How Much Does the DMFT Index Underestimate the Need for Restorative Care?


Abstract: The DMFT index, which represents caries experience as recommended by the World Health Organization (clinical examination without radiographs), was compared with a modified DMFT index with radiographs. The purpose was to evaluate how much the DMFT index underestimates the need for restorative care. A cohort of 376 young adults (eighteen to twenty years old) was examined from March 2003 to December 2004. Dental screening was based on clinical examination and bilateral bitewing radiographs. DMFT index was calculated with and without radiographs to compare DMFT scores. The average DMFT was 1.42 higher with radiographs than without (6.35 vs. 4.93, respectively), and the D component was 1.75 higher. The Pearson correlation between DMFT indices was 0.899 (p<0.0001) and 0.759 between the D components (p<0.0001). A correlation was found between D with radiographs and smoking more than ten cigarettes per day (p=0.0069). Without radiographs, there is a 44 percent probability that the caries decay value will be lower than the actual value, thus causing a greater possibility of diagnostic errors. The findings indicate that assessing treatment needs for a population based only on DMFT screening is inadequate and incomplete without radiographs.

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The World Health Organization (WHO) recommends epidemiological data regarding dental health and morbidity to be of primary importance. The DMFT index was created to express caries experience. The D component is for untreated caries, M for missing teeth due to caries, and F for filling (dental restorations for caries treatment). The T means index per tooth (as opposed to S per surface). The recommended protocol for oral health surveys is based only on clinical examinations and excludes dental radiographs. Use of radiographs to detect proximal caries is not recommended because radiographic equipment is not always available in health care facilities in many nations. Nevertheless, radiographic assessment is an important contributor to the assessment process and treatment planning. In 1987, the WHO reported that oral health assessments that do not include radiographic information are likely to underestimate the need for restorative care.

In many countries, including Israel, most epidemiological research in dentistry has been conducted among children and adolescents. The source of data for young Israeli adults has been among military personnel since the 1950s. In 2004, Bloemendal et al. published a review of the literature regarding the necessity of radiographic examinations to evaluate caries prevalence. Data were collected from epidemiological studies that compared the results of clinical and radiographic examinations in young populations. The radiographic prevalence was considerably higher than the clinical in the proximal surfaces. In the occlusal surfaces, it was similar, but extra lesions were detected with both methods. The authors concluded that radiographs are not necessary to study trends, but they do have an unknown additional value for assessing caries prevalence and that further investigation in population subsamples is needed to obtain a valid conversion factor for relevant patient categories.

Our study was conducted among eighteen- to twenty-year-old recruits of the Israeli Air Defense Artillery. The dental examination is an integral part of
the enlistment process in the base camp. The DMFT index was modified to include the use of radiographs. The objectives of this study were to compare the DMFT index, as recommended by the WHO (e.g., clinical examination without radiographs), with this modification and to determine how much the DMFT index underestimates the need for restorative care.

Material and Methods

Recruits in all army units undergo a week of enlistment in their base units before basic training. An integral part of this process is a dental examination to help recruits improve their dental health before being assigned to their unit where dental care may not be available. The study population consisted of 376 young adults (eighteen to twenty years old, 85.4 percent males and 14.6 percent females) who were examined between March 2003 and December 2004 at a single dental clinic by the same experienced dentist (TB). There were some background differences regarding place of birth, education, and socioeconomic setting. All recruits received an explanation regarding the examination and were assured that their compliance with the survey would not affect their future military service. The Ethics Committee of the Medical Corps, Israeli Defense Forces approved the study. Examination was voluntary. Two male recruits and one female (0.7 percent) refused to be examined and were excluded from the survey.

Dental screening was based on clinical examinations and bilateral bitewing radiographs taken by the dental staff. One examiner performed all examinations under artificial light, using a dental explorer, flat-surface mouth mirror, gauze, sponges, and compressed air. Two bitewing radiographs were taken, contrary to past surveys and the protocol recommended by the WHO in 1987. The DMFT index was calculated both with and without radiographs to compare DMFT scores. Data calculation was done by two of the study team; one of them is the examiner (TB). Missing teeth were scored as “M” when the tooth was extracted due to caries, as judged by the examiner after interviewing the subject. Erupted third molars were included. Fissure sealants were scored as “F.”

Self-administered questionnaires were given to the subjects before the examinations to determine independent variables, including age, gender, years of education, father’s country of origin, number of siblings, and smoking habits (cigarettes per day).

Mean DMFT and its components were calculated both with and without radiographs and compared. Pearson correlation was used to assess the association between the two indices. Associations to the independent variables were analyzed using ANOVA tests. P was considered statistically significant if <0.05 (SAS version 9.1).

Results

The average DMFT with the use of radiographs was 1.42 higher than without radiographs (6.35 with radiographs and 4.93 without radiographs). Without radiographs, the D component was 1.75 higher than without radiographs (Table 1).

The Pearson correlation between the DMFT indices, with and without radiographs, was 0.899 (p<0.0001); between the D component 0.759 (p<0.0001); between the M component 1 (p<0.0001); and between the F component 0.953 (p<0.0001).

In the ANOVA model, a correlation between D with radiographs and smoking was found (p=0.0069). The effect on D was found only for subjects who had smoked more than ten cigarettes per day. No effect of smoking on M or F was found with statistical significance. A correlation between D value and number of siblings was also found (p=0.0026).

| Table 1. DMFT values of both indexes (with and without radiographs) |
|------------------|---|---|---|---|
|                  | D  | M  | F  | DMFT |
| Without radiographs | 1.24 | 0.04 | 3.64 | 4.93 |
| With radiographs   | 2.99 | 0.04 | 3.29 | 6.35 |
| Pearson correlation coefficient | 0.75* | 1* | 0.95* | 0.89* |

*p<0.001
No correlation was found among gender, years of education, father’s country of origin, number of siblings, and DMFT indices.

**Discussion**

The difference between the two DMFT indices (4.93 without radiographs and 6.35 with radiographs) was mainly because early proximal caries are usually not identified during clinical examination. Only when the lesion is much larger and deeper is it possible to be seen as an opaque or grey reflection under the marginal tooth ridge. In our study, we assume that this was the reason for the difference between the D component with and without the radiographs. Proximal secondary caries are also rarely seen in the clinical examination. In DMF scores, these are marked as “F” due to the presence of a restoration in the tooth. After detection in the bitewing radiographs, it was marked as D. In these cases, the F in the index was lower with radiographs than without radiographs. This did not influence the total DMFT value, although the D and the F components were influenced.

The use of esthetic restorations occasionally makes it impossible to detect whether there is a composite restoration in the tooth with only a clinical examination. Radiographs are the only method that can detect the restoration. In these cases, the F component was higher in the index with radiographs than without radiographs. The correlation between D values was 0.759. This means that only 56 percent of the variability in the radiographic group can be explained by the conventional D value. Consequently, there is a 44 percent probability that the D value without radiographs will be different from the D value with radiographs, e.g., undetected caries. In lower values of D there is a higher possibility of error (see Figure 1). Thus, the D component of the DMFT index that includes radiographs may shed more light on the population’s treatment needs.

Our study found that smoking more than ten cigarettes per day was associated with high caries levels. This is similar to previous reports and may indicate a lower health care awareness and attitude among smokers.

Dental surveys of army recruits are a fairly good model for the dental status of the young adult population in Israel since it is a heterogeneous group. However, it may not be completely considered as a representative sample of the young Israeli adult population because it excludes the ultrareligious and Arab populations, who do not serve in the army but constitute an inseparable part of the society. In our study, the cohort was comprised mainly of males (85.4 percent vs. 14.6 percent), and thus the subjects may not necessarily represent the adult female population in Israel.

A review of previous epidemiological data obtained from DMFT surveys conducted on army recruits in Israel reveals a steady, almost linear trend of increased caries severity that peaked in 1986, arrested, and then declined in the year 2000, in which the largest survey was published by Sgan-Cohen et al. The study was conducted among 7,139 Israeli soldiers (twenty-one years old). The average DMFT level was 8.49 (±4.95), and the untreated caries (D component in DMFT) was 2.25 (±2.9), significantly higher among males.

In our study, the DMF level indicated a continued decline in caries severity. The cohort was small, which makes it difficult to generalize the findings to the young adult Israeli population. Nevertheless, when compared to surveys conducted in the army over the past fifty years, a possible decreased trend for caries severity was shown.

Since the current new recommendation of the WHO for caries detection does not recommend the use of an explorer, there could possibly be a slight increase in false-positive findings in our study protocol. However, the same protocol was used in most of the previous studies, so comparison of the results is still relevant.

Public health workers, dental practitioners, educators, and students encounter the DMFT index in their everyday professional lives. Their awareness of the fact that this index is primarily a researcher’s tool and does not include Roentgenograms is not trivial and should be more heavily emphasized. Application of the DMFT index to the clinical field is an educational challenge to dental students and practitioners. As we noted, a potential significant difference may occur when only a DMFT assessment is made. This variance could reach up to 44 percent probability that the caries decay value in the index will be lower than the actual one. The general dentist should keep in mind that the DMFT index alone does not define a patient’s dental needs.
Summary

When performing dental examination without the use of oral radiographs, there is a 44 percent probability that the caries decay value will be lower than the actual one. There is a higher possibility of error in lower values of caries decay. To assess treatment needs for a population, the D component of DMFT screening that excludes radiographs will be inadequate. The use of radiographs should be considered when conducting an epidemiological examination in dentistry.

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REFERENCES