J Clin Periodontol 2007; 34: 860–866 doi: 10.1111/j.1600-051X.2007.01124.x

Journal of Clinical Periodontology

Periodontal conditions in Swiss army recruits: a comparative study between the years 1985, 1996 and 2006

Beat Röthlisberger, Patrick Kuonen, Giovanni E. Salvi, Jeanne Gerber, Bjarni E. Pjetursson, Rolf Attström, Andreas Joss and Niklaus. P. Lang

Dental Services of the Swiss Army, Switzerland School of Dental Medicine, University of Bern, Bern, Switzerland

Röthlisberger B, Kuonen P, Salvi GE, Gerber J, Pjetursson BE, Attström R, Joss A, Lang NP. Periodontal conditions in Swiss army recruits: a comparative study between the years 1985, 1996 and 2006. J Clin Periodontol 2007; 34: 860–866. doi: 10.1111/j.1600-051X.2007.01124.x.

Abstract

Aim: To compare the periodontal conditions of Swiss Army recruits in 2006 with those of previous surveys in 1996 and 1985.

Material and Methods: A total of six hundred and twenty-six Swiss Army recruits were examined for their periodontal conditions, caries prevalence, stomatological and functional aspects of the masticatory system and halitosis. In particular, this report deals with demographic data, the assessment of plaque index (PlI), gingival index (GI) and pocket probing depth (PPD).

Results: Two per cent of all teeth were missing, resulting in a mean of 27.44 teeth per subject, and 77% of the missing teeth were the result of pre-molar extractions due to orthodontic indications. The mean PlI and GI were 1.33 and 1.23, respectively. On average, 27% of the gingival units bled on probing. The mean PPD was 2.16 mm (SD 0.64). Only 3.8% of the recruits showed at least one site of PPD $\geqslant$ 5 mm, and 1.4% yielded more than one site with PPD $\geqslant$ 5 mm. In comparison with previous, this survey yielded lower bleeding on probing (BOP) percentages than in 1985, but slightly higher scores than in 1996. This may be attributed to increased PlI scores in 2006. However, PPD remained essentially unaltered from 1996 to 2006 after having improved significantly from 1985.

Conclusion: A significant improvement of the periodontal conditions of young Swiss males was demonstrated to have taken place between 1985 and 1996, but no further changes during the last decade were noticed.

Key words: army recruits; epidemiology; gingivitis; oral health; periodontal conditions; plaque; prevention; smoking; Swiss Army

Accepted for publication 25 June 2007

In Switzerland, where the entire young male population is required to serve in the Army with exception of exemptions due to medical reasons, the recruits represent a cross-sectional sample of the entire socioeconomic structure of the country as well as the geographical distribution of the male population at approximately 20 years of age.

In 1970, a group of 556 Swiss Army recruits was examined in an infantry military base (Curilović et al. 1972, Saxer et al. 1972, German et al. 1973). Later in 1974, another 1119 recruits at the army base of Thun were examined (Ramel 1976) representing a true random sample of Switzerland with regards to socioeconomic and geographical distribution. In this study, the functional aspects of the masticatory system were especially considered. Eleven years later, in 1985, 757 Swiss Army recruits were examined with respect to their oral health status at the same Army base of Thun. In that survey, the status of dental caries (Menghini et al. 1991) and the functional aspects (Ingervall et al. 1987, Jenni et al. 1987) of the masticatory system were, again, subject to evaluation. Additionally, an analysis of bitewing radiographs was performed (Lang

Conflict of interest and source of funding statement

The authors declare that they have no conflict of interests.
This study was supported by the Clinical Research Foundation (CRF) for the Promotion of Oral Health and the Fund of the University of Berne School of Dental Medicine.

et al. 1988) in addition to the assessment of the periodontal conditions (Joss et al. 1992). Again 11 years later, in 1996, the examination at the Army base of Thun was repeated and involved 419 Swiss Army recruits (Lang et al. 1998). Compared with the survey in 1985, the periodontal conditions in 1996 yielded substantial reductions in mean bleeding on probing (BOP) and in the prevalence of periodontal pockets of 5 mm or more. It was concluded that the efforts in oral health prevention practiced by the dental profession for the previous decade had dramatically improved periodontal health in young Swiss male adults (Lang et al. 1998).

Because the 1985 and 1996 surveys were performed by the same group of examiners and organized by the same team of the Dental Services of the Swiss Army, the results of these surveys provide an ideal basis for comparison with todays oral health conditions. Hence, the purpose of the present survey was to compare the various aspects of oral health in young male Swiss Army recruits again at the Army base of Thun, Switzerland. This report, in particular, deals with the periodontal conditions of the 2006 survey.

Material and Methods

Study sample

At the Swiss Army base for mechanized and armoured troops of Thun, Switzerland, 626 recruits, aged 18–24 years (mean: 20.0; SD 0.91), were selected on the basis of the availability of their section during the period of detailed basic military training in the third week after drafting into active service. Care was taken to select a sample representative of the young Swiss male population using the information of the Swiss Federal Statistical Office (2006) with regards to the different language and geographical distribution of the Swiss population. As for the surveys performed in 1985 (Joss et al. 1992) and 1996 (Lang et al. 1998), the recruits at the Army Base at Thun, Switzerland, represent also a typical distribution in ethnicity and across the socioeconomic status of the young Swiss male population.

The examinations were performed in cohorts of approximately 20 recruits totalling about 90 subjects per day for 7 working days. They included an assessment of the prevalence of dental caries based on clinical and radiographic evaluation, the inspection of the oral cavity regarding stomatological changes and halitosis, an assessment of erosive lesions of the hard structures of all teeth and an evaluation of the functional aspects of the masticatory system. Also, the smoking history was assessed. Moreover, periodontal conditions were evaluated using the following clinical parameters.

Clinical parameters

The oral hygiene status was assessed using the criteria of the plaque index (PlI) system (Silness & Löe 1964). Gingival health or inflammation was evaluated according to the criteria of the gingival index (GI) system (Löe & Silness 1963). Pocket probing depths (PPDs) as well as probing attachment loss (PAL) were determined to the nearest millimetre using a calibrated Michigan M1 periodontal probe with a point diameter of 0.4 mm (Glavind & Löe 1967). No special attempt was made to standardize the probing pressure. All the parameters, however, were scored by experienced specialists in Periodontology. Before the clinical examinations the investigators were calibrated and yielded high reproducibility (intra-examiner variability of $>88\%$).

For the determination of the PlI and GI, all four surfaces of all teeth (28) (mesial, buccal, distal, oral) were scored. For PPD and PAL, six sites were measured at every tooth (mesio-buccal, buccal, disto-buccal, disto-oral, oral, mesio-oral).

Statistical analysis

Descriptive statistics were used to present the data. Means and standard deviations per subject were computed as well as site means. Frequency analyses for different scores and probing measurements were depicted graphically. The χ^2- test was used to test for significant differences in tables.

Results

Smoking

Two of the 626 recruits did not declare their smoking status and were excluded from the analysis.

Of the 624 recruits, 68% were non-smokers and 32% declared to be a smoker. No statistically significant difference was found between the German and French-/Italian-speaking recruits.

In analysing the level of education before the military commitment, statistically significant differences ($p<0.01$) could be found between non-smokers and smokers (Table 1) (Fig. 1).

Asked about the well-being with their dentition, non-smokers were significantly ($p<0.01$) more content compared with the smokers. Among the recruits not satisfied with the status of their oral health, 68% were smokers and 32% were non-smokers. Of the smokers, 6% indicated a dissatisfaction with their oral health status, while only 1% of the non-smokers expressed a dissatisfaction. Conversely, 50% of the non-smokers were completely satisfied with their oral health status, while only 34% of the smokers expressed such satisfaction.

Tooth loss, implants

Considering a set of 28 teeth as a complete dentition, 2% of the teeth were missing, corresponding to a total of 350 teeth lost in 626 recruits. This results in a mean number of 27.44 teeth

Table 1. Smoking status and educational level prior to military service

	Non-smoker	Smoker	Total
No data	15 (62%)	9 (38%)	24 (100%)
Primary school	29 (50%)	29 (50%)	58 (100%)
Secondary (high) school	102 (64%)	58 (36%)	160 (100%)
High school+and ongoing higher education	154 (66%)	79 (34%)	233 (100%)
University student	124 (83%)	25 (17%)	149 (100%)
Total	424 (68%)	200 (32%)	624 (100%)

Primary school (9 years of education) with or without ongoing professional education.
Secondary school (9 years of education) = high school with ongoing professional education.
High school (9 years of education) with professional education and ongoing higher education.
University (college) student (12 years of education and ongoing education at a university (graduate school).

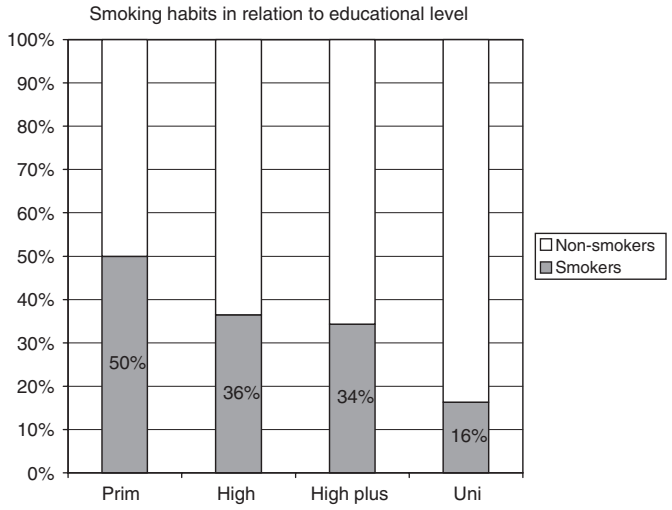

Fig. 1. Smoking habits in relation to the educational level prior to the military service. Primary school (Prim) with 9 years of mandatory schooling. High school (High) with 9 years of mandatory schooling and ongoing professional education. High school (High plus) 9 years of education with professional education and ongoing higher education. University (College) student with 12 years of education and ongoing education at a university (Graduate school).

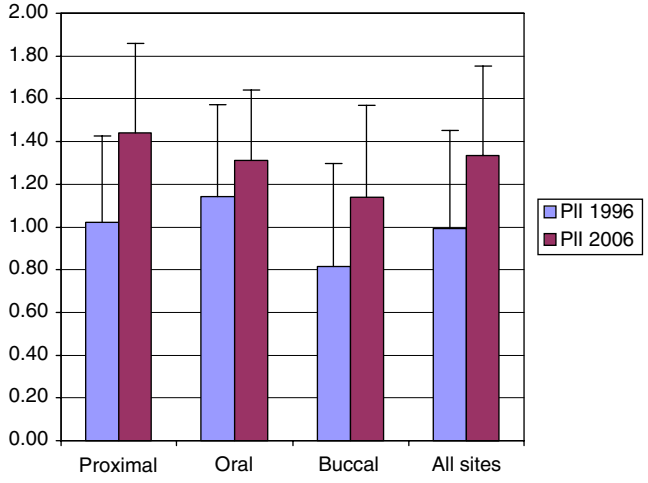

Fig. 2. Mean plaque indices (PII) (Silness & Löe 1964) for buccal, oral and proximal surfaces as well as for all surfaces comparing 1996–2006.

per recruit. By and large, tooth loss was encountered in the pre-molar region ($n = 269$), i.e. 77% of the teeth lost were pre-molars. Ten molars representing 2.8% of the teeth lost and 12 maxillary lateral incisors representing 3.4% were missing. Also three canines and 11 mandibular incisors were missing. Ten of the missing teeth (four maxillary front/canine, three mandibular front/canine and three mandibular premolar) had been replaced with dental implants. For four of the 10, implants were chosen to replace a tooth due to agenesis, while six implants were to replace traumatically lost teeth. Teeth replaced by implants were not calculated as lost teeth.

Only five single porcellain fused-to-metal crowns were found in 626 recruits. No other prosthetic reconstructions were found.

Periodontal parameters

The mean PII for all surfaces are compared with those of 1996 and are depicted in Fig. 2. A slight but not significant increase in the mean PII was encountered between the years 1996 and 2006 for all single as well as the total amount of surfaces. In 1996, the mean PII was 0.99 (SD 0.46) and in 2006 it was 1.33 (SD 0.37). No statistically significant differences were found between interproximal, oral and buccal mean PII, although a trend for lower PII was noted for the buccal surfaces.

The mean GI for all surfaces are compared with those of 1996 and are depicted in Fig. 3. A slight but not significant increase in the mean GI was encountered between the years 1996 and 2006 for all single as well as the total amount of surfaces. In 1996, the mean GI was 0.91 (SD 0.43) and in 2006, it was 1.23 (SD 0.21). No statistically significant differences were found between interproximal, oral and buccal mean GI.

In analysing the various frequencies of scores of 0, 1, 2 or 3 for both PII and GI, the percentage of the different clinical sites are depicted in Fig. 4. Of all the surfaces, 40% scored PII = 2 or 3 representing plaque deposits visible to the naked eye. In 1996, the corresponding value was 24%.

The proportion of sites scoring GI = 2 or 3, i.e. provoking bleeding on gentle sulcular probing, was 27% in 2006 as opposed to 17% in 1996. In 1985, this proportion was still at 38% (Fig. 5). In 1970, the proportion of bleeding sites was still at 94%.

On proximal gingival units of the present study, 21% scored GI = 2 or 3, while on buccal 27% and on oral 39% yielded GI = 2 or 3. This corresponded to a mean BOP of 27% for all gingival units (Fig. 4). Twenty-five percent of the molar surfaces yielded BOP as indicated by a GI of 2 or 3.

Slightly lower mean PII was observed in non-smokers when compared with smokers. The mean PII were 1.31 (SD 0.37) and 1.38 (SD 0.36) for non-smokers and smokers, respectively. For the mean GI, the values for non-smokers were 1.24 (SD 0.21) and for smokers 1.20 (SD 0.18), respectively. These differences reached statistical significance ($p < 0.05$).

When comparing the ethnicity of the recruits regarding their PII, it was evident that the German-speaking recruits yielded significantly higher ($p < 0.01$) mean PII (1.36; SD 0.36) than did the French- and Italian-speaking recruits (1.25; SD 0.39). However, no significant differences were found when comparing the mean GI of German and French-/Italian-speaking recruits.

Moreover, the mean PII decreased with increasing pre-military levels of education of the recruits. Subjects with the mandatory 9 years of elementary schooling only showed a mean PII of

1.41 (SD 0.36), while the recruits with secondary or high school education for 9 years had a mean PII of 1.35 (SD 0.38). Finally, the university students presented with a mean PII of 1.26 (SD 0.36). These differences were statistically significant ($p < 0.05$). Similar, however non-significant trends ($p = 0.053$) for lower mean GI with higher educational levels were observed decreasing from GI = 1.26 (SD 0.19) for elementary school subjects to GI = 1.20 (SD 0.20) for university students.

The mean PPD values are presented in Fig. 6. On the average, the recruits showed a mean PPD of 2.16 (SD = 0.64). The proximal and oral surfaces had slightly higher values of PPD = 2.34 and 2.33. Buccal surfaces showed a mean PPD of 1.64. Out of the 626 recruits in the present survey, 14% of the 58 recruits with only elementary school education, 11% of 159 recruits with 9 years of high school education, 6% of 230 recruits with ongoing higher education after 9 years of mandatory high school and 7% of 147 university students showed at least one site with PPD $\geqslant$ 4 mm. This, in turn, means that the level of higher education was reflected in a lower proportion with periodontal pockets. Of all recruits, irrespective of their educational level, 24 recruits (3.8%) contributed with at least one site of PPD $\geqslant$ 5 mm (55 sites total). Twelve subjects (1.9%) had PPD $\geqslant$ 5 mm at two or three sites (Fig. 7).

While the majority of recruits did not yield visible recession beyond the cemento-enamel junction, 8.7% in the maxilla and 10.5% in the mandible showed recessions to various degrees.

In the buccal maxilla, 14.7% of the first pre-molar, 7.2% of the second pre-molar and 17.4% of the first molar sites showed recession. In the buccal mandible, 15.7% of the first pre-molar, 11% of the second pre-molar and 13% of the first molar sites presented with recessions (Table 2).

Recruits displaying recessions generally showed a tendency for increased PPD (range 3–4 mm) while those without recessions presented with a lower PPD (2–3 mm). Also, 12.9% of the sites with PPD $\geqslant$ 4 mm displayed recession and only 2.2% of the sites with PPD $\geqslant$ 4 mm displayed

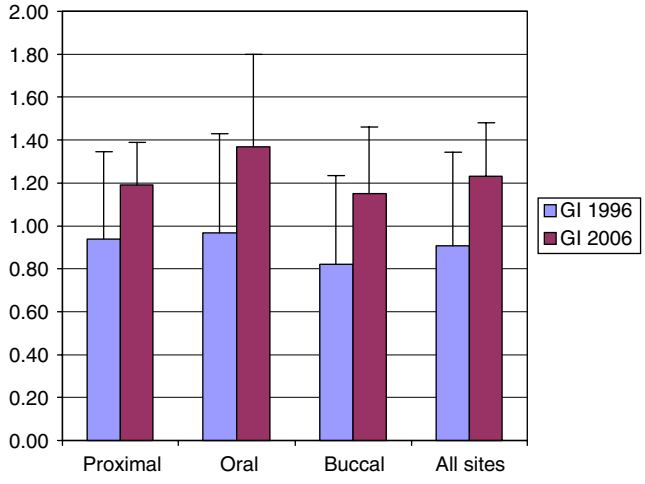

Fig. 3. Mean gingival indices (GI) (Löe & Silness 1963) for buccal, oral and proximal surfaces as well as for all surfaces comparing 1996–2006.

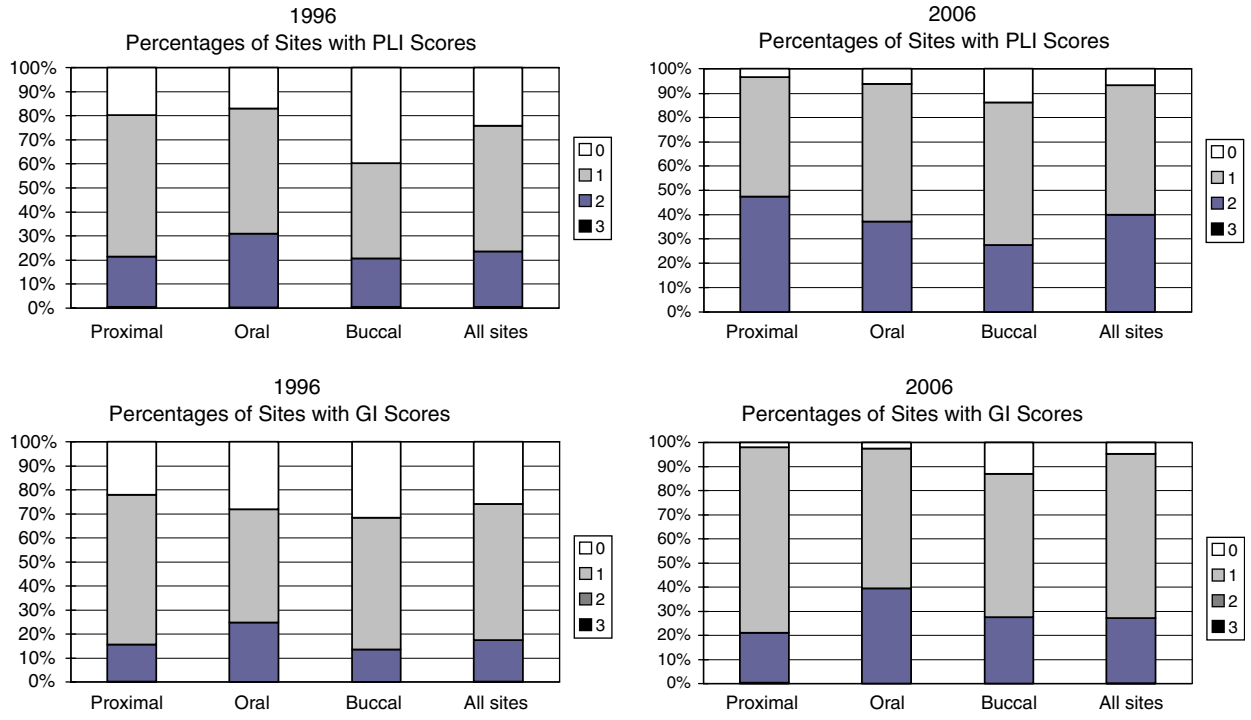

Fig. 4. Percentages of different clinical sites scoring either 0, 1, 2 or 3 stratified for all surfaces and the proximal, oral and buccal surfaces, respectively for PII (top rows) and GI (bottom rows) in 1996 (left column) and 2006 (right column).

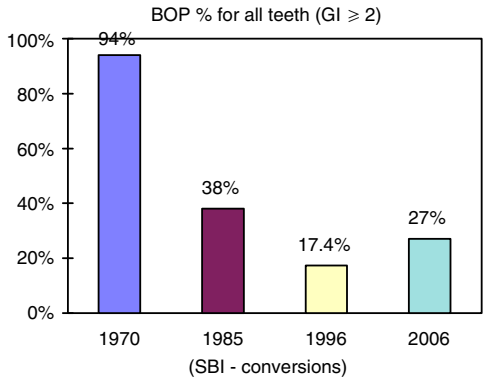

Fig. 5. Comparison of the gingival health or gingivitis results of Swiss Army recruits in the surveys of 1970, 1985, 1996 and 2006. Data from 1970 and 1985 were converted from sulcus bleeding index (SBI; Mühlemann & Son 1971) scores (SBI⩾1) into bleeding on probing (BOP) percentages. Data from 1996 and 2006 were converted from Gingival Index (GI; Löe & Silness 1963) scores (GI⩾2) to BOP percentages.

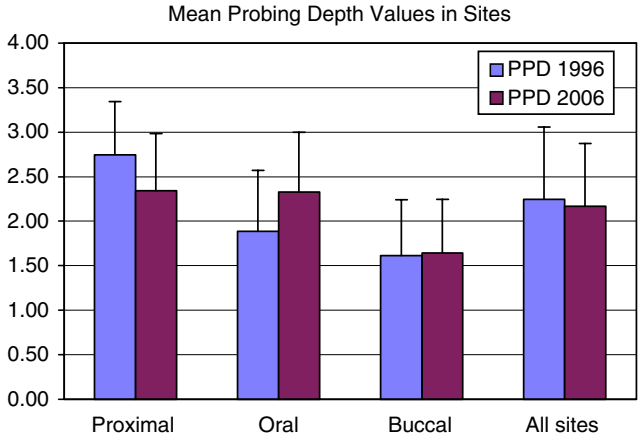

Fig. 6. Mean pocket probing depths (PPDs) in millimeter for all surfaces as well as proximal, oral and buccal surfaces, respectively comparing 1996–2006.

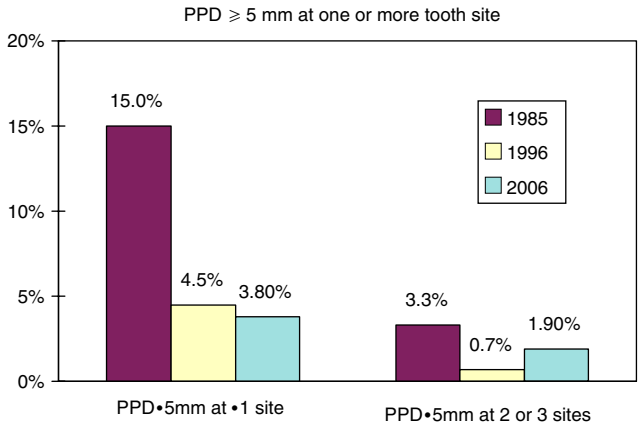

Fig. 7. Comparison of the prevalence of pocket probing depths (PPDs) of 5 mm or more in the surveys of 1985, 1996 and 2006.

no recession, while 97.8% without recessions yielded PPD⩽3 mm and 87.1% displaying recessions yielded PPD⩽3 mm.

Discussion

The present survey was the fourth evaluation of a young Swiss male population performed at a military base in the course of 34 years (Curilović et al. 1972, Saxer et al. 1972, Germann et al. 1973, Lang et al. 1988, 1998, Joss et al. 1992). The comparison of the socioeconomic and geographical background of the 1985, 1996 and 2006 surveys yielded great similarities and hence the present study may be considered as a truly representative survey for the young adult male Swiss population in 2006.

On the other hand, the fact that the clinical parameters assessed in 1970 differed substantially from those used in the evaluation of 1985, 1996 and 2006 renders a direct comparison of the four surveys difficult. The present report, therefore, did not consider the results of the 1970 survey in detail.

In 1985, the sulcus bleeding index (SBI) (Mühlemann & Son 1971) was used as a leading index for the assessment of gingivitis, while in the study of 1996 and in the present study, the criteria of the GI (Löe & Silness 1963) were used. The latter also allowed direct conversion of GI scores of 2 or 3 into BOP-positive sites. However, in converting the SBI into BOP%, the values of SBI⩾1 have to be scored as BOP-positive. When comparing the surveys with converted SBI scores for BOP in 1970 and 1985 to the BOP % in 1996 and 2006, a dramatic decrease from 94% (1970) to 38% (1985) to 17.4% in 1996 could be demonstrated. Then, from 1996 to 2006, an increase of about 10% was noted. This increase of BOP% may represent a true modest deterioration in gingival health in the last decade indicating less prophylactically oriented young male adults compared with adults 10 years back. It has to be realized that the socioeconomic levels may have been affected by immigrants that were not yet actively drafted in 1996. Hence, a higher proportion of previously immigrants became Swiss citizens and were drafted in 2006 than it was a decade ago. Moreover, inter-examiner variability has to be considered since the examiners of the 1996 and 2006 surveys were not identical.

However, when the mean PlIs of 1996 are compared with those of 2006, an increase of 34% was noted. For this parameter, the same calibrated examiner assessed the oral hygiene conditions in the two surveys. It seems unlikely that an increase of 34% from 1996 to 2006 could only be explained on the basis of intra-examiner variability. This, in turn, means that a slight deterioration in oral

Table 2. Proportion (%) of gingival recessions of either 1 mm or 2 or more mm for all buccal aspects of all teeth in the maxilla (upper rows) and mandible (lower rows)

Total recession	1.8	5.1	8.7	14.7	7.2	17.4	6.4	8.7
Recession ⩾ 2 mm	0.1	0.2	1.0	2.6	0.8	2.4	0.4	1.0
Recession 1 mm	1.7	4.9	7.7	12.1	6.4	15.0	6.0	7.7
No recession	98.2	94.9	91.3	85.3	92.8	82.6	93.6	91.3
Tooth#	1	2	3	4	5	6	7	Total
No recession	88.5	93.5	92.0	84.3	89.0	87.0	95.0	89.5
Recession 1 mm	10.7	5.8	7.4	14.1	9.6	12.3	5.0	9.6
Recession ⩾ 2 mm	0.8	0.7	0.6	1.6	1.4	0.7	0	0.9
Total recession	11.5	6.5	8.0	15.7	11.0	13.0	5.0	10.5

health has been encountered at the end of the last century in Swiss Army recruits. Such a change is also reflected in the fact that the proportion of recruits with two or three sites with PPD ⩾ 5 mm increased from 0.7% in 1996 to 1.9% in 2006. This means that relatively few recruits yield early signs of periodontitis. In 1996, only one recruit was diagnosed with aggressive periodontitis. In 2006, however, no such diagnosis could be established. In the light of the fact that aggressive periodontitis affects approximately one patient in 1000 in Switzerland (Kronauer et al. 1986), one certainly would not expect more than one recruit in the entire survey to yield this diagnosis. In comparison with another recent survey of recruits aged 19.6 years of the Israeli Army, 5.9% were diagnosed with aggressive periodontitis (Levin et al. 2006). At least one site with PPD ⩾ 5 mm was found in 20.1% of the Israeli recruits. In the present study, however, the corresponding proportion was 3.8%, indicating a substantially lower prevalence of both aggressive and chronic periodontitis in the Swiss recruits. The dramatic difference between the two populations may be attributed to the fact that a higher proportion of recruits were of North African ethnicity (28.9%) that traditionally displays a 15.1–24. 6-times higher susceptibility for aggressive periodontitis than do Caucasians (Löe & Brown 1991). In the present study, approximately 1% were of African ethnicity.

Even though the mean PlI were significantly higher in the German-speaking compared with the French-/Italian-speaking recruits, the mean GI did not differ between the two ethnic groups, indicating that the significant difference may not be clinically relevant. On the other hand, both PlI and GI were higher in recruits of lower educational level than in recruits with ongoing higher education in addition to the 9 mandatory years of high school and university students. Also, the latter groups had fewer smokers than the groups with lower educational background.

These observations are in agreement with numerous surveys (Ross 1984, Norderyd & Hugoson 1998, Ide et al. 2002, Nicolau et al. 2005, Millar & Locker 2007) and indicate that the susceptibility to periodontitis may be affected by environmental and socioeconiomic factors that are already present at a young age.

Non-smokers indicated a high degree of satisfaction with their oral health and functionality of the dentition, while smokers were less satisfied. It may be speculated that non-smokers generally are more dental-minded than smokers.

Because of the slow progressive and chronic nature of periodontitis (Papapanou & Wennström 1990), it is unlikely that 20-year-old recruits would be diagnosed with fully developed disease. The signs may be inconspicuous and localized. In the present study, only a small proportion of recruits presented with initial lesions that most likely will develop into chronic periodontitis. In comparison with the random survey of the Swiss population at the turn of the century, the PlI and GI of the recruits were substantially higher in the recruits than in the average 20-year-old population (PlI: 0.72; GI: 1.17) (Schürch & Lang 2004). It has to be kept in mind, however, that females consistently yielded than males, a fact that may help explain the discrepancies. Another population study in Sweden (Hugoson et al. 1998) also revealed an increase in plaque and gingivitis scores in the last decade of a 30-year triple cross-sectional study indicating a levelling-off of the preventive efforts of the 1970s. Likewise, the increase in PlI and GI encountered in the present survey should be taken as a new challenge for reiterating preventive programmes both on a population as well as on individual bases (Hugoson et al. 1998). Owing to the fact that plaque accumulations in the interproximal areas deteriorated significantly from the situation in 1996, the use of interproximal cleansing devices especially has to be promoted.

Smoking habits were clearly associated with the educational levels of the recruits. This is in agreement with similar clinical studies in other countries (e.g. Millar & Locker 2007). According to the Swiss Federal Office of Health (Keller et al. 2006), the proportion of smokers in male adolescents (14–19 years) corresponds to 27%. In the present survey, the proportion of smokers was 32%, indicating a substantial increase of the young male smokers in Switzerland. This results in a prevalence of male smokers of 48% between age 20 and 24 years (Keller et al. 2006). It is to be anticipated that the upward trend in smoking prevalence starts around the time of military training, and hence, special efforts have to be made to act against such development.

Recession was a finding in approximately 15% of the recruits. Considering the fact that only visual recession beyond the cemento-enamel junction was assessed, this percentage may underestimate the true prevalence of recessions. Generally, the buccal aspects of the first premolars and first molars were most frequently affected, but also the buccal aspects of the second premolars and the canines were affected. As opposed to the buccal aspects of the anterior maxilla, the buccal aspects of the anterior mandible yielded a remarkable proportion of recessions. It was evident that recessions were especially developed in areas with very thin buccal bony plates and small amounts of gingiva (Lang & Löe 1972). These findings are in agreement with those obtained from a young male population in Oslo, Norway (Heitz-Mayfield et al. 2003). However, it has to be realized that recessions of the magnitude observed in the present study do not necessarily progress, but need special attention during daily toothbrushing.

In conclusion, this third cross-sectional survey of Swiss Army recruits documented an improvement in the periodontal conditions of the Swiss male adolescent population between the years 1985 and 1996. However, no further improvement and even a slight deterioration was observed between 1996 and 2006. This, in turn, means

that efforts to promote dental mindedness should be reiterated in the present and future adolescent population.

Acknowledgements

The cooperation of Colonel Kurt Jäger, Chief of the Dental Service of the Army (ZDA), and the technical support of the Pharmacy of the Army are greatly appreciated. Special thanks are due to the officers, subofficers and recruits of the Recruit Schools Pz Trp RS 21–2 (Pz Stabskp, Aufkl Kp, Pz Kp, Pz Gren Bes Kp, Pz Gren Gef Kp, Pz Sap Kp).

Many thanks are due to the Surgeon General of the Swiss Army, Div. Gianpiero Lupi.

References

Curilović, Z., Renggli, H. H., Saxer, U. P. & Germann, M. A. (1972) The condition of the periodontium in a group of Swiss recruits. *Schweizerische Monatsschrift für Zahnheilkunde* **82**, 437–451.

Germann, M. A., Curilović, Z., Saxer, U. P. & Renggli, H. H. (1973) Periodontal condition of a group of Swiss Army recruits. *Schweizerische Monatsschrift für Zahnheilkunde* **83**, 1220–1229.

Glavind, L. & Löe, H. (1967) Errors in the clinical assessment of periodontal destruction. *Journal of Periodontal Research* **2**, 180–184.

Heitz-Mayfield, L. J., Schläatzle, M., Löe, H., Burgin, W., Anerud, A., Boysen, H. & Lang, N. P. (2003) Clinical course of chronic periodontitis. II. Incidence, characteristics and time of occurrence of the initial periodontal lesion. *Journal of Clinical Periodontology* **30**, 902–908.

Hugoson, A., Norderyd, O., Slotte, C. & Thorstensson, H. (1998) Oral hygiene and gingivitis in a Swedish adult population 1973, 1983 and 1993. *Journal of Clinical Periodontology* **25**, 807–812.

Ide, R., Mizoue, T., Ueno, K., Fujino, Y. & Yoshimura, T. (2002) Relationship between cigarette smoking and oral health status. *Sangyô eiseigaku zasshi or Journal of Occupational Health* **44**, 6–11.

Ingervall, B., Gebauer, U., Thuer, U. & Bürgin, W. (1987) Malocclusions in Swiss recruits in 198. *Schweizerische Monatsschrift für Zahnmedizin* **97**, 1366–1373.

Jenni, M., Schürch, E. Jr. & Geering, A. H. (1987) Symptoms of functional disorders in the masticatory system – an epidemiological study. *Schweizerische Monatsschrift für Zahnmedizin* **97**, 1357–1365.

Joss, A., Weber, H. P., Gerber, C., Siegrist, B., Curilović, Z., Saxer, U. P. & Lang, N. P. (1992) Periodontal conditions in Swiss Army recruits. *Schweizerische Monatsschrift für Zahnmedizin* **102**, 541–548.

Keller, R., Krebs, H. & Hornung, R. (2006) Der Tabakkonsum der Schweizer Wohnbevölkerung in den Jahren 2001 bis 2005. Tabakmonitoring – Schweizerische Umfrage zum Tabakkonsum. Im Auftrag des Bundesamtes für Gesundheit, Gesundheitspolitik, Fachstelle Tabakpräventionsfonds. Zürich: Psychological Institute of the der University of Zürich, Social – and health psychology.

Kronauer, E., Borsa, G. & Lang, N. P. (1986) Prevalence of incipient juvenile periodontitis at age 16 years in Switzerland. *Journal of Clinical Periodontology* **13**, 103–108.

Lang, N. P., Joss, A., Saxer, C., Wallkamm, B., Brägger, U., Schürch, E., Hofer, D., Schmid, B., Luterbacher, S., Etter, T., Christensen, M. & Attström, R. (1998) Periodontal conditions of Swiss Army recruits – positive effects of prevention-oriented dentistry. *Acta Medicinae Dentium Helvetica* **3**, 81–86.

Lang, N. P., Kaarup-Hansen, D., Joss, A., Siegrist, B., Weber, H. P., Gerber, C., Saxer, U. P. & Curilović, Z. (1988) The significance of overhanging filling margins for the health status of interdental periodontal tissues of young adults. *Schweizerische Monatsschrift für Zahnmedizin* **98**, 725–730.

Lang, N. P. & Löe, H. (1972) The relationship between the width of keratinized gingiva and gingival health. *Journal of Periodontology* **43**, 623–627.

Levin, L., Baev, V., Lev, R., Stabholz, A. & Ashkenazi, M. (2006) Aggressive periodontitis among young Israeli army personnel. *Journal of Periodontology* **77**, 1392–1396.

Löe, H. & Brown, L. J. (1991) Early onset periodontitis in the United States of America. *Journal of Periodontology* **62**, 608–616.

Löe, H. & Silness, J. (1963) Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontologica Scandinavica* **21**, 533–551.

Menghini, G. D., Marthaler, T. M., Steiner, M., Bandi, A. & Schürch, E. (1991) Kariesprävalenz und gingivale Verhätlnisse bei Rekruten im Jahre 1985. Einfluss der Vorbeugung. *Schweizerische Monatsschrift für Zahnmedizin* **101**, 1119–1126.

Millar, W. J. & Locker, D. (2007) Smoking and oral health status. *Journal of the Canadian Dental Association* **73**, 155.

Mühlemann, H. R. & Son, S. (1971) Gingival sulcus bleeding – a leading symptom in initial gingivitis. *Helvetica Odontologica Acta* **15**, 107–113.

Nicolau, B., Marcenes, W., Bartley, M. & Sheiham, A. (2005) Associations between socio-economic circumstances at two stages of life and adolescents' oral health status. *Journal of Public Health Dentistry* **65**, 14–20.

Norderyd, O. & Hugoson, A. (1998) Risk of severe periodontal disease in a Swedish adult population. A cross-sectional study. *Journal of Clinical Periodontology* **25**, 1022–1028.

Papapanou, P. N. & Wennström, J. L. (1990) A 10-year retrospective study of periodontal disease progression. Clinical characteristics of subjects with pronounced and minimal disease development. *Journal of Clinical Periodontology* **17**, 78–84.

Ramel, U. (1976) Symptome sogenannter Kiefergelenksbeschwerden bei einer Gruppe Schweizer Rekruten. Med. Dissertation, University of Bern.

Ross, C. B. (1984) Oral health status and tradition in New Zealand. *International Dental Journal* **34**, 266–270.

Saxer, U. P., Curilović, Z., Germann, M. A. & Renggli, H. H. (1972) Habits of oral hygiene in a group of Swiss recruits. *Schweizerische Monatsschrift für Zahnheilkunde* **82**, 1090–1099.

Schürch, E. Jr. & Lang, N. P. (2004) Periodontal conditions in Switzerland at the end of the 20th century. *Oral Health and Preventive Dentistry* **2**, 359–368.

Silness, J. & Löe, H. (1964) Periodontal disease in pregnancy. II Correlation between oral hygiene and periodontal conditions. *Acta Odontologica Scandinavica* **22**, 121–135.

Swiss Federal Statistical Office (SFSO) (2006) Espace de l'Europe 10, CH-2010 Neuchâtel, http://www.bfs.admin.ch/bfs/portal/en/index.html

Address:
Niklaus P. Lang
School of Dental Medicine
University of Bern
Freiburgstrasse 7
CH-3010 Bern
Switzerland
E-mail: perio@zmk.unibe.ch

Clinical Relevance

Scientific rationale for the study: Oral health studies in Army recruits reflect the status of health or disease in a representative young male population for a given country. Even in cross-sectional studies, conclusions on the trends in oral health may be made if intervals between examinations are substantial.

Principal findings: This study reports on the latest Swiss Army recruit survey and compares the findings with results 10 and 20 years back. It is evident that major improvements in gingival and periodontal conditions occurred between 1985 and 1996, while in the last 10 years, little improvement has been noticed.

Practical implications: The study documented the need for further preventive efforts during adolescence.