**, *Омар Хардзешивили***, *Омар Кевлишвили****

*Стоматологическая клиника Тбилисского государственного медицинского университета, совместно с грузинско-немецко-испанской клиникой стоматологии и медицинской эстетики "Унидент - Росс";

**Тбилисский государственный медицинский университет, кафедра патологической анатомии;

***Тбилисский государственный медицинский университет, Научно исследовательский институт экспериментальной и клинической медицины, Грузия

Р Е З Ю М Е

Целью настоящей работы являлось применение различных стоматологических средств для успешного закрытия перфорации зубов различных локализаций. Среди предложенных препаратов: Dyract (Dentsplay), Ultracal XS, Colapan, был выбран фотополимеризирующий иономерный цемент "Perma flow" (Ultradent), который своим составом обнаруживает свойства композиционных масс и иономерных цементов. Эксперимент проведен на десяти кроликах. Перфорацию производили с помощью стальных боров на разных областях коронковой части зуба. После закрытия перфорации с помощью "Perma flow" изготавливали морфологические препараты для дальнейшего исследования. Установлено, что препарат не вызывает развитие в мягких тканях воспалительных процессов иммунологического типа. Морфологические исследования выявили фиброзные изменения тканей, что является логичной защитной реакцией организма и обосновывает дальнейшее клиническое применение исследуемого препарата в стоматологической практике.

Ключевые слова: *перфорация, корень, препарирование зуба, эндодонтическое лечение, реакция периодонта, Perma flow, искусственный кариес*