

**Original Article**

## **Color Differences between Artificial and Natural Teeth in Removable Partial Denture Wearers**

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### **Abstract**

The purpose of this study was to investigate differences between natural tooth color and that selected for artificial teeth in partial dentures at our department with a view to establishing criteria for obtaining greater harmonization between colors. The participants in this study comprised partial denture wearers visiting the Department of Prosthodontics, Tokyo Dental College Chiba Hospital, in whom both artificial teeth and natural teeth were present in the maxillary anterior tooth area. Natural tooth color was measured according to VITA classical shade guide number using a dental color measurement apparatus. Artificial tooth color in partial dentures produced at our department was investigated by referring to medical records. Color of 28 participants' natural teeth and 345 participants' artificial teeth was investigated. Differences in color distribution between the natural and artificial tooth were analyzed using the Fisher exact test. The most frequent color of natural tooth was C-type, accounting for 39%, followed by D- at 32%, A- at 22% and B-type at 7%. In terms of artificial tooth color, A-type was the most common (97%). The color distribution of natural teeth differed significantly from that of artificial teeth in partial dentures. These results suggest that artificial tooth color did not harmonize with the color of the natural teeth in partial denture wearers.

**Key words:** Removable partial denture—Tooth color selection—Artificial tooth—Natural tooth—Elderly people

### **Introduction**

Japan has a rapidly aging population, with the ratio of persons aged over 65 years being predicted to increase to 38% by 2050<sup>10)</sup>. This is expected to bring about a concomitant rise in the demand for partial dentures. Furthermore, the need to improve overall quality of life has meant that not only functional, but

esthetic considerations must be taken into account. Tooth color differs not only among individuals, but also with age<sup>1)</sup>. Therefore, artificial tooth color must reflect the age of the recipient<sup>4)</sup>, not to mention the color of the remaining natural teeth<sup>9,11)</sup>. However, the color options available with ready-made artificial teeth may make matching with remaining teeth impossible in every case. Selection of

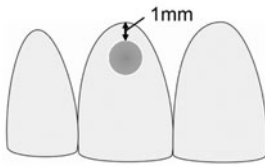


Fig. 1 Color measurement area assessed using dental color measurement apparatus

tooth color is often arbitrary, being based on clinical experience<sup>2,3,13</sup>. This means that the artificial tooth color in partial dentures may often be a poor match with that of the remaining natural teeth. However, to our knowledge, no studies have been published regarding this problem.

Therefore, the purpose of this study was to investigate differences between natural tooth color and that selected for artificial teeth in partial dentures at our department with a view to establishing criteria for obtaining greater harmonization between colors.

### Materials and Methods

Study participants comprised partial denture wearers visiting the Department of Prosthodontics, Tokyo Dental College Chiba Hospital in October 2002 with both artificial and natural maxillary anterior teeth and at least one maxillary natural central incisor. Where restoration work had been performed, these teeth were excluded from the study. A total of 28 participants (9 men and 19 women, mean age:  $58 \pm 13$  years) were selected for measurement of color of natural tooth.

The color of the maxillary natural central incisor was measured using a dental color measurement apparatus (Shade-Eye NCC, Shofu Co., Kyoto, Japan). The color of an area mesio-distally central and approximately 1 mm from the cervical area was determined (Fig. 1). Measurement was performed by applying the tip of the dental color meter to the tooth surface in the standard way. The color of the natural teeth was recorded according to the guide numbers of the VITA classical shade

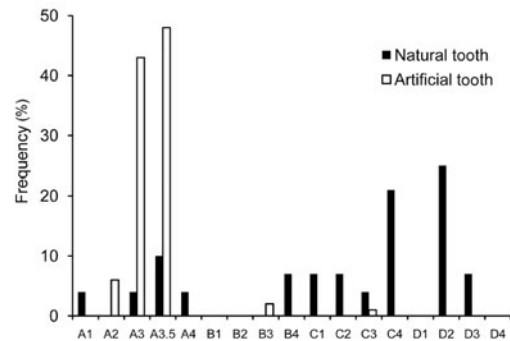


Fig. 2 Comparison between color distribution of natural tooth and frequency of use of each color in artificial tooth

Natural teeth of 28 participants and artificial teeth of 345 participants were compared. There were significant difference between the 2 groups.

guide. Color value was based on the mean of 3 measurements by one operator.

Distribution of artificial tooth color was investigated based on medical records compiled over 3 years (1999–2001) on partial denture patients treated at the Department of Prosthodontics in Tokyo Dental College Chiba Hospital in whom both artificial and natural maxillary anterior teeth were present. The artificial maxillary central incisor was selected from patients with at least one artificial central incisor, the color of which was determined according to the guide numbers of the VITA classical shade guide. Based on the criteria, the artificial teeth of 345 patients (172 men and 173 women, mean age  $62 \pm 13$  years) were selected.

Difference in color distribution between the natural and artificial tooth was analyzed using the Fisher exact test. Analysis was performed using the SPSS 11.0J statistical analytic software (SPSS Inc., Illinois, U.S.A.). Significance level was set at 0.05. There was no significant difference in sex or age between participants in terms of natural or artificial teeth.

### Results

Figure 2 shows color distribution in natural tooth and frequency of use of each color of

artificial tooth. The color frequency of natural tooth was 39% for C-type, 32% for D-type, 22% for A-type and 7% for B-type. The color frequency of artificial tooth was 97% for A-type, 2% for B-type, 1% for C-type and 0% for D-type. There was a significant difference between color distribution in natural tooth and frequency of use of each color in artificial tooth.

### Discussion

The results revealed that color distribution of remaining natural teeth differed from that of artificial teeth in partial dentures. This suggests that partial dentures do not harmonize with the color of the natural teeth.

The color distribution of each tooth type in the natural teeth in partial denture wearers revealed that various colors from A- to D-type were present. In terms of the guide numbers of the VITA classical shade guide, although brightness decreased in the order of A1, B1, A2, B2, A3, C1, D2, C2, B4, A3.5, B3, D3, D4, A4, C3 and C4, our results showed that the colors D3, D4, A4, C3 and C4, which indicate a low level of brightness, were noted in 10 teeth, accounting for 36%. Previous studies reported that the brightness of natural teeth decreases with age<sup>5,9</sup>. We believe that the age range of the participants (between 50 and 69 years, accounting for over 60% of all participants) accounts for this result.

In terms of color distribution of artificial teeth in the anterior tooth area of partial dentures, A-type was noted in most teeth, and A3 and A3.5 accounted for 91%. These results differed from those regarding the color distribution of natural teeth. The color of artificial teeth is selected using a tooth coronal colorimetric method in clinical cases<sup>6</sup>. We believe that A-type, with its high-level brightness and chroma, had been selected in many cases, as the number of esthetic-based requests regarding the appearance of the lip and mouth area has recently increased, and as the color of the natural central incisors is yellow-orange-like<sup>5</sup>. On the other hand, color measurement with

an apparatus revealed that the color of natural teeth was more frequently C- than A-type, although individual differences were noted.

A significant difference was detected in color distribution between the natural and artificial tooth groups. In terms of color differences between the left and right central incisors, it has been reported that, although a difference between the left and right sides was noted, it was small<sup>5</sup>. Furthermore, no differences between the left and right sides or between men and women were found<sup>12</sup>, indicating a lack of consistency. In our preliminary experiments, no significant difference in color was detected between the left and right sides or between men and women.

In this study, C- and D-types were frequently noted in the natural tooth group, and A-type selection was most frequent in the artificial tooth group. However, differences in tooth color selection have been noted both within and among clinicians, depending on their experience as a dentist<sup>2,3,13</sup>. Therefore, tooth color selection has recently been performed using apparatuses to objectively measure color, as in this study<sup>7,8</sup>. Our results suggest that it is important to objectively select artificial teeth from among many types of artificial teeth, including those manufactured based on other shade guides, to produce dentures which harmonize with the remaining natural teeth.

### Conclusions

1. The most frequent color of natural tooth was C-type, accounting for 39%, followed by D- at 32%, A- at 22% and B-type at 7%.
2. The most frequent color of artificial tooth was A-type, accounting for 97% in artificial teeth selected by dentists.
3. The color distribution of natural teeth differed from that of artificial teeth in partial dentures.

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