The kinetics of dental liquid in odontogenesis

The kinetics of dental liquid in odontogenesis in the concept of the functional acid resistance of the enamel

Abstract

The phenotypical characteristics of teeth and namely the caries resistance essentially depends on the particularities of odontogenesis. They determine the structural and functional stability of the enamel to the micro flora of the oral cavity. Resistance of hard dental tissues to caries depends on the degree of mineralisation, in its turn depends on physiological processes of these tissues. Processes, which majority of them is controlled and guided on distance by specific cells – odontoblasts, through interstitial liquid. Clinically the degree of resistance to caries, could be appreciated only using the Test of Acid Resistance of enamel.

Objectives: The identification of morphological elements that assure the dental flow’s kinetics of the dental germens from the crypt.

Methods: We prepared macropreparations using “ phased congelation”, “ contrastation” and “ maceration” methods.

Conclusions:

1. All permanent teeth in mammals, including humans, develop in crypts
2. Crypt’s channels open close to the corresponding temporary teeth
3. The topography and structure of the described crypts indicate upon their possible role in collecting and eliminating the dental liquid
4. The functional insufficiency of the crypt’s drainage mechanism at different stages of odontogenesis as a result of the particularities of

development may serve as a predictive and preventive factor of the morbidity of dental caries .

Keywords: dental crypt, dental flow, acid resistance of enamel.

Introduction

The phenotypical characteristic of teeth and namely the caries resistance essentially depends on the particularities of odontogenesis. They determine the structural and functional stability of the enamel to the micro flora of the oral cavity. At the same time, the study of the processes that determine the formation of the tooth as well as its function after the eruption is practically inexistent.

All medical disciplines, including the surgical ones, except, maybe, only the traumatological ones have a therapeutical treatment stage. Only stomatology things are upside down.

Why?

We do not have elementary knowledge about the physiology and the pathological physiology of teeth. All the medical disciplines are based on vast physiological knowledge that are exposed in a tremendous number of scientific books. We do not. Although the clinical dentistryenjoys a great success and the patients cannot complain about a lack of services form the part of dentists our specialty cannot guarantee the prediction of dental caries and their complications.

The cause is obvious: we don’t know the causes of the apparition of dental caries.

We immediately resort to treatment actions, namely surgical actions only when the hard tissues are affected. When they are not, we do not have the diagnostic nor the motive to get involved.

Why do we have this situation?

Is this the specific of our activity?

Why don’t we interfere with therapeutical remedies at the stage when the physiological processes in teeth progress to the pathological stage, when the changes in the hard tissues are just at the beginning, when the tissue is still intact?

Because we can neither identify nor foresee this stage.

We talk a lot about the tooth’s environment, about the aggressiveness of bacterial flora, about the composition of saliva forgetting that the tooth is a living organ with its own physiology.

The enamel is an acellular tissue and just like the other tegumental tissues it is formed, sustained and restored directly by the internal resources of the organism. All these processes are coordinated by specific cells of the organ (in the case of the tooth by the odontoblasts). The latters, not having a direct contact with the whole enamel, can only coordinate the processes through the liquid flow , which moves centrifugally pushed by the dental pump-the pulp.

But still in that sphere there are concrete factual proofs of existence and functioning everything above described, and these proofs have been existing

for a long time. There is enamel liquid in the enamel and it centrifugally moves through special transporting structures, providing biologically necessary changes in all its strata. These facts are directly connected with caries problem and its possible prediction and control. Below we will talk about the data, and first of all, about four cardinal scientific facts.

1. Inside enamel an essential volume depends on fraction liquid. Nobody knows the name of the first researcher who has noticed that enamel is wet and while being dried loses water becoming easier. Weight index counting due to volume has led to the proving that at teeth eruption up to one tenth belongs to free transferring liquid. Immediately after eruption the volume is much bigger than at old age. We don’t need hi-tech laboratories for discovering that fact. It is a problem for a high – school student. But in the whole special literature (known to us) that basic fact is being smoothed over even to the direction that the discussed volume makes 0, 1-0, 2%, i. e. there is a “ mistake” in 2 orders, almost in 100 times.
2. There is no doubt that between the internal environment of the organism (dental pulp) and the external layers of the enamel there is a column of liquid that moves towards the exterior and later appears as small liquid drops on the surface of the enamel. This was known well back in the 1930’s and has been proved and confirmed by many researchers including A. Bertacci. [1. 2.]

The speed of the flow is different in different parts of life and even in different parts of the day.

Fig. 1. Liquid drops on the surface of the enamel depending on the age of the person

(1. immature enamel, 2. mature enamel, 3. senile enamel). (Drawn by prof. V. Okushko)

3. Liquid transporting transfer ways existence , their “ absence” served a reason to talk about surface strata autonomy, depending today exclusively on new environment. But the problem Is finally solved: there is a regular transporting structure connecting a tooth pulp with all dentine and enamel strata. Nobody doubts that there arepores on the tissue surface. And finally wonderful watery branch-looked tubular structures were found which surely refer to liquid movement. [4, 5.]

4. This phenomenon is a scientific one close to clinics. Functional mobility of acid resistance is typical for tooth enamel. The ability of enamel surface to acid damage (“ pickling”) turned out to be dependent not only on stable chemical structural peculiarities of minerals and organics but also on enamel micro-pores, which are protected by functional liquid stream. At experiments on rats and further in clinic research it was proved that tooth devitalization leads to enamel surface acid resistance reducing. In an alive tooth acid resistance can fluctuate in significant limits, being minimal in cariogenic conditions. [5.]

Structural (on the devitalized tooth) and structural-functional resistance determination (on an alive tooth) was made on the basis of numerical evaluation of the enamel surface disorganization degree under the influence of acid pickling certain doses at an incisor vestibular surface sector. The

roughness was measured maximum objectively by the prophilometer – prophilograph and was expressed in commonly used units of measuring.[7, 9.]

Such are in general the almost not recognized fundamental scientific facts concerning real tooth physiology concept.

In the theories of development of the carious process are thoroughly described the external factors that lead to the demineralisationand loss of the hard dental tissues, but the internal processes of the tooth are ignored. In the chemical concept of caries the leading role is attributed to the microbial flora and its metabolical products. In the biological concept the accent is put on the mineralisation of hard tissues , on the physiological processes and especially on the central control through the liquid flow.

The goal of the research

The identification of morphological element that assure the dental flow’s kinetics of the dental germens from the crypt.

Materials and research methods:

1. The “ phased congelation” method of the maxillaries’ native preparates. This method allows us to visualise the liquid in solid form. We section the frozen preparate with a diamonded disc. During the sectioning the preparate is heating. To avoid this, the sectioning process is interrupted to freeze the preparate once again. Usually the congelation phases are repeated thrice. The sectioning is made 1/3 at

a time, after which the preparate is congealed at -18 or -24 degrees Celsius.

2. The “ contrastation” method- the insertion of the Methylene Blue solution in the invagination using a needle. The volume of the solution varies from 1 ml to 3 ml, until the surplus leaks thrugh the interosseous channel of the crypt.
3. The maceration method- the preparate is obtained after boiling by horizontally sectioning the maxillary at 13-15 mm below the neck of a temporary tooth

Fig. 2. A sagittal section with dental follicle in a crypt.

Fig. 3. A crypt cavity with contrast solution.

Fig. 4. Scheme of limits of dental follicle and dental crypt.

Fig. 5. Macerated dental crypt in different mammals.

Fig. 6. Opening of crypt’s channelsin different mammals

The experimental data allowed us to conclude that the components of dental follicles analysed and studied previously and appreciated as elements of the drainage system, that have the biological mission to evacuate the liquid from the area where the hard dental tissue forms perhaps genuinely perform this task. We have objective data that talks about the possible residual liquid drainage system, which gaveforconstruction necessary ingredients to odontoblasts and enammeloblasts.

In our experiments, we had to exercise a force that generated pressures of about tens of grams per square centimetre.

The crypt’s cavity in all preparates were bigger than limits of dental follicle, whichagainshowsaboutthepressureinside of it.

Obviously, this data does not have complete veracity that would prove the affiliation of the previously described formations to the drainage system, which are utilised in the formation of dental tissues. But, at the same time, the clinical and experimental data gathered till this very moment, allow us to speak more confidently about this hypothesis. Its confirmation has a key role in finding the missing link that could help us appreciate the epidemiological status of dental caries. The insufficiency of this mechanism could be seen as an important factor in the spreading of caries and however different the local biological mechanisms of a tooth’s vitality and the global epidemiologic phenomenon may seem their bond is truly genuine. They are caused by the contemporary’s man biological living conditions that are far from normal.

Conclusions:

5. All permanent teeth in mammals, including humans, develop in crypts
6. Crypt’s channels open close to the corresponding temporary teeth
7. The topography and structure of the described crypts indicate upon their possible role in collecting ad eliminating the dental liquid
8. The functional insufficiency of the crypt’s drainage mechanism at different stages of odontogenesis as a result of the particularities of development may serve as a predictive and preventive factor of the morbidity of dental caries .