

# Patient preference and knowledge of ceramic implants

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**This investigation aimed to gather information** from two dental patient populations on preferences regarding ceramic or metallic implants, and the factors that influence those preferences. Patients at dental centres in Switzerland and Germany received a 22-point questionnaire on knowledge of and preferences for implant materials. Patient demographic information was also gathered and used as the reference basis for multivariate logistic regression models. Subsequent steps considered knowledge of implant materials and acceptance of statements on strength, preference and allergenicity of implants. Four main questions were considered regarding preference of material and willingness to accept treatment costs. The overall response rate was 45.3 per cent. Age and gender had little effect on choice of implant material, but patients who viewed ceramic implants more positively (e.g. regarding strength and aesthetics) were more likely to prefer such an implant. Patients with higher incomes and greater education level were more likely to accept higher treatment costs for ceramic implants.

## Introduction

The use of ceramic materials for restorative purposes in dentistry dates back to the early 1900s; however, dental implants made from ceramic materials are a relatively new phenomenon (i.e. in the last 40 years). The unsatisfactory biomechanical performance of early aluminium oxide implants led to the modern wave of zirconia (zirconium dioxide,  $ZrO_2$ ) ceramic implants, with promising osseointegration, biomechanical strength and clinical outcomes.<sup>1-8</sup>

Development has particularly been driven by increasing patient requests for metal-free restorations and more demanding aesthetic standards.<sup>1</sup> Despite this, however, there is very little information on patient opinions and knowledge of ceramic implants, and patient questionnaires regarding ceramic implants in the literature are limited to outcome measurements or satisfaction,<sup>9,10</sup> or include only a small number of participants.<sup>11</sup> The aim of this investigation, therefore, was to survey patients at two clinical centres on their knowledge and opinions regarding ceramic dental implants and to determine the

social and demographic factors that may affect their preferences and decisions regarding such implants.

## Materials and methods

A questionnaire was administered to 300 patients in Basel, Switzerland, and Munich, Germany, respectively, between June 2012 and April 2013. Participating patients had either recently received or were due to undergo dental implant treatment at one of two centres: the Clinic for Oral and Cranio-Maxillofacial Surgery at the University Hospital Basel or at Praxis Drs Kniha and Gahlert, a private practice in Munich. The questionnaire, completed by the patients themselves, consisted of 22 main questions that were broken down into detailed sub-questions, covering existing dental prostheses, how the patients had obtained their information on dental implants and the importance of such information, knowledge about different implant materials, aesthetic considerations, and treatment considerations. In addition, important information on socio-demographic factors was gathered, that is age, gender, level of education and monthly household net income. These socio-demographic factors were used as the reference categories for the logistic regression models.

The statistical analysis was based on a heuristic model in which these socio-demographic factors were considered using multivariate logistic regression models in the first step. In these, the probability that a particular statement would be accepted was divided by the probability that the statement would not be accepted ( $P(X = 1) / 1 - P(X = 1)$ ) = odds ratio) as a linear function of demographic characteristics. The second step also considered knowledge about implant materials, and the third step considered the acceptance of certain statements, such as:

1. "ceramic implants have a longer lifespan than metallic implants";
2. "ceramic implants have higher strength than metallic implants";
3. "ceramic implants are more aesthetic than metallic implants";
4. "I would rather have a ceramic implant than a metallic implant in the body";

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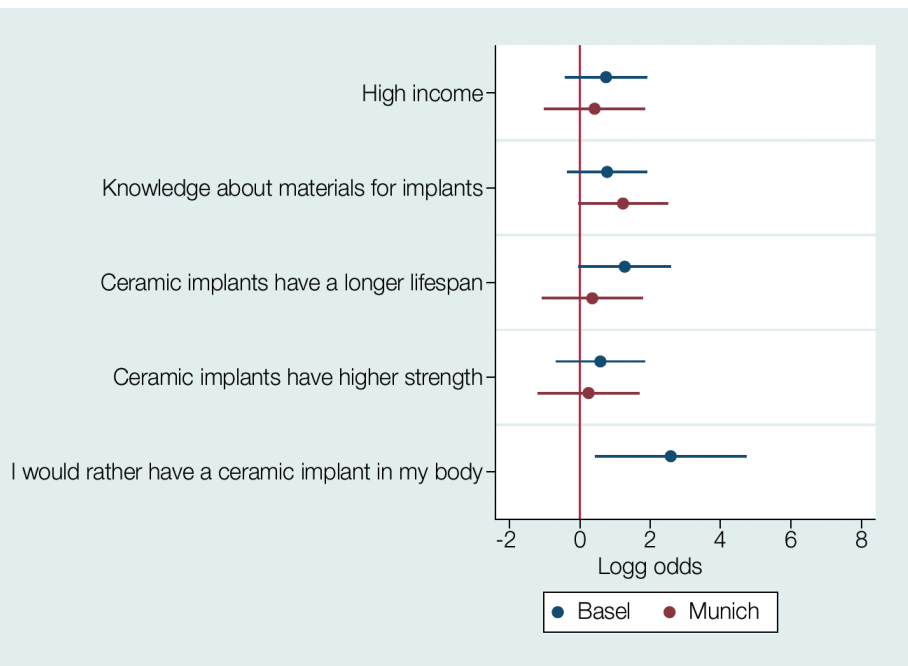


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**Fig. 1:** Estimated odds ratios for the answer “rather ceramic implant” to the question “Would you prefer a ceramic or a metallic implant?”.

- 5. “metallic implants can cause allergies”; and
- 6. “ceramic implants can cause allergies”.

For the estimated coefficients of the logistic model, a value of 1 indicated no effect, > 1 indicated a higher probability of agreement than in the reference category, while < 1 indicated a lower probability of agreement than in the reference category.

This short report focuses on the responses to four main questions:

- A) Would you prefer a ceramic or a metallic implant?
- B) Are you willing to accept higher treatment costs for an implant with a natural tooth colour?
- C) Are you willing to accept higher treatment costs for an implant that is not made of metal?
- D) Are you willing to accept a longer treatment duration for an implant with a natural tooth colour?

**Results**

Completed questionnaires were returned by 172 patients in Basel and 100 patients in Munich (response rates of 57.3% and 33.3%, respectively; average: 45.3%). Most patients (70.9% in Basel and 83.0% in Munich; average: 77.0%) already had some form of tooth restoration, mostly crowns and/or previous dental implant treatment. Most also had received some information about dental implants, mainly from their dentist (85.5% in Basel and 89.3% in Munich; average: 87.4%); relatively few had gained information from implant company websites (20.7% and 25.0%, respectively) or neutral websites (13.1% and 28.6%, respectively).

The analyses were stratified by sex into male (reference category) or female; by age group into 18–39 years, 40–59 years (reference category) or 60–87 years; by education level into primary (minimum mandatory education), secondary (reference category; beyond minimum but not university level) or tertiary (university attendance); and by income level into low, medium (reference category) or high. The income levels in each country were calculated by splitting the range between the minimum and maximum reported incomes into equal thirds.

**A) Would you prefer a ceramic or a metallic implant?**

Of the patients who wished to have an implant (or additional implant), 29.5% of patients in Basel would choose a ceramic implant, compared with 14.7% for a metallic implant. In Munich, the preference was 52.6% for a ceramic implant versus 1.3% for a metallic implant. Overall, 38.9% of patients at both centres would thus choose a ceramic implant, compared with 9.3% who would choose a metallic implant. The probability of choosing a ceramic implant did not vary significantly between men and women or according to age and income, although there was a slightly greater preference for ceramic implants in 18- to 39-year-old patients in Basel and 60- to 87-year-old patients in Munich, and lower-third income patients in Munich.

Knowledge of dental implant materials showed no significant effect on the results (Fig. 1). The Basel patients who agreed with statements 1 and 2 on longer lifespan and higher strength of ceramic implants, as well as statement 4’s preference for a ceramic versus a metallic implant in the body, showed greater probability of choosing a ceramic implant. These effects were not observed in Munich, but Munich patients who agree with statement 5, that metallic implants can cause allergies, were more likely to choose a ceramic implant.

**B) Are you willing to accept higher treatment costs for an implant with a natural tooth colour?**

Most patients (51.6% in Basel and 51.7% in Munich; average: 51.7%) were prepared to accept higher treatment costs for a tooth-coloured implant. Gender, age, education level and income did not appear to have a significant influence on willingness to accept greater treatment costs for a tooth-coloured implant, although the upper-third income patients in both Basel and Munich showed a slightly greater likelihood, as did Munich patients with a tertiary education. Basel patients with a knowledge of dental implant materials showed a greater likelihood of accepting increased treatment costs for a

tooth-coloured implant. Munich patients who agreed with statement 4, that they would prefer a ceramic implant in their bodies, were more likely to accept higher treatment costs for a tooth-coloured implant, but none of the other statements showed any significant influence for the patients at either centre.

#### C) Are you willing to accept higher treatment costs for an implant that is not made of metal?

A total of 39.0% in Basel and 47.1% in Munich (average: 43.1%) were prepared to accept higher treatment costs in this case. In both Basel and Munich, patients in the upper-third income group were more likely to accept higher treatment costs for a non-metal implant, but age, gender and education level showed no significant influence. Knowledge of implant materials showed no significant influence, though Basel patients who knew about implant materials were slightly more likely to accept increased treatment costs in this case. None of the statements had a significant influence on the likelihood of accepting higher treatment costs in this case, though a slightly greater likelihood was shown by Munich patients who agreed with statement 5, that metallic implants can cause allergies.

#### D) Are you willing to accept a longer treatment duration for an implant with a natural tooth colour?

Most patients (65.1% in Basel and 63.5% in Munich; average: 64.3%) were prepared to accept a longer treatment duration. Gender, education and income had no significant effect, but there was a significant age effect in Basel.

## Discussion

The results of this survey indicated that patients were generally well informed about different implant materials, and that age and gender had little influence on choice of material. Ceramic implants were viewed as just as strong and stable as metallic implants, if not more so, and were also seen as more aesthetic. Interestingly, the potential of allergies caused by metallic implants was not generally seen as a major concern by the patients in Basel, indicating that most preferences towards ceramic implants were motivated from the perspective of aesthetics. Higher-earning patients were more likely to accept greater treatment costs associated with ceramic implant placement.

To our knowledge, this is the first multicentre survey with reasonable patient numbers to give an indication of the most important perspectives regarding choice and knowledge of dental implant materials from the patients' point of view.

Despite these important strengths, several potential limitations must be acknowledged. It should be noted that

the number of questionnaires returned by the patients at the Basel clinic was much greater than those at the Munich clinic. Since the Munich centre is a private practice, the patient population is narrower and tends to consist of those with higher incomes. This introduces a potential bias in the results, not least because these patients are generally less willing to respond to surveys. The Basel centre, however, is part of the university hospital and therefore includes a more heterogeneous patient population. Cultural differences and differences in terms of types of treatment and insurance practices may also have contributed to differences in results between the two centres.

Overall, ceramic implants are viewed as an attractive option for patients, particularly in terms of aesthetics, and they are generally viewed in a positive light regarding strength and lifespan. Interestingly, on average, four times more patients would prefer ceramic over metal implants. Any additional treatment cost associated with treatment using ceramic implants is not viewed as a deterrent to choosing them over metallic implants.

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