Patterns of tooth loss in young Hong Kong adults: a preliminary study based on Prince Philip Dental Hospital patients in 1984, 1998 and 2004

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ABSTRACT

Objective. To describe the change in the patterns of tooth loss among 21- to 25-year-old Hong Kong dental patients over the 20-year period from 1984 to 2004 inclusive. Materials and methods. The first panoramic radiographs of all young adult patients who registered at the Prince Philip Dental Hospital of Hong Kong in 1984, 1998 and 2004 were viewed and the presence of teeth by tooth type in each patient was recorded. Results. The proportions with a full dentition (32 teeth including the third molars) were 38.4% in 1984, 46.7% in 1998 and 48.2% in 2004; the mean numbers of teeth present were 30.5, 30.8 and 30.7, respectively. The change between 1984 and 2004 is significant ($\chi^2=5.57, df=1, P<0.05$), but the change between 1998 and 2004 is not ($\chi^2=0.16, df=1, P=0.69$). Differences in the proportions of teeth missing among 1984, 1998 and 2004 subjects were statistically significant ($\chi^2$ test, df=2, P<0.05) for all tooth types. The tooth missing rates have decreased over the years for all tooth types, except premolars and third molars, the missing rate of which has increased. A major portion of these changes occurred during the period between 1984 and 1998. The missing rate in upper premolars was higher for females than males in 1984, 1998 and 2004; the differences being statistically significant between 1998 and 2004. Conclusions. Significant changes in the pattern of tooth loss in the young adult patients seen at the dental hospital between 1984 and 2004 have been detected. There has been a reduction in tooth loss generally for all tooth types, except the premolars.

Key words: Adult; Hong Kong; Tooth diseases/epidemiology; Tooth loss

Introduction

Though many studies have been conducted on the oral health of people in Hong Kong, most tended to focus on children or older adults; young adults have received much less attention [1-15].

Major differences were found in the tooth missing pattern in the early 1980s and 15 years later in 1998, in separately sampled young adult Chinese patients attending the Prince Philip Dental Hospital (PPDH) in Hong Kong [16]. Tooth loss over those years has decreased, since, for example, more teeth with caries were saved from extraction. The change in tooth loss, however, varied across tooth types; for premolars and third molars there was actually an increase, attributed to more orthodontic and oral surgery procedures.

While the earlier study identified changes in tooth pattern in the 1980s and early 1990s, it was not known whether the change had become more stable or continued in recent years. Therefore, the aim of this study was to describe any change in tooth patterns across 1984, 1998 and 2004, and any recent trend in tooth loss patterns.
among young adult male and female dental patients.

Materials and methods

This study was based on the review of dental panoramic radiographs of patients of the PPDFH in Hong Kong. For the three chosen years, in 1984 (n=297; 118 male and 179 female), 1998 (n=612; 257 male and 355 female) and 2004 (n=274; 103 male and 171 female), all new patients of PPDFH aged 21 to 25 years were selected to form the three sample groups.

The radiographs were obtained at the time of patient’s first visit and were taken with identical panoramic units: two Panelipse units (General Electric, US) in 1984 and two Orthoralix units (Dentsply Gendex, US) in 1998 and 2004. Each radiograph was viewed on a standard light box under normal room lighting. For each patient, all 32 permanent teeth (8 per quadrant) were charted, together with comments if needed. A tooth was considered present if any part of it could be identified in the radiograph.

Two examiners, whose assessments had been calibrated, examined all radiographs together. A third examiner, whose assessments had been calibrated to the first two examiners, was consulted to make a final decision on a few abnormalities if the first two examiners disagreed.

The 32 teeth were grouped into 12 tooth types. The missing rate at tooth level was presented, while for reference, the prevalence or the missing rate at patient level was also included. For the missing rate at tooth level, the number of missing teeth of a tooth type was averaged across the expected number of teeth of the type. For example, the missing rate of 15% for the lower first molars in 1984 was calculated from (49+40)/(297+297), as there were 49 lower left and 40 lower right first molars missing in 297 patients. The missing rate at patient level was the percentage of patients missing at least one tooth of the tooth type. In the case of the lower first molars, the missing rate of 23% is calculated from dividing the number of patients missing at least one molar by the total number of patients, i.e. 69/297.

Differences in the missing teeth, among the patient groups of 1984, 1998 and 2004, were assessed using the Chi squared test and the level of statistical significance was set at 0.05.

Results

Respective proportions of patients with full dentition (i.e. 32 teeth including the third molars) in 1984, 1998 and 2004 were 38.4% (114/297), 46.7% (286/612) and 48.2% (132/274). Although the respective periods from 1984 to 1998, and 1998 to 2004 were 14 years and 6 years (i.e. about half the preceding interval), the corresponding differences were 8.3% and 1.5% (about a fifth of the preceding difference). The change between 1984 and 2004 was statistically significant ($\chi^2=5.57$, df=1, $P<0.05$), but not the change between 1998 and 2004 ($\chi^2=0.16$, df=1, $P=0.69$). The respective mean numbers of teeth present in 1984 and 1998 were 30.5 (male 30.2, female 30.7) and 30.8 (male 30.8, female 30.8) and 30.7 (male 30.8, female 30.7) in 1984, 1998 and 2004 (Table 1). The difference between numbers of teeth present in 1984 and 1998 were statistically significant ($\chi^2=10.38$, df=1, $P<0.05$) but not between 1998 and 2004.

If the third molars were excluded, the respective proportions of patients with the remaining 28 teeth were 49.8% (148/297), 74.3% (198/274) and 72.3% (455/612). The change between 1984 and 2004 was significant ($\chi^2=30.03$, df=1, $P<0.05$), but the change between 1998 and 2004 was not ($\chi^2=0.42$, df=1, $P=0.52$). The proportions of patients with a full set of teeth in 1984, 1998 and 2004 are shown in Figure 1.

![Figure 1](image-url)
The missing teeth rates of each tooth type in 1984, 1998 and 2004 at tooth level were presented in Figure 2. The differences among 1984, 1998 and 2004 were statistically significant ($\chi^2$ test, df=2, $P<0.05$) for all tooth types.

In the 20 years between 1984 and 2004, there were overall decreases in the rate of missing incisors, canines, and first and second molars, but overall increases in the rate of missing premolars and third molars. In the first 14 years of the 20-year time period, the rate of missing teeth followed the overall pattern while in the last 6 years, the rate of missing premolars and first and second molars had increased further though the rate of missing third molars had decreased.

For each tooth type in 1984, 1998 and 2004 the missing rates at patient level are presented in Figure 3. The pattern of missing rates at patient level was similar to that of missing rates at tooth level (Figure 2).

The missing rates of each tooth type in 1984, 1998 and 2004 according to gender are presented in Table 2. In the three sampled years, for upper premolars the missing rate was higher for females than males; the differences being statistically significant in 1998 ($\chi^2=6.84$, df=1, $P<0.05$) and in 2004 ($\chi^2=3.92$, df=1, $P<0.05$). For lower premolars, the missing rate was lower for females than males in 1984 but higher in 1998 and 2004; the difference being statistically significant in 1984 ($\chi^2=5.30$, df=1, $P<0.05$). For upper incisors and lower incisors, the missing rate for females was higher than in males in 1984 but lower in 1998 and 2004; such differences were statistically significant in 1998 ($\chi^2=14.35$, df=1, $P<0.05$).

**Discussion**

In young adult patients attending the PPDH, major changes could be identified in terms of missing teeth patterns in the selected intervals (between 1984 and 1998, and between 1984 and 2004), but were less significant between 1998 and 2004.

The figures presented in the previous study, though quoted as being based on individual patients, were actually averages of tooth counts. This may explain some of the
discrepancy in results from this study.

Tooth loss over the years has decreased, presumably due to a decline in the loss of incisors, canines, and the first and second molars, despite increases in the loss of premolars and third molars. In this study, it was found that most of the

Figure 3  Tooth missing rate by tooth type in 1984, 1998 and 2004, at patient level

Table 2  Missing tooth rate according to tooth type and gender in 1984, 1998 and 2004

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<tbody>
<tr>
<td>Upper incisor</td>
<td>4.0%</td>
<td>4.6%</td>
<td>2.0%</td>
<td>0.4%</td>
<td>1.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Upper canine</td>
<td>6.8% *</td>
<td>3.1% *</td>
<td>0.6%</td>
<td>1.3%</td>
<td>1.9% *</td>
<td>0.3% *</td>
</tr>
<tr>
<td>Upper premolar</td>
<td>1.9%</td>
<td>2.2%</td>
<td>1.6% *</td>
<td>3.2% *</td>
<td>2.4% *</td>
<td>4.8% *</td>
</tr>
<tr>
<td>Upper first molar</td>
<td>5.9%</td>
<td>4.2%</td>
<td>2.1%</td>
<td>1.1%</td>
<td>2.9%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Upper second molar</td>
<td>1.7%</td>
<td>1.4%</td>
<td>0.2%</td>
<td>0.3%</td>
<td>0.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Upper third molar</td>
<td>15.3%</td>
<td>14.5%</td>
<td>20.0%</td>
<td>20.9%</td>
<td>18.9%</td>
<td>20.2%</td>
</tr>
<tr>
<td>Lower incisor</td>
<td>1.9%</td>
<td>2.4%</td>
<td>2.0% *</td>
<td>0.9% *</td>
<td>1.5%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Lower canine</td>
<td>0.4%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>0.3%</td>
<td>0.5%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Lower premolar</td>
<td>3.2% *</td>
<td>1.3% *</td>
<td>1.7%</td>
<td>2.5%</td>
<td>2.7%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Lower first molar</td>
<td>17.4%</td>
<td>13.4%</td>
<td>5.8%</td>
<td>4.2%</td>
<td>5.8%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Lower second molar</td>
<td>8.5% *</td>
<td>2.2% *</td>
<td>1.0%</td>
<td>0.9%</td>
<td>1.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Lower third molar</td>
<td>11.4% *</td>
<td>6.4% *</td>
<td>13.6%</td>
<td>16.5%</td>
<td>13.6%</td>
<td>13.5%</td>
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* Significant difference in the numbers of missing teeth between males and females for the tooth type (df=1, P<0.05)
changes took place in the earlier part of the 20-year span and became minimal in the later part. The one exception to this trend was the increasing loss of the premolars, which had become particularly marked in the later years.

The changes occurring over the years were due to many factors that affect tooth loss and tooth preservation.

In 1991, tooth extractions in Hong Kong patients ≥16 years old were reported to be due to caries, periodontal disease, prosthetic indications, trauma, orthodontics and other problems; caries was the dominant reason in all age-groups 17. The causes of tooth loss also correlated with tooth types to some extent, for example, caries has a larger impact on the molars and premolars, eruption problems mostly affect the third molars and the upper canines, orthodontic extractions mostly involve premolars, and trauma mostly affects upper incisors 18.

The findings of this study suggest that:
• There was a significant decrease in tooth loss due to caries in the early years, but the change might have stabilized in later years.
• There was a significant increase in the extraction of third molars in the early years, but this trend might have diminished in later years.
• There was an increase in the extraction of premolars for orthodontic treatment, which had become more marked in later years.
• Awareness in esthetics (the undesirable appearance resulting from loss of incisors, and the desirable appearance of well-aligned dentition) has increased.

Throughout the years, public attitudes towards dental care have changed. A palliative approach involving the extraction of painful teeth, has given way to prevention involving regular therapeutic care, and oral health maintenance 19. The School Dental Care Service established in 1980, the supply of locally trained dentists since 1985, the continuous promotion of oral hygiene and health awareness, and the use of oral care services were no doubt important. All of these innovations could have contributed to the significant improvement in oral health ensuing during the 1980s and early 1990s. Moreover, the availability of dentists in the under-served areas had increased considerably between 1989 and 1998 20. Although whether the changes in the financial and psychological barriers to dental care could have played a part has not been investigated, the lowering of geographic barriers is very likely to have conferred some benefit.

Besides the change in treatment availability and awareness, the change in treatment effectiveness and trends also influence tooth loss patterns. As opposed to merely being extracted, improvements in endodontic and conservative techniques have led to more teeth being preserved from caries and trauma. In endodontics, there have been significant improvements in the techniques and instruments for root canal treatment and surgery 21. Major technological changes in the mid-1990s include the introduction of nickel-titanium rotary instrumentation, warm gutta-percha obturation, microscopes, and digital imaging. Regrettably, there are signs of saturation in the prevention of tooth loss in the later years. For example, in 2001 it was found that regular dental check-up was not common among teenagers in Hong Kong 1.

However, it is not the goal of the dental profession for every individual to possess 32 teeth. There is no optimal number of teeth, nor a minimal acceptable number agreed by the dental profession 1.

The increase in the loss of third molars might be due to increased provision of oral surgery in Hong Kong; more asymptomatic impacted third molars being removed 16,22. Arguably, the decrease in the loss of the first and second molars due to better oral health care might lead to less space for eruption and so a higher incidence of impacting third molars, thus contributing to more third molars being removed. The scenario might also be complicated by the orthodontic considerations. For example, extraction of third molars was being advocated to prevent lower labial segment crowding, even though such crowding could occur in their absence.

The rate of missing premolars has increased and continues to do so in recent years. The local orthodontics service is still in the development phase, whereas the need for such treatment for 12-year-old children or above and young adults is very high 23,24. However, the present demand remains low, though it has been predicted that it will increase in the future, due to increasing public awareness and the improved accessibility 23. Besides, in recent years orthodontic treatment for adults has gained social and professional acceptance 26. The higher rate of missing upper premolars in females than males appears to be in line with more females than males receiving orthodontic treatment.

Our study is nevertheless still preliminary and based primarily on the examination of panoramic radiographs. Perhaps future studies will investigate the exact causes of
loss for each tooth, and also integrate more snapshots of different years into the overall picture.

Teeth could be missing congenitally or be lost after birth. In this study, the rate of congenital abnormalities in tooth numbers was assumed to be relatively low and constant over years, and have an almost negligible impact on changing patterns of missing teeth.

There were about 3% non-Chinese in the data. This level appears reasonable, considering there were about 5% non-Chinese in Hong Kong according to the 2001 Population Census. The variation in tooth patterns due to variations in ethnicity was also assumed to be negligible.

Conclusion

Major decreases in tooth loss in young adult patients attending the dental hospital between 1984 and 2004 have taken place and have stabilized over recent years. Underlying this change, the rate of missing incisors, canines, and the first and second molars has become stable or low; the change in the loss of third molars has diminished; but there has been a significant increase in missing premolars.

References