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Patient- and therapy-related factors on the wear of denture teeth – Results of a clinical trial☆

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ABSTRACT

Objective. When we examined a previously published prospective multi-center clinical trial in which complete denture-wearers were followed over a period of 2 years, we found that about 30% of the variability in the clinical wear data of denture teeth was due to unknown characteristics of the subjects. In the second part of the study, we try to identify which patient- and therapy-related factors may explain some of this variability.

Methods. The clinical wear data of denture teeth at different recall times (6, 12, 18, 24 months) in 89 subjects (at baseline) were correlated with the following parameters, which may all have an influence on the wear of denture teeth: age, gender, bruxism as reported by the subjects, number of prostheses used so far, time since last extraction, smoking, fit of dentures as judged by the subject and the clinician, average denture wearing time and wearing of denture during the night. To evaluate the influence of the different patient- and therapy-related variables, both a univariate analysis (one extra factor to the model) and a multivariate analysis were carried out using linear mixed models with the variable *Log* mean as the outcome.

Results. None of the patient- and therapy-related parameters showed a statistically significant effect on the wear of denture teeth. There was, however, a trend for women to show less wear compared to men and a trend of decreasing wear with increasing age.

Significance. Further research is required to identify the factors which are responsible for the high variability observed between the subjects regarding clinical wear data.

1. Introduction

In general, clinical wear studies describe a large variation in occlusal wear which may be attributed to individual but yet unknown patient and/or therapy effects [1].

Gender and age may influence the wear rate in subjects with complete dentures. Occlusal forces diminish with increased age [2,3], which may result in less wear. In one study over a period of 12 months, there was a trend of decreased wear with increased age [4]; however the difference was not statistically significant. Three studies did not find a correlation

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between gender and wear of denture teeth [4–6] while one study did find a significant influence after 6 months [7]. Generally, women have smaller masticatory muscles than men, resulting in lower masticatory forces [8]. However, this has only been confirmed in dentate patients but not in edentulous patients [9].

Bruxism patients have been reported to show more wear in their teeth than non-bruxism patients [10,11]. However, no clinical study that investigated the influence of bruxism and wear on denture wearers has been found.

The number of dentures already in place before the insertion of the denture for the current study may also have had an effect on the wear rates of the denture teeth. If a patient receives a complete denture for the first time, more wear may be expected compared to patients that have already worn complete dentures for some time as these patients are better accustomed to dentures and use less chewing force. Likewise, patients who underwent tooth extraction shortly before they received their set of complete dentures may exhibit higher chewing forces than patients whose last tooth extraction was a long time ago. In a pilot study on 28 denture wearers over a period of 12 months, no significant correlation could be found between the above two variables and vertical loss [4].

One study reported significant higher masticatory forces in patients who do not smoke [8] which may be correlated with higher wear.

The fit of the denture, specially the denture of the lower jaw, influences the acceptance of the dentures by the patient and the amount of time the denture is worn during the day [12]. The longer the dentures are worn by the patient, the higher may be the wear of the denture teeth. The wear of the dentures can further be accelerated if the dentures are also worn at night, although this is not advised because it enhances the resorption of the alveolar bone.

In 2013, we reported on the clinical wear of two denture tooth materials over a period of 2 years [1]. The materials were tested both in a split-mouth design (6 centers) and a two-arm design (1 center). There was no statistical difference in the overall wear between the test and control material and the relative increase in wear over time was similar in both study designs. A higher degree of wear was consistently recorded in the maxillary teeth compared to the mandibular teeth and in the first molar teeth compared to the premolar teeth and the second molars. Likewise, the supporting cusps showed more wear than the non-supporting cusps. The amount of wear did not depend on whether or not the lower dentures were supported by implants. The factors of time, tooth and center accounted for 43% of the variability and the random subject effect for 29% of the variability; about 28% of the variability could not be explained. In that study, patient- and therapy-related factors, such as age, gender, bruxism, fit of denture, average denture wearing time, were also recorded. The purpose of the second part of the study is to evaluate whether these patient- and therapy-related factors correlate with the clinical wear of denture teeth and explain some of the variability.

The null hypothesis of the present study was that none of the patient- and therapy-related factors correlate significantly with the wear of denture teeth at any given recall over a period of 2 years.

2. Materials and methods

The trial was approved by the ethical committee of the Heidelberg University Hospital, Germany (No. 375/2006) as well as by the Institutional Review Board of the State University of New York (SIS0380807E).

2.1. *Selection of subjects*

Inclusion criteria for subjects

- Edentulous patients with indication for full denture.

Exclusion criteria for subjects

- Allergy against ingredients of the denture base material.
- Patients that wear the denture for less than 6 h a day.
- Patients from whom no compliance could be expected.
- Patients that received the first set of full dentures less than 12 months ago.

The denture tooth materials were a doublecrossed-linked polymer (DCL = control material) and a material that comprised additionally 20% of UDMA/PMMA fillers (experimental). For the posterior teeth, SR Ortholingual molds were used and for the anterior teeth SR Vivodent molds (Ivoclar Vivadent). The teeth were available in the following colors: A1, A2, A3 and A3.5. The dentures were fabricated with ProBase High Impact or SR Ivocap High Impact (Ivoclar Vivadent) denture base material according to the manufacturer's instructions for use (standard polymerization).

2.2. *Study centers and randomization*

2.2.1. *Study 1 (split-mouth design)*

Six test centers were selected: four denturist practices in the Netherlands, one denturist practice in Canada and the Department of Prosthodontics of the Heidelberg University Hospital as an academic reference center. In the denturist centers and in the Heidelberg University Hospital the two materials under investigation were placed in 10 subjects at each center according to the split-mouth design (60 subjects in total). The test teeth and the control teeth were randomly assigned to the left and the right side of the dentures. Randomization was performed at Ivoclar Vivadent using the minimization technique including the variables sex, age, smoker/non-smoker and center. The teeth were set in bilateral balanced occlusion using the Ivoclar Vivadent template.

2.2.2. *Study 2 (two-arm design)*

The Department of Restorative Dentistry at the University of Buffalo (USA) was chosen as test center for Study 2. Two different groups of subjects (29 subjects in total) received the complete dentures. Each denture was made either by a trained prosthodontist or by residents of the Postgraduate Prosthodontics Program.