

The Frequency of Dental Materials Use for Fixed Prosthesis in a General Dental Practice

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ABSTRACT: This retrospective study aimed to evaluate the frequency of dental materials use for fixed prosthesis depending on the location of the teeth, the restorative prosthetic type, the age and sex of the patients from a dental practice in Essen, Germany. The analysis of the collected data showed that zirconia is currently the most common material for making dental fixed prostheses, a larger number of prosthetic elements for women and a significant increase for these restorations at ages over 40 years. Most of the prosthetic elements were made in the mandibular molar area, with an increased frequency of zirconia bridges in the mandible, while for the upper jaw the number of crowns was higher. Zirconia was more frequent used in female patients and in the age group 60-69.

KEYWORDS: Dental materials, fixed prostheses, zirconia.

Introduction

Prosthetic rehabilitations made by fixed prostheses offer a special satisfaction to both the patient and the dentist, allowing the restoration of the shape and function of the altered dental structures [1].

Recently, it can be noted an increase in the frequency of the use of fixed prostheses in Europe, due to the possibility of making implant supported prostheses but also the increased requirements of patients for a fixed treatment, instead of removable restorations [2].

Today, although fixed metal prosthetic restorations are the standard variant of treatment in the posterior area offered by German national health insurance companies [3], the increasing aesthetic requirements of patients impose a more and more frequent use of restorations with an esthetic component, monolithic restorations made of ceramics being more and more requested by patients [4,5].

Tooth loss is associated with an overall decrease in quality of life related to oral health [6], but aesthetic requirements, especially in economically developed societies, are becoming increasingly important, giving edentulism and masticatory function a minor status [7,8].

That is why lately it is more and more often supported the idea that in the decisions at the level of public health regarding the prosthetic treatments of the population the subjective needs

of the patient should be taken more into account [9].

There is currently a considerable shortage of epidemiological studies on the frequency of tooth loss and their prosthetic restoration in many European countries, and the amount and quality of available data varies considerably depending on the geographical area [10].

The aim of this study was to survey the activity in a general dental practice in order to establish the frequency of dental materials use for fixed prosthesis depending on the location of the teeth, the restorative prosthetic type, the age and sex of the patients.

Materials and Methods

For this study a datasheet was completed with retrospective data regarding the patients who received a fixed prosthetic treatment, data obtained from the activity of a general dental practice Zahnarztpraxis Zahn und Zähnen Essen Heisingen, Zahnärzte Elena und Andrei Caracas, Essen, Germany.

A number of 58 patients were selected which received a total of 225 prosthetic elements, between 1.01.2020 and 30.06.2021, being recorded data regarding the age and sex of the patients, the type of prosthetic restoration received and its location according to the FDI system of notation of the teeth and the restorative materials used for these prostheses.

All patients signed a written informed consent for participation in this study.

To facilitate the statistical analysis of the collected data, 6 age groups were created (<30 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years, 70 years) and three types of fixed prosthetic restorations (inlays, crowns, bridges) were mentioned.

Regarding the localization, the distribution on the two arches, maxilla and mandible, was analyzed, and the restored teeth were grouped in 3 anatomical areas (frontal, premolar and molar).

Regarding the materials used for making the analyzed prosthetic restorations, 5 options were identified: gold alloy (G), gold alloy covered with ceramics (G/C), Co-Cr alloy covered with ceramics (CC/C), full ceramic made from pressed ceramics (C) and full ceramic made from zirconia (Zr).

The information obtained were statistically processed using the Chi square test for independence and the resulting data were presented in the form of graphs and tables.

Statistical analysis was performed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA), together with the XLSTAT add-on for MS Excel (Addinsoft SARL, Paris, France).

A p value <0.05 was deemed statistically significant.

Results

The analysis of the collected data showed that zirconia is currently the most common material for making dental fixed prostheses, being used for 76.88% of all prosthetic elements.

On the 2nd place are the metal-ceramic restorations on non-noble alloys in proportion of 16%, the rest of the materials being used only in particular situations (Figure 1).

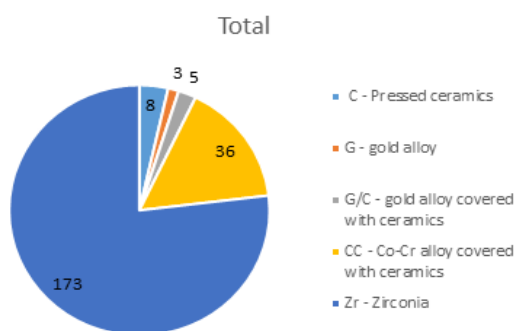


Figure 1. Distribution of the reconstructive prosthetic materials used for making the 225 prosthetic elements.

The analysis of the distribution according to sex showed us in the conditions of an equal number of male and female patients, a larger number of prosthetic elements for female patients 62.22%, but also an increased interest for the full ceramic restorations used for 80% of the prosthetic elements for the feminine gender.

Over all, we found there is a significant difference concerning the material used between genders, the Chi square test p value being $0.022 < 0.05$ (Figure 2).

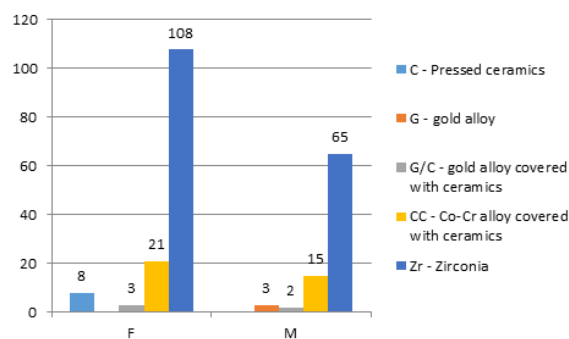


Figure 2. Distribution of the prosthetic materials used for fixed prostheses by gender.

The distribution by age groups showed a significant increase in the making of these restorations at ages over 40 years, with a maximum frequency in the age group 60-69 years (26,66% of the total).

Regarding the materials used, it is worth noting the almost exclusive use of full ceramic prosthetic options up to the age of 50, while in the age group over 70 the metallic and metal-ceramic options represent 45,23% of the total prosthetic elements.

We can conclude that the materials greatly differ among age groups, and these differences are highly significant (p Chi square = $5.18 \times 10^{-7} < 0.001$) (Figure 3).

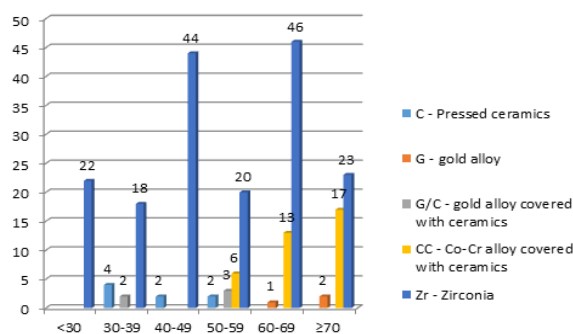


Figure 3. Distribution of the prosthetic materials used for fixed prostheses depending on the age group.

Despite the fact that the number of mandibular fixed prosthetic elements is slightly lower than the maxillary ones (43.11% of the

total), the anatomical area in which most of the elements were made is the mandibular molar area (29.33% of the total).

At the same time, for the maxillary arch, although zirconia remains the most frequently used material, the percentage of use of other prosthetic options is higher (28.9%) and especially in the frontal area (37.9%).

For both mandible and maxilla, the differences between the frequencies of the materials used for different types of teeth are significant ($p=0.009$ for mandible, and $p=0.002$ for maxilla) (Figure 4).

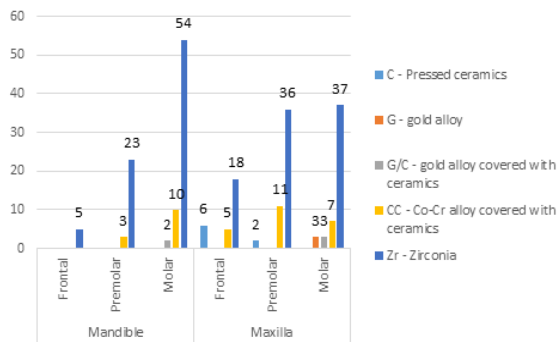


Figure 4. Distribution of the prosthetic materials use for fixed prostheses depending on the arch and the anatomical area.

Regarding the frequency of materials used depending on the type of prosthetic restoration and the arch on which it is made, we noticed an increased frequency of zirconia bridges in the mandible, while for the upper jaw the number of singular elements such as crowns exceeded that of elements contained in dental bridges ($p=0.0009 < 0.001$ -highly significant difference).

Moreover, in the case of maxillary crowns we also encountered a greater variation in terms of options for other prosthetic restorative materials, besides zirconia (Figure 5).

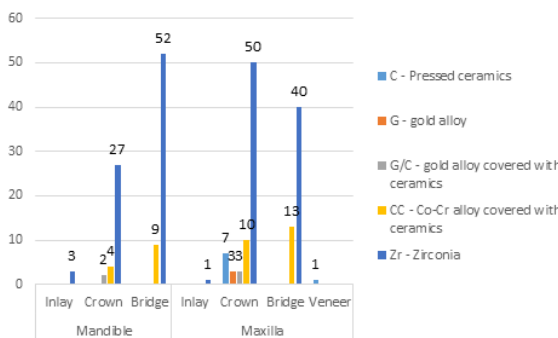


Figure 5. Distribution of the prosthetic materials use for fixed prostheses depending on the arch and the prosthetic restoration type.

Since zirconia proved to be the most used material for making fixed prosthetic restorations,

we also analyzed the distribution of its use according to sex and age group.

Thus, we observed its more frequent use in female patients (62.42% of the total prosthetic elements in zirconia), while for men, almost half of the prosthetic elements in zirconia were made for the age group 60-69 years.

Our analysis shows there is a highly significant differences concerning the use of zirconia between different age groups, in males and females, the result of the Chi square test being $p=1.5 \times 10^{-14} < 0.001$ (Figure 6).

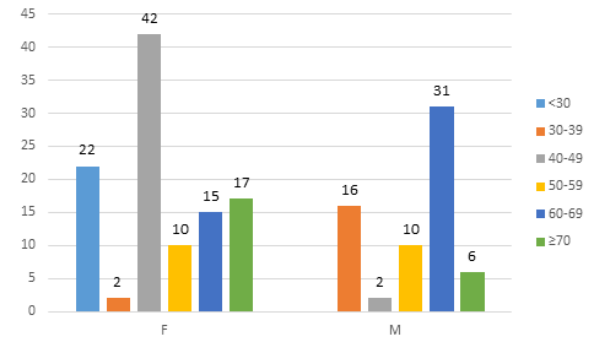


Figure 6. Distribution of zirconia use for fixed prostheses by sex and age group.

Discussions

Since the seventh decade of the last century there has been a dramatic increase in the number of dental crowns made in dental practices with a significant increase in the frequency of use of metal-ceramic and all-ceramic restorations [11] and a 1992 study already shows that most restorations had a ceramic component, the number of all-ceramic restorations increasing annually [12].

A 2016 study in Rawalpindi, Pakistan showed a frequency of using metal-ceramic restorations of 47% in the anterior area and 61% in the posterior area.

All-ceramic restorations were considered the first choice in 51% of the anterior area cases and only 2% of the posterior area cases, zirconia being slightly more requested compared to lithium disilicate.

In the posterior area, in a significant number of cases (37%) metal alloys were considered the optimal material, with a higher frequency for non-noble alloys compared to noble ones (29% vs. 8%) [13].

In the same year, 2016, in Nigeria, a study reported a frequency of use of metal-ceramic crowns of 80.3%, while metal restorations were used in 14.7% of cases, fully resin restorations in 4.2% of cases and only a single all-ceramic restoration was reported (0.8% of cases).

Interesting in this study is the increased frequency (77.8%) of maxillary restorations compared to mandibular ones, but also the higher frequency (58.7%) of restorations on incisor teeth compared to premolars and molars [14].

It is also interesting to note that in a study conducted in the same area 10 years ago, fully resin restorations predominated [15].

In Switzerland and Germany, changes in the prevalence of fixed dental prosthetic restorations are also significant for a period of 10 years, being observed in all age groups, significant decreases in the frequency and severity of edentations, but also an increase in the proportion of higher-end prosthetic restorations [16,17].

However, the prevalence of fixed prostheses is still related to annual household income, health insurance type or the presence of a chronic disease [18], while in the case of fixed prosthetic restorations quality in the anterior maxillary area there is an increasingly strong correlation with occupational status [19], similar to the observations made in our study.

A good knowledge by the dentist of the available prosthetic options and of the capacities of the partner dental laboratory is necessary in order to be able to finally offer the patient a dental restoration that corresponds to his needs.

An important aspect in achieving a successful prosthetic restoration is related to the communication between the dentist and the dental technician.

A series of studies have shown existing concerns in this regard to improve the relationship between the dental practice and the dental laboratory, frequently highlighting a lack of communication between the 2 parties [20,21].

In the case of restorations with implant support, a recent study conducted in Germany showed that most dentists preferred the use of ceramic materials in the case of crowns with implant support, metal or resin materials being mentioned by only a few respondents, even if modern CAD-CAM processing technologies were used [3].

Karasan D. et al. did not find a statistically significant correlation between the type of material chosen for the fixed prostheses and the occurrence of technical failures or the survival rate in the oral cavity [22].

However, the wear of the prosthetic material is significantly different, especially in the case of total arch restorations with implant support, with an annual wear rate of 7.3% for ceramics compared to

19.4% for metal-resin total bridges with implant support [23], while the wear rate at 5 years can reach 49%, in the case of total bimaxillary prosthetic restorations implant supported [24].

Our study showed that zirconia is, at least at the level of the analyzed dental practice, the most used material for making fixed prosthetic restorations.

However, there are not enough data to attest to the obvious superiority of zirconia-based restorations over other prosthetic options, so the dentist must make a decision based on the experience and technical possibilities at hand, but also the particularities of each case and the patient preferences [25].

Although there are a number of promising studies on the qualities of zirconia for use as a material for making fixed prostheses [26,27], there are a number of concerns about its exaggerated hardness and potential wear on antagonistic dental structures [28,29].

Therefore, clinical trials, in as larger study groups as possible and over a longer period of time are needed to evaluate the behavior of this material over time [30].

Conclusions

The results of this retrospective study based on the activity of a dental practice in Essen, Germany showed that zirconia is currently the most widely used material for fixed prosthetic restorations.

The fixed prostheses are more common in female patients, in the age group of 60-69 years.

Dental bridges are made more frequently in the mandible, while in the upper jaw a larger number of individual crowns were made.

Other materials are taken into account as prosthetic options, especially in the maxillary frontal area or for the age group over 70.

Conflict of Interest

None to declare.

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