7. Summary

There are several methods to describe substance loss of dental materials. Most of them are based on optical methods, which allow a qualitative, but not a precise quantitative evaluation. In the examination of dental materials, information on the 'hardness' of a material is also an imprecise predictor for describing abrasion characteristics.

This study was conducted to assess *in vitro* abrasion with neutron activation using three different composites. This was done by measuring a radiotracer which was produced at the research reactor of the Hahn-Meitner-Institute in Berlin. The three composite restorative materials used in the study (Arabesk®/VOCO, Durafill®/Heraeus-Kulzer and Z100®/3M) were activated by irradiation with reactor-neutrons to produce the radiotracer ^{24}Na. This radionuclide was considered the most suitable tracer, as it could be homogeneously distributed in all the samples. In addition, the half-life of ^{24}Na (14.96 hours) allows sufficient time to carry out the experiments.

After neutron-activation, each cylindrical sample of 1 mm thickness and 7 mm diameter was exposed to abrasion via air-powder polishing (Air-flow S1/EMS) at six different sites. The cylindrical chamber had to be leakproof to prevent radioactive contamination. Abrasion time for each composite product was different to produce similar groove geometry on the samples. This was achieved through the use of a protective lid infront of the sample, which was then removed to expose the sample to the air-powder polishing. After switching on the air-powder polishing device, the first three seconds of the airflow jet stream were not used for abrading since it is not continuous. Sample and experimental chamber were rinsed after the abrasion procedure to remove the abraded debris. The resulting suspension of water, powder and debris containing the tracer ^{24}Na was collected in a container. The container has an indent which matches with the shape of the detector. Radioactivity of the tracer was measured by a high efficient NaI(Tl) crystal scintillation detector. When determining the countrates the suspension was agitated to prevent sedimentation. Durafill® (27.7 µg) showed the greatest substance loss per second of air-powder polishing exposure, followed by Arabesk® (15.0 µg) and Z100® (6.5 µg).

In conclusion, it can be said that this method allows further differentiation between dental materials which show similar response to abrasion. When used together with other

methods of wear assessment, greater detail about material characteristics can be obtained which facilitates the selection of restorative composites.