

7. Summary

In this study, the shape behavior of complete dentures in household dishwashers was investigated. The ulterior motive was to establish an improved and simpler method of cleaning dentures in geriatric institutions.

For the investigation of the shape behavior, a method involving digital 3-D measuring technique was used, which was modified to meet the specific requirements.

It was shown that the digital 3-D measuring technique is suitable for the evaluation of the shape behavior of complete dentures. For the entire test assembly, the average deviation was $\pm 19 \mu\text{m}$.

For the investigation, stylized maxillary dentures without tooth arch were fabricated of heat-curing and cold-curing polymer. All denture bases were stored in tap water at 37 °C for three weeks. After that, some dentures of each material group were washed in a common household dishwasher twice a day, in addition to the water storage. The dentures were subject to a total of 81 dishwasher cleaning cycles. Digital data records were collected by means of optical recording of the internal denture aspects prior to the immersion in water and after 23, 26, 40, and 62 days. Additionally, the weight of the dentures was determined each time. The first data record of each denture was used for comparison with each of the corresponding subsequent data records by means of a computer program. The resulting color-coded difference images were evaluated visually and by means of histograms. To assess the movements of the different surface areas, separate histograms were created for four areas of the difference images. The mean deviations of these areas were then statistically evaluated and compared. The movements of the individual elements of the internal aspects were recorded by means of sections of the difference images and vector representation.

The dentures that were only stored in water were compared to those that underwent dishwasher cleaning cycles. The dentures stored in water can be considered suitable for incorporation, since the water storage corresponds with the in-vivo situation. The first measurable shape changes occurred on different days in the two material groups, but the changes steadily increased until the last measurement in both

material groups. The heat-curing polymer group demonstrated considerably less shape changes than the cold-curing polymer group.

In the heat-curing polymer group, there was no significant difference between the dentures stored in water and those that were subject to additional dishwasher cleaning cycles. As far as the dentures made of cold-curing polymer is concerned, a slightly significant difference between the two subgroups was noticeable. The dentures cleaned in the dishwasher showed more shape changes. This test assembly does not permit a comparison with other studies on shape behavior in general, or on dimensional behavior in particular. The observation that the denture bases extend, however, and the tendency of individual surfaces to change direction correspond with the results of existing studies.

The weight development is also congruent with the results of other studies on water absorption. The largest weight increase occurs during the first three weeks. The test samples that were subject to water storage alone continued to absorb water, if only little, until the end of the observation period. The weight of the dentures subject to dishwasher cleaning cycles considerably decreased between the 26th day and the end of the test, with the dentures made of heat-curing polymer losing more weight than those made of cold-curing polymer.

In order to make a reliable statement on the dishwasher stability of dentures, tests involving more than 81 cleaning cycles would have to be conducted. The weight loss indicates that the dentures desiccate. Consequently, changes in flexural strength are to be expected, which should also be investigated.