P-122

Antimicrobial efficacy of different copper salts incorporated in dental zinc phosphate cement

Mario Helmis[a,*], Sainab Yehia[a], Marie Luise Heinig[a], Michael Heubel[b], Nathalie Dantan[b], Yvonne Hoffmann[b], Mont Kumpugdee Vollrath[a]

[a]Beuth University of Applied Sciences, Berlin 13353, Germany

[b]Hoffman Dental Manufaktur GmbH, Berlin 12099, Germany

*E-mail: mhelmis@beuth-hochschule.de

If patients have a hole in one of their teeth, dentist needs to remove or drill it. Usually dentists remove accurately all parts which are affected by caries. Excavated areas will be covered by a dental filling. One consequence is that these zones are unaffected even from best oral hygiene which can cause caries again very quickly. Furthermore the restorative margin, which is the region between filling material and tooth structure, is a critical domain. Due to aging processes or other influences like temperature variations, the filling material might expand or shrink. Leaking restorative margins leads to permeation of air, saliva, food remains, and bacteria into the gap between filling material and tooth structure. This causes secondary caries. This is a very critical development, because such a covered caries infection can lead to an inflammation and can end up in a tooth nerve die off. Because of the coverage this couldn't even detected by x-ray examination in early stage and that is why it's often too late for a tooth rescue. For this reason, there is a great interest in luting agents or other dental materials which are able to prevent potential growth of bacteria from the outset. This field of research has been extensively examined by means of several ingredients e.g. silver, copper, zinc oxide in recent years. Consequently, the aim of the present study was to investigate the influence of different copper salts in zinc phosphate cement on bacterial growth incorporated. Therefore, a number of samples with contents of 2 - 10 % iodide, thiocyanate, hydroxide, oxides, and pyrophosphate of copper were tested. In addition some commercial products of different manufacturers were investigated, which in some extent contains trace elements such as copper silver, [1, 2] and gold [3].

The type of copper salt and its portion influences the setting time of zinc phosphate cement.

Different amounts of copper salt leads to differences in mass and hardness of the samples. Examination with scanning electron microscope reveals an increase in porosity of samples with higher contents of copper salt. Furthermore the usage of different copper salts leads to big variations in structure and porosity as well. For microbiology tests dominant mouth germs were selected. *S. mutans* and *L. rhamnosis* exhibits metabolic affections and accounts for caries as well as *S. sobrinus*. *P. gingivalis* is considered to be the main cause of periodontosis. *A. viscosus* is associated with periodontal disease and caries. *E. faecalis*, *S. oralis* and *P. intermedia* were examined as representative bacteria of the root area. With agar diffusion test and liquid culture test two different methods were applied to test the antimicrobial efficacy of the samples. Contrary to expectations copper(I) iodide shows a comparable low efficacy against microorganisms. In comparison of the inhibitory effects of various copper salts it was found that copper(I) thiocyanate and copper(II) oxide give the best inhibition results. However, copper(II) oxide seems to be less suitable for use due to its dark colour.

Keywords: Liquid culture test; Agar diffusion test; Dental filling; Bacterial inhibition; *S. mutans*

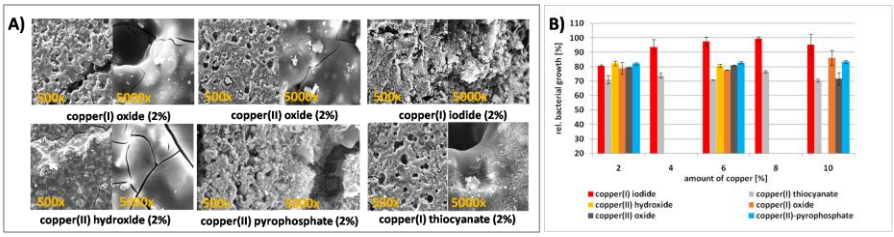

Fig. 1. SEM pictures from different copper salts incorporated in zinc phosphate cement (A), and relative bacterial growth of *P. gingivalis* contacted with samples (B).

Acknowledgements

The workgroup of Prof. Dr. Kumpugdee Vollrath (Pharmaceutical Engineering, FB II, Beuth University of Applied Sciences Berlin) would like to thank Susanne Gröschl for the ability to perform AAS-measurements, as well as Jürgen Landskron, FB II, for help with SEM-measurements. Thanks is also given to Central SME Innovation Program (ZIM) along with the Federal ministry of Economicsand Technology (BMWi) for the financial support.

References

[1] Nunez L. J., Schmalz G., Hembree J., J Dent Res 1976;55**:**257-261.

[2] Bapna M. S., Murphy R., Mukherjee S., J Oral Rehabil 1988;15:405-411.

[3] Shay D. E., Allen T. J., Mantz R. F., J Dent Res 1956, *35;*25-32.