

Impact of Oxidizing Water and Feed intake on Enamel Surface and Plaque Formation in Rats

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Purpose of the study

It is obvious that plaque is closely related to the attack and development of periodontitis, so that plaque control is essential for its treatment. Plaque control can be categorized into mechanical and chemical controls. Mechanical control such as brushing, scaling and root planing cannot completely remove plaque. Chemical plaque control exemplified by mouthwash with 0.2% aqueous solution of chlorhexisine is harmful to the oral membrane, and is considered undesirable for cleaning body cavities in Japan. Therefore, it is urgently needed to study and develop chemical agents that can effectively remove plaque with minimum noci-influence on the living organism.

Oxidizing water is safe and easy-to-use chlorine solution produced by electrolysis of low-density salt water, and is drawing much attention for its intensive bactericidal effect and inactivation effect against viruses. Nishida et al in our department¹⁾ have conducted in vivo tests of decalcification effect of oxidizing water against dental enamel indicating that oxidizing water does not have little risk of enamel decalcification. However, its noci-effect against living organisms and the impact on the teeth when used in the oral cavity is not clarified yet.

We have tested with rats by giving them oxidizing water and examined its impact on the dental enamel as well as the amount of tartar when they are given tartar-forming feed. The following is the report.

Test materials and testing method

1) Drinking water

Oxidizing water was adjusted at pH 2.9 ± 0.1 , ORP 1,100 mV or more using Sedent Pyrenizer (SD 1000 by Sekimura). As a control group, tap water was used. Both of these were freely given to rats.

2) Feed

Following the Briner's method²⁾, tartar-forming feed was prepared in the form of powder and given to rats together with regular solid feed as a control group.

3) Animal tests

The tested rats are 22 to 23 days old female Donryu rats weighing 560g in average. Twenty-eight of them were divided into the following groups; A group given oxidizing water and tartar-forming feed (OX+C), a group given oxidizing water and regular solid feed (OX+S), a group given tap water and tartar-forming feed (W+C), and a group given tap water and regular solid feed (W+S).

After 3 weeks of testing, the rats were treated by euthanasia. Immediately afterward, maxillae and mandibulae were taken out to treat with autoclave at 121°C for 15 minutes. After carefully removing the soft tissues, dental surface was observed under a stereoscopic microscope (x 25) to take scoring of formed tartar. Also, following a conventional method, samples were prepared to examine their enamel surface under scanning electron microscopy (x 350).

Test results and analysis

There has been no change in rats' health conditions during the 3 weeks of testing. Their average weight was 621g which kept increasing all during the test. Average scoring of tartar for each group was 27.8 for OX+C group, 4.4 for OX+S, 10.5 for W+C, and 2.3 for W+S. Significant difference was identified between OX+C and OX+S groups, as well as between OX+C and W+S groups ($p<0.01$).

As to the SEM observation of the dental surface, wave configurations were found in the entire enamel of OX+C and OX+S groups, although no coarse surface like an enamel tag was identified. No such problems were found in W+C and W+S groups.

These results indicate that intake of oxidizing water is useful as chemically controlling dental plaque, because it does not affect the amount of tartar formed, and cause minimum decalcification of the enamel surface. In these tests, no increase of tartar scoring was identified due to the intake of oxidizing water. However, since SEM observation revealed the wavy configuration on the enamel surface, more study is needed for longer use of oxidizing water and some cases of insufficient plaque control.

Bibliography

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- 2) *The Control of Dental Calculus in Experimental Animals*, by W.W.Briner et al, Int.Dent. J No.21, 1971, pp.61-73