Swedish Dental Journal

Scientific Journal of The Swedish Dental Association

Treatment of smarting symptoms in the oral mucosa by appliance of lingual acrylic splints

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No. 4/08
Vol.32 Pages 157-204

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Swedish Dental Journal

Scientific journal
of the Swedish Dental Association
and the Swedish Dental Society
ISSN: 0347-9994

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Printing office
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Introduction

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Relationship between smoking and periodontal probing pocket depth profile

LOTTIE ADLER, CAROLINA MODIN, JOHAN FRISKOPP, LEIF JANSSON

Abstract

◎ The purpose of the present study was to investigate if the periodontal probing pocket depth profile differs significantly between smokers and non-smokers as well as within the smoking group.

Subjects born 1940-1943 were collected from a computer database at a specialist clinic of periodontology. The patients included consisted of 293 individuals between 57 and 64 years of age examined by nine periodontists. The periodontal probing depth at site level, age, gender and smoking habits were collected from the database. Former smokers and patients with an uncertain history of smoking habits were excluded. The smokers were stratified into three groups according to the daily consumption of cigarettes (1-10 cig/day, 11-20 cig/day, >20 cig/day). The relative frequencies of periodontal probing pocket depths of 4-5 mm and ≥ 6 mm were calculated and these two categories were used in the analyses. The partial correlation coefficients between smoking and the percentage share of periodontal pocket depths in different tooth regions were calculated by using multiple regression analyses.

The smokers had significantly deeper periodontal pockets compared to the non-smokers. The correlation between smoking and the percentage share of palatal periodontal pockets ≥ 6 mm was significant. The percentage share of palatal pockets ≥ 6 mm was significantly increased for subjects who smoked >20 cigarettes per day (25 %) compared to non-smokers as well as compared to subjects with a daily consumption of 1-20 cigarettes per day. This difference was significant within all tooth groups in the upper jaw.

The results support the hypothesis that smoking has a local effect on periodontal pocket depth beside the systemic effect.

Key words

Smoking, risk factor, periodontal probing pocket depth, periodontitis, retrospective study

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Samband mellan fickdjupsprofil och rökning

LOTTIE ADLER, CAROLINA MODIN, JOHAN FRISKOPP, LEIF JANSSON

Sammanfattning

◉ Syftet med denna studie var att undersöka om fickdjupsprofilen skiljer sig signifikant mellan rökare och icke-rökare och om skillnader även kan påvisas bland rökare beroende på rökningens omfattning.

Materialet bestod av individer från en journaldatabas på en specialistklinik i parodontologi. De inkluderade patienterna utgjorde 293 individer i åldersintervallet 57-64 år. Variablerna sonderingsdjup på ytnivå, ålder, kön och rökvanor hämtades från databasen. Tidigare rökare och de fall där journaluppgifterna om rökvanor var ofullständiga uteslöts ur studien. Rökarna delades in i tre grupper med avseende på genomsnittlig daglig cigarettkonsumtion (1-10 cigaretter per dag, 11-20 cigaretter per dag, >20 cigaretter per dag). De procentuella andelarna fickdjup 4-5 mm och ≥ 6 mm beräknades och dessa två kategorier användes i analyserna. De partiella korrelationskoefficienterna mellan rökning och fickdjupsprofil i olika tandregioner beräknades med multipel regressionsanalys.

Rökare hade signifikant djupare fickor i jämförelse med icke rökare. Rökning var signifikant korrelerad till andelen palatinalytor med sonderingsdjup ≥ 6 mm. Den procentuella andelen palatinalytor med sonderingsdjup ≥ 6 mm var också signifikant högre hos individer som rökte >20 cigaretter per dag i jämförelse med icke rökare och individer med en daglig konsumtion av 1-20 cigaretter per dag. Denna skillnad var signifikant inom alla tandgrupper i överkäken.

Resultaten stöder hypotesen att rökning har en lokal effekt på fickdjupet utöver en systemeffekt i en parodontitbenägen population.

Introduction

Several longitudinal studies during the last 20 years have evaluated the influence of smoking on periodontitis progression (5, 6, 7, 10, 11, 15). These studies, representing different populations, have shown a significant relationship between smoking and periodontitis progression. Smoking is regarded as an established risk factor of periodontal disease (16) with risk estimates between 1.4 and 11.8 (3). The harmful impact of cigarette smoking on periodontal status appears to increase with increased daily consumption of tobacco (11, 12) and smoking life time exposure (5). The relative risk of periodontal disease among heavy smokers is estimated between 9.8 and 20.3 (3).

Several studies indicate that current smokers have significantly higher mean periodontal pocket depths and more sites with deep periodontal pockets compared to non-smokers (12). The pocket depth, attachment and bone loss profiles differ between smokers and non-smokers (12). The largest differences between smokers and non-smokers according to periodontal pocket depth were found on the palatal sites especially in the anterior and premolar region (1, 2, 8, 9, 18, 19) and in the anterior region in the lower jaw (8). The difference according to proportion of sites with bone loss ≥ 4.5 mm was found to be greatest in the upper anterior region (2). These reports have suggested that the results indicate a local effect of smoking in addition to a systemic effect.

The purpose of the present study was to investigate if the periodontal probing pocket depth profile differs significantly between current smokers and non-smokers as well as within the smoking group in order to test the hypothesis of a local effect of smoking.

Material and methods

The investigation was conducted as a retrospective study on a consecutive referral population at the Department of Periodontology at Kista, Public Dental Service, Stockholm County Council. Subjects born 1940-1943 were collected from a computer database. Former smokers and patients with an uncertain history of smoking habits were excluded. The patients included consisted of 293 individuals between 57 and 64 years of age examined by nine periodontists. The frequencies of examined patients were not equally distributed among the examiners. The subjects had been referred by general dentists or dental hygienists because of periodontal disease. The periodontal probing pocket depths at site level, gender and smoking habits were collected from the dental records in the database. The daily consumption of cigarettes was divided into three groups in the health questionnaire (1-10, 11-20 or >20 cigarettes per day). The probing pocket depth registrations were performed by nine periodontists at the baseline examination using graded probes (Hu-Friedy XP 23/11, Immunity, Chicago IL., USA). The pocket depths were registered on the mesial, buccal, distal and lingual tooth surfaces.

Statistical analysis:

The descriptive statistics and statistical analyses were performed using the statistical package SPSS (PC+ 4.0, SPSS, INC., Chicago, IL). The statistical computational unit was at subject level. The smokers were stratified into three groups according to the daily consumption of cigarettes (1-10 cig/day, 11-20 cig/day, >20 cig/day). The relative frequencies of periodontal probing pocket depths of 4-5 mm and ≥ 6 mm were calculated and these two categories were used in the analyses. Oneway variance analyses were performed in order to study differences according to number of teeth and periodontal pocket depths between groups according to smoking habits. The partial correlation coefficients between smoking and the percentage share of periodontal pocket depth in different tooth regions were calculated by using multiple regression analyses with the general percentage share of periodontal pockets ≥ 6 mm included as an independent variable. Results were considered statistically significant at $p<0.05$.

Results

The sample consisted of 293 individuals (52 % males, 48% females) with a mean age of 60.1 years (range 57-64) at the baseline clinical examination. The distributions according to smoking habits and number of remaining teeth are presented in Table 1. The number of teeth and the periodontal pocket depth profile was not significantly correlated to gender or age. The relative frequency of non-smokers was 53% and 16% of the sample declared that they smoked more than 20 cigarettes per day. The smokers had significantly ($p<0.03$) fewer teeth (Table 1)

Table 1. Distribution according to smoking habits and number of remaining teeth

Daily consumption of cigarettes	n	%	Number of remaining teeth (mean (S.D.))
Non-smokers	155	52.9	24.1 (4.69)
1-10 cig/day	39	13.3	23.0 (4.84)
11-20 cig/day	53	18.1	22.3 (4.53)
>20 cig/day	46	15.7	23.4 (4.16)

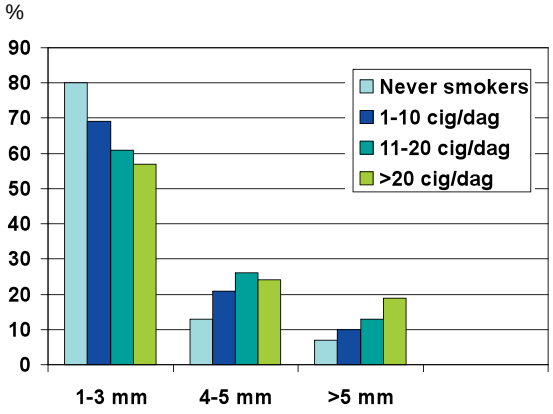

Figure 1. The distribution of periodontal probing pocket depths (%) according to smoking habits.

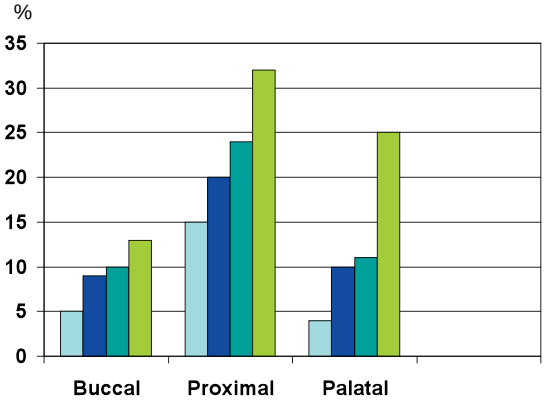

Figure 4. The percentage of periodontal probing pocket depths ≥6 mm in the upper jaw according to smoking habits.

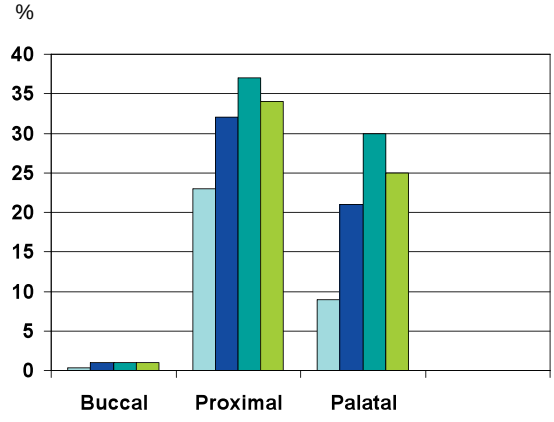

Figure 2. The percentage of periodontal probing pocket depths 4-5 mm in the upper jaw according to smoking habits.

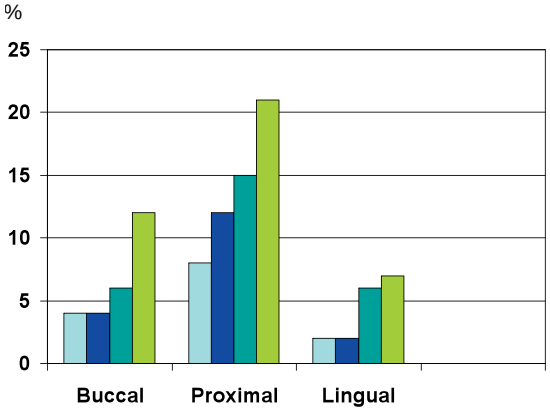

Figure 5. The percentage of periodontal probing pocket depths ≥6 mm in the lower jaw according to smoking habits.

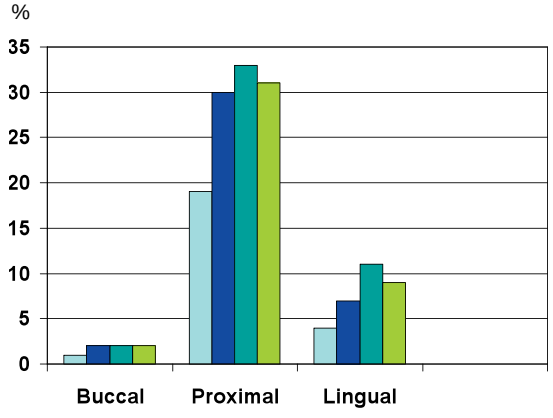

Figure 3. The percentage of periodontal probing pocket depths 4-5 mm in the lower jaw according to smoking habits.

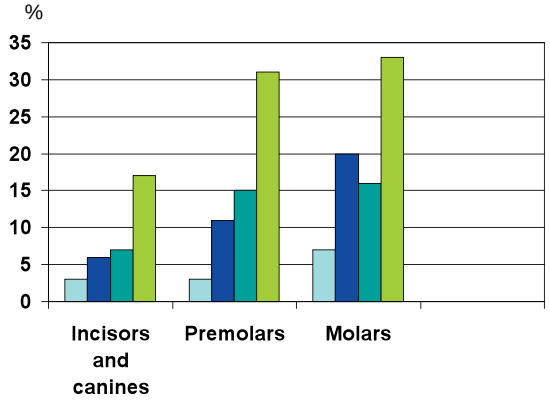

Figure 6. The percentage of periodontal probing pocket depths ≥6 mm at the palatal sites of the upper jaw according to tooth group and smoking habits.

and significantly ($p<0.001$) deeper periodontal probing pockets compared to non-smokers (Fig. 1). The number of remaining teeth did not differ significantly among smokers according to the daily consumption of cigarettes. The percentage of periodontal probing pocket depths of 4-5 mm in smokers were significantly higher ($p<0.01$) in both jaws at buccal, proximal as well as palatal/lingual sites compared to non-smokers (Fig. 2, 3). A significant positive correlation was found between the daily consumption of cigarettes and the percentage of periodontal probing pocket depths >6 mm in the upper jaw ($p<0.001$, Fig. 4) as well as in the lower jaw ($p<0.01$, Fig. 5). The percentage share of palatal pockets ≥ 6 mm was significantly ($p<0.001$) increased for subjects who smoked >20 cigarettes per day (25 %) compared to non-smokers (4 %) as well as compared to subjects with a daily consumption of 1-20 cigarettes per day (11 %) (Fig. 4). This difference was significant within all tooth groups in the upper jaw (Fig. 6) and the difference did not vary significantly between tooth groups. The partial correlation between smoking and the percentage share of palatal periodontal probing pockets ≥ 6 mm was significant ($p=0.001$) after adjustment for the general percentage share of periodontal pockets ≥ 6 mm, while the partial correlations between smoking and proximal, buccal or lingual periodontal pockets ≥ 6 mm were not found to be significant (Table 2).

Table 2. The partial correlation coefficients between smoking and the relative frequency of periodontal pocket depths > 6 mm (adjusted for the general percentage share of periodontal pockets >6 mm).

Location	r	P
Buccal sites in the upper jaw	0.08	NS
Proximal sites in the upper jaw	-0.04	NS
Palatal sites in the upper jaw	0.12	0.001
Buccal sites in the lower jaw	-0.04	NS
Proximal sites in the lower jaw	-0.02	NS
Lingual sites in the lower jaw	0.01	NS

Discussion

This retrospective case-control study on a referral patient population at a specialist clinic of Periodontology was carried out to determine if the periodontal probing pocket depth profile differs significantly between current smokers and non-smokers. In addition, another purpose was to investigate if the magnitude of the daily consumption of cigarettes influenced the pocket depth profile among smokers. Consequently, we used the groups according to smoking habits in the health questionnaire in order to study the dose effect. A case-control study is usually retrospective and most sources of error due to confounding are more common in retrospective studies. A retrospective study means also that the reliability of periodontal pocket depth measurements is likely to be lower than for a prospective study since the intra- and inter-examiner variability may be expected to be higher. Given these limitations, testing for significant relationships is still possible since a large material can be obtained from the database of the referral pool.

The present results were based on self-reported data of smoking habits. The response outcomes may therefore suffer from inaccuracy. Respondents may under-report the number of cigarettes consumed per day and former smoking habits. This may lead to limitations regarding the validity when interpreting the results in this retrospective study. Former smokers were excluded in order to increase the validity. However, measurements of smoking habits by self-reports has been shown to be a valid method for estimating prevalence of smoking (17).

In the present study, 47% of the patients declared that they were smokers. The magnitude of the frequency is in accordance with two earlier cross-sectional studies on samples from patients referred for periodontal treatment in Stockholm, who reported that 51% of the periodontitis patients were smokers (14, 18). In the study from 1986 (18), 33% of the individuals from a reference material was found to be smokers. In a longitudinal study on the population of the County of Stockholm (11), the prevalence of smokers was reduced from 50% in 1970 to about 30% in 1990, resulting in a considerable number of subjects who stopped smoking during the 20-year period. The number of adults who are smokers in Sweden has further decreased since 1986 and 14% of the men and 19% of the women smoked on a daily basis in 2004 (14). Consequently, the percentages of smokers in the studies on periodontitis patients are considerably higher than in a general population.

In the non-smoking group, the mean number of teeth was found to be 24.1 compared to mean numbers between 22.3 and 23.4 in the smoking strata. This difference was statistically significant. However, within the group of smokers the correlation between number of remaining teeth and the number of cigarettes consumed per day was found to be non-significant. Consequently, in the present study

the effect of smoking on number of teeth was not dose dependent. Tooth loss may be due to different reasons and cross-sectional studies on periodontitis patients show different results according to the relationship between number of remaining teeth and smoking habits. In an earlier study on 289 periodontitis patients ranging in age from 20-86 years (9), the smokers had significantly fewer teeth compared to non-smokers in accordance with the present study, while others report a non-significant difference between smokers and non-smokers concerning the number of remaining teeth (2, 8, 19). However, in these studies the mean age of the patients was considerably lower than the subjects of the present study and an earlier cross-sectional epidemiological study (1) showed that the significance of smoking on tooth loss increased with increasing age.

The percentage share of palatal pockets ≥ 6 mm was significantly increased for subjects who smoked >20 cigarettes per day compared to non-smokers as well as compared to subjects with a daily consumption of 1-20 cigarettes per day. Thus, the periodontal pocket depth profile was found to be exposure dependent among smokers with a significantly stronger local effect on palatal surfaces for heavy smokers.

The positive correlation between smoking and the percentage share of palatal periodontal pockets ≥ 6 mm was significant after adjustment for the general percentage share of periodontal pockets ≥ 6 mm, while the relationship between smoking and other surfaces with periodontal pockets ≥ 6 mm was not found to be significant. In an earlier study on periodontitis patients aged between 46 and 60 years (2), similar results was found for pockets ≥ 4 mm in the anterior palatal region. Several other studies on periodontitis patients conclude also that the strongest effect on periodontal pocket depth of smoking was found on palatal surfaces and especially in the anterior region (8, 9, 18, 19). In the present study, no significant difference between anterior, premolar or molar regions could be found.

The detrimental effect of cigarette smoking on periodontal tissues has been shown to be dose dependent (4). In addition, results of earlier studies have demonstrated that ceasing to smoke may improve periodontal health (4, 5, 11), which strengthens the conclusion that smoking is a true risk factor for periodontitis. In the present study, the sample consisted of a homogenous group in the age interval 57-64 years at the clinical examination. Since the period of major risk for initiation to cigarettes is completed for the most part by age 20 (13), it is likely that the smoking exposure time for a majority of the subjects of the present sample can be expected to be about 40 years.

The life-time smoking exposure can be expressed as the product of the daily consumption of cigarettes and the number of years of smoking (5). In the present study the number of cigarettes consumed per day was registered and the subjects were classified in four groups according to the daily consumption. However, the daily consumption of cigarettes may vary over time and the quantity should be regarded as an approximate measure of the consumption. The duration represents the other aspect of life-time exposure of smoking and can be expected to be high in the present sample. The homogenous age distribution presumably results in differences of no significance between individuals according to duration. The effect of duration of smoking on the periodontal pocket depth profile will be studied in a future study by including a sample of individuals about 20 years younger than the subjects of the present sample.

In conclusion, the periodontal pocket depth profile differed significantly between smokers and non-smokers. Smokers had a significantly deeper palatal periodontal pockets compared to non-smokers within all tooth groups in the upper jaw. In addition, heavy smokers had significantly deeper palatal periodontal pockets compared to the subjects who smoked ≤ 20 cigarettes per day. The results support the hypothesis that smoking has a local effect on periodontal pocket depth beside the systemic effect and that the local effect is dose-dependent. An important task for clinicians is to encourage patients to quit smoking. The local damaging effects of smoking may contribute to motivate the patients to quit smoking and facilitate the understanding of the interactions between smoking and periodontal disease.

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Treatment of smarting symptoms in the oral mucosa by appliance of lingual acrylic splints

TONY AXÉLL

Abstract

◉ The aim of the present study was to evaluate the relieving effect on smarting symptoms in the oral mucosa by the use of lingual acrylic splints. Recruited for the study were 53 persons, 48 women and 5 men, with smarting symptoms in the oral mucosa, not associated with general disease, and with signs of erythema, most often on the apex of the tongue, and/or crenated tongue. Symptoms were registered from the tongue in 49 cases, the palate in 28 cases and the lips in 15 cases. A lingual acrylic splint was applied in the lower jaw behind the front teeth, not covering the occlusal surfaces and it was kept in the mouth day and night. At an average the splint was used in 8 months. A group of 10 women was recruited for comparison. These women were just instructed to avoid tongue pressing for at least a two month period. All patients were asked whether the treatment affected the symptoms and they registered their opinion on a 100 mm VAS line with end effect points "not helped at all/deteriorated" and "now completely without symptoms". On the question whether the treatment had affected the symptoms, the average result was 55 mm and median value 64 mm. The treatment results were somewhat better among those with moderate initial symptoms compared to those with severe symptoms. Interestingly, in the group for comparison, symptom VAS values improved significantly from 60 to 41 mm ($P<0.05$).

Conclusion: Treatment of smarting symptoms in the oral mucosa may to a great extent be relieved by the application of an acrylic lingual splint. However, before using this splint method, an effort should be made to make the patient actively avoid tongue pressure.

Key words

Burning mouth syndrome, glossitis, lingual splint, smarting symptoms

Maxillofacial Unit, Halmstad Hospital, Halmstad, Sweden

Behandling av sveda i munslemhinnan med hjälp av lingvala akrylatplattor

TONY AXÉLL

Sammanfattning

◉ Syftet med föreliggande studie var att värdera den symptomlindrande effekten på sveda från munslemhinnan med hjälp av lingvalplattor av akrylat. I studien deltog 53 personer, 48 kvinnor och 5 män som alla upplevde sveda från munslemhinnan. Symptomen kunde inte relateras till allmänsjukdom och individerna uppvisade rodnad, oftast på tungspetsen, och/eller impressioner i tungan. Symptom registrerades från tungan i 49 fall, gommen i 28 fall och läpparna i 15 fall. En akrylatplatta i underkäksfronten, som inte täckte ocklusalytorna, framställdes och bars dygnet runt, i genomsnitt 8 månader. En kontrollgrupp på 10 personer med liknande symptom instruerades att undvika tungpressning under en två-månaders-period. Efter behandlingsperioden tillfrågades individerna huruvida behandlingen hade påverkat symptomen, något som registrerades på en 100 mm visuell analog skala (VAS). I försöksgruppen med lingvalplatta var genomsnittsresultatet 55 mm och medianvärdet 64 mm. Behandlingsresultatet var något bättre i gruppen med moderata jämfört med svårartade initiala symptom. Intressant var att notera att kontrollgruppens VAS-värden förbättrats från 60 till 41 mm ($P<0.05$).

Konklusion: Sveda från munslemhinnan kan i påtaglig grad lindras med hjälp av en lingval akrylatplatta. Innan en sådan behandling ges bör man emellertid avvakta resultatet av att låta patienten försöka undvika tungpressning.

Introduction

The prevalence of unspecified glossitis and atrophy of tongue papillae in an adult population, if geographic tongue and median rhomboid glossitis are excluded, is about 3% (2). Smarting symptoms from the oral mucosa is an annoying complaint and it has frequently been attributed to the condition of Burning mouth syndrome (BMS), often including a neuropathic trait (4) or psychological components such as anxiety, depression or cancerophobia (7). From a review by *van der Waal* (10) can be cited "The so-called 'burning-mouth syndrome' (BMS) is a fairly rare but extremely unpleasant condition characterised by a bilateral burning sensation of the oral mucosa in the absence of clinically visible mucosal changes. Frequently,associated symptoms include dry mouth and loss or change of taste. The aetiology is unknown, even though most of the literature focuses on the role of a possible underlying psychogenic disorder". However, several symptoms similar to BMS are accompanied by clinical signs and should then not be classified as BMS.

Symptoms related to oral mucosal signs have been reported in the literature and then most often associated with nutrition deficiency (3, 6). Prevailing symptoms, such as redness or erythema at the tip of the tongue (Fig.1) and/or crenated tongue (Fig. 2) should exclude a diagnosis of BMS. Instead, these symptoms should most probably be related to or caused by hyperactivity of the tongue.

Figure 1. Erythematous tip of the tongue caused by tongue pressing

Figure 2. Crenated tongue caused by tongue pressing

Treatment of these symptoms, and then most often related to BMS, has included an array of attempts including use of various pharmacological entities (5), though most often without sustaining positive results.

The aim of the present study was to evaluate the relieving effect on smarting symptoms in the oral mucosa, especially from the tongue, by the use of a lingual acrylic splint.

Material and methods

Recruited for the study were 53 consecutive patients, 48 women and 5 men, referred to the Maxillofacial Unit in Halmstad, Sweden (43 patients) and a private clinic in Oslo, Norway (10 patients). All of them experienced smarting symptoms from the oral mucosa. Symptoms were not associated with general disease such as e.g. nutritional deficiencies All patients showed signs of erythema, most often on the apex of the tongue (Fig. 1), and/or crenated tongue (Fig. 2). Mean age was 60.4 ± 13.9 years, range 23-86 years. Symptoms were registered from the tongue in 49 cases, the palate in 28 cases and the lips in 15 cases. They were registered on a 100 mm VAS line, where 0 mm indicated no symptoms at all and 100 mm severe/unendurable symptoms. Average initial symptoms were 63.9±23.0 mm, median 66 mm, range 4-100 mm. Average duration of symptoms was 39 months, range 1-228 months. A lingual acrylic splint was applied behind the front teeth and premolars in the lower jaw not covering the occlusal surfaces (Fig. 3a-3d). It was kept in the mouth day and night. At application of the splint the person was

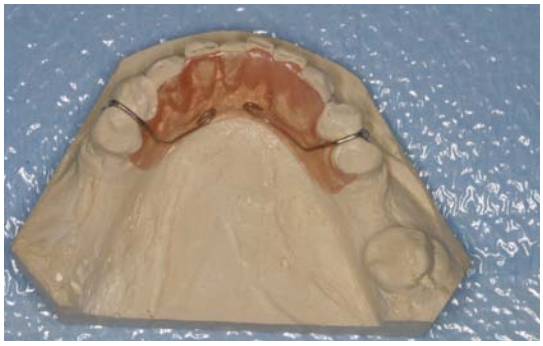

Figure 3a. Lingual acrylic splint on plaster model. Photo Ann Ljungman

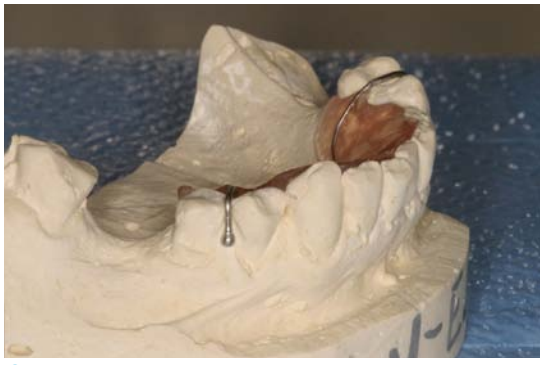

Figure 3b. Lingual acrylic splint on plaster model. Photo Ann Ljungman

Figure 3c. Lingual acrylic splint in place. Photo Ann Ljungman

Figure 3d. Detailed picture of retention clamp

asked to apply a saliva substitute as an additional aid avoiding friction. The patients were instructed to remove the splint when eating. At an average the splint was used during 8 months. A group of 10 women for comparison was recruited from the Maxillofacial Unit, Halmstad, Sweden. Their mean age was 64.2 ± 6.6 years. Average symptoms registered on a 100 mm VAS line, where 0 mm indicated no symptoms at all and 100 mm severe/unendurable symptoms, were 60±26.3 mm, median 56 mm, range 30-94 mm.These women had similar symptoms and signs as the study group patients and they were instructed just to avoid tongue pressing for at least a two month period.

Statistical analyses

Differences between groups were calculated by one- and two-sided Student *t*-tests.

Results

A calculated mean VAS value after treatment was 30.1±25.2, range 1-96 mm, median 23 mm*. *(* direct VAS values were not registered after treatment but calculated according to the formula a-ax(b/100), where a=initial VAS value and b=VAS value for estimation of treatment effect.)* This is averagely a statistically significant improvement as compared to initial VAS values (P<0.001). The patients were asked whether the treatment had affected the symptoms and they registered their opinion on a 100 mm VAS line with end effect points "not helped at all/deteriorated" and "now completely without symptoms". Mean value was 54±30.3 mm, range 3-98 mm, median 64 mm and third quartile value 77 mm. On the question whether the treatment had affected daily life and with end effect points "not at all/deteriorated" and "affected extremely positively" the mean value was 55±32.3 mm, range 0-100 mm, median 61 mm and third quartile value 81 mm. The treatment results were somewhat better among those with moderate initial symptoms compared to those with severe symptoms. On the question whether the treatment had affected the symptoms, the results in these two groups were: mean values 58 mm and 49 mm, respectively and median values 70 mm and 52 mm, respectively. Interestingly, in the group for comparison, symptom VAS values improved significantly from 60±21.6 to 41±26.4 mm (P<0.05).

Discussion

Smarting symptoms from the oral mucosa and then especially from the tongue and lips may to a great

extent affect daily quality of life. Among participants in the present study, symptoms had for many of them been present for months and even many years. They had not been subject to attempts using any therapeutic remedies since such remedies were not known about or not considered worth while to use. Included in the group treated with lingual splints were only patients where systemic associated disease or nutrition deficiency had been excluded. Further, daily use of medicines was very limited. Neither were any diagnoses such as geographic tongue or median rhomboid glossitis present.

Persons seeking treatment for smarting symptoms also frequently complained of dry mouth, a condition probably contributing to their symptoms. Therefore, a saliva substitute containing sunflower oil was given in order to reduce friction between mucosa and teeth/splints.

Treatment results ranged from none effect at all to complete relief of symptoms. Notably, the third quartile positive effect was 77 mm on a 100 mm visual analogue scale and third quartile positive effect on daily quality of life 81 mm. These results are encouraging since there are only few alternatives to offer these patients. In case of sustained symptoms from the palate a palatal plate similar to the lingual one may be considered.

As an alternative to using lingual splints, as in the present study, stabilisation splints often used for treating pain dysfunction syndrome or myofacial pain dysfunction, could have been tried (1). Thus, occlusal appliances seem to be more effective in the treatment of e.g. temporomandibular disorder than information and relaxation therapy (9). However, the lingual splint is less complicated and less expensive to produce and, above all, it is more feasible from a daily life point of view, since it can easily be used at daytime without disturbing work or social life.

In the present study, cognitive relaxation though seemed to give relief. Relaxation training has previously shown useful e.g. in cancer patients (8). In the present study the patients in the group for comparison were asked to avoid pressing the tongue towards the teeth. They were further asked to train this by exercises using the letter "n" as often as posible.

In conclusion, treatment of smarting oral mucosal symptoms, especially from the tongue, may to a significant extent be relieved by the application of an acrylic lingual splint. However, before using this splint method an effort should be made to make the patient actively avoid tongue pressing.

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Impaired jaw function and eating difficulties in Whiplash-associated disorders

JOHAN GRÖNQVIST, BIRGITTA HÄGGMAN-HENRIKSON, PER-OLOF ERIKSSON.

Abstract

◉ Eating requires mouth opening, biting, chewing and swallowing and should be performed without dysfunction or pain. Previous studies have shown that jaw opening-closing movements are the result of coordinated activation of both jaw and neck muscles, with simultaneous movements in the temporomandibular, atlanto-occipital and cervical spine joints. Consequently, it can be assumed that pain or dysfunction in any of the three joint systems involved could impair jaw activities. In fact, recent findings support this hypothesis by showing an association between neck injury and reduced amplitudes, speed and coordination of integrated jaw-neck movements. This study investigated the possible association between neck injury and disturbed eating behaviour. Fifty Whiplash-associated disorders (WAD) patients with pain and dysfunction in the jaw-face region and 50 healthy age- and sex-matched controls without any history of neck injury participated in the study. All participants were assessed by a questionnaire, which contained 26 items about eating behaviour, jaw pain and dysfunction.

For the WAD group there were significant differences in jaw pain and dysfunction and eating behaviour before and after the accident, but no significant differences between WAD before and healthy. The healthy and the WAD group before the accident reported no or few symptoms. The WAD patients after the accident reported pain and dysfunction during mouth opening, biting, chewing, swallowing and yawning and felt fatigue, stiffness and numbness in the jaw-face region. In addition, a majority also reported avoiding tough food and big pieces of food, and taking breaks during meals. Altogether, these observations suggest an association between neck injury and disturbed jaw function and therefore impaired eating behaviour. A clinical implication is that examination of jaw function should be recommended as part of the assessment and rehabilitation of WAD patients.

Key words

Chewing, eating behaviour, jaw, neck, whiplash injuries.

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Ätbesvär och försämrad käkfunktion efter Whiplash skada.

JOHAN GRÖNQVIST, BIRGITTA HÄGGMAN-HENRIKSON, PER-OLOF ERIKSSON.

Sammanfattning

◎ Vi har tidigare visat att när man äter, dvs gapar, tuggar och sväljer, används inte bara käkled och käkmuskulatur, utan även nackens muskler och leder sätts i arbete vilket leder till koordinerade rörelser av såväl käke som nacke-huvud. Gapning åtföljs av extension av nacke-huvud och sammanbitning av flexion. Under tuggning används nacken mer vid stora tuggor och hård konsistens på födan. Fynden tyder på att de nervbanor i hjärnan som styr käkens och nackens muskler är mycket nära sammankopplade, och att naturlig käkfunktion kräver att man är frisk i både käke och nacke. Denna tes styrks av studier som visat att individer med whiplashskada har mindre och långsammare nack- och käkrörelser, försämrad koordination mellan underkäks- och nackrörelserna, samt sämre uthållighet vid tuggning. I denna undersökning testades hypotesen att det finns ett samband mellan nackskada och försämrad ätförmåga. Femtio patienter med whiplashskada jämfördes med 50 friska köns- och ålders matchade individer utan besvär i käk/nacksystemet. Alla deltagare besvarade en enkät med 26 frågor angående ätbeteende samt smärta och dysfunktion i käkar och ansikte. I motsats till friska, rapporterade patienterna ätsvårigheter pga problem med att gapa, bita och tugga. De undvek hård föda, stora tuggor samt tog pauser vid måltider. Resultaten tyder på att ätförmågan kan försämras som följd av en whiplashskada. En förklaring kan vara att nackskadan stör hjärnans finstämda styrning av käkens och nackens muskler som är nödvändig för god käkfunktion och problemfri ätförmåga. Nackskadade individer bör därför erbjudas undersökning även av sin käkfunktion.

Introduction

A series of studies have shown that jaw opening-closing movements are the result of coordinated activation of both jaw and neck muscles, with simultaneous movements in the temporomandibular, atlanto-occipital and cervical spine joints (11, 34). From these findings it has been proposed that jaw function, by definition, includes integrated control of mandibular and head-neck movements. Eating requires mouth opening, biting, chewing and swallowing, and should be performed without dysfunction or pain. Consequently, it can be assumed that pain or dysfunction in any of the three joint systems involved could impair eating behaviour. In fact, recent findings support this hypothesis by showing an association between neck injury and deranged jaw function in individuals suffering from Whiplash Associated Disorders (WAD) (13). The findings include reduced amplitude for mandibular and head movements, disturbed coordination of mandibular and head-neck movements (12, 20, 35), and reduced endurance during chewing (22). These signs of jaw dysfunction in WAD suggest that eating behaviour might be disturbed following neck injury. However, the possible detrimental effect on eating behaviour from neck injury has so far not been reported. The aim of this study was to test the hypothesis of an association between neck injury and impaired eating behaviour. Using a questionnaire, eating behaviour, jaw function, and jaw pain and dysfunction were investigated in 50 WAD patients and 50 age- and sex-matched healthy controls without any history of neck injury.

Material and methods

Subjects

Fifty patients, diagnosed as WAD by physicians, were compared with 50 age- and sex-matched healthy subjects. The WAD patients, 11 males and 39 females (aged 20-68), had been concecutively referred to the department of Clinical Oral Physiology, University Hospital of Umeå for assessment and management of jaw-face pain and dysfunction that had developed following head-neck trauma. All experienced long-standing neck pain (more than 6 months), impaired and painful head-neck movements. The trauma, mostly in motor vehicle accidents, had resulted in a WAD class II-III according to the Quebec classification (32). In this classification, grade O denotes no neck pain, and grade I neck pain but no signs. Grades II and III denote neck pain with musculoskeletal signs and neck pain with neurological signs, respectively. Grade IV denotes neck pain with fracture. Exclusion criteria for the healthy subjects were joint and/or muscle disorders, pain and dysfunction in the jaw/neck regions or history of trauma to the head-neck region. All participants gave informed consent according to the World Medical Association's declaration of Helsinki. The Ethics committee of the University of Umeå approved the investigation.

Questionnaire

Eating behaviour in both healthy individuals and WAD patients was assessed by means of a questionnaire. The questionnaire contained 26 items about eating behaviour, jaw function, jaw pain and dysfunction (Table 1).

The healthy individuals completed one questionnaire and the WAD patients completed two identical questionnaires. In the first questionnaire, "Before accident", the WAD patients assessed how they remembered their situation before the whiplash trauma. In the

Table 1. Items in the questionnaire.

A. Jaw function
Do you find it difficult to
Open — Bite — Chew — Swallow — Yawn — Speak
B. Difficulties in eating, yawning and speech
Do you
Avoid tough food
Cut food in small pieces
Mainly live on fluids
Take "breaks" when eating due to pain/fatigue
Abort meals due to pain or fatigue
Avoid meals/social events due to pain/fatigue when eating
Avoid swallowing due to pain/fatigue
Avoid yawning due to pain/fatigue
Avoid speaking due to pain/fatigue
C. Clenching/Grinding
Do you
clench your teeth — grind your teeth
D. Jaw dysfunction
Do you experience
fatigue/ stiffness jaw-face
fatigue/ stiffness tongue
numbness jaw-face
numbness tongue
jaw joint sounds (clicking, scraping)
jaw joint locking
E. Jaw pain
Do you experience pain in your
mouth — throat — jaw-face

second identical questionnaire, "After accident", they marked how their situation was at the present time.

There were five alternatives for each question: (0) No, never; (1) Yes, seldom, every year; (2) Yes, often, every month; (3) Yes, very often, every week; and (4) Yes, always, every day.

Analysis

In the analysis, scores 1 or 2 were classified as "low frequency" 3 or 4 as "frequent ". Six WAD patients had for some questions marked two alternatives in the "After accident" questionnaire and for the analysis the lowest score was chosen.

The questions were grouped in five sections (Table 1):

A. Jaw function (6 items)
B. Difficulties in eating (7 items), yawning (1 item) and speech (1 item)
C. Grinding/clenching (2 items).
D. Jaw dysfunction (6 items)
E. Jaw pain (3 items)

For A and B, items were analyzed separately. For C-E, items were grouped before analysis.

Statistics

Median scores were used for descriptive statistics. Differences for WAD before and after the accident and between groups were tested with Wilcoxon matched pairs test. A probability level of 0.05 was considered as statistically significant.

Results

Healthy subjects

Symptoms of low frequency (every year or month), were reported by 65% of the healthy subjects. Reported low frequence symptoms were fatigue/stiffness in jaw/face (28%); jaw joint sound (18%); jaw joint lock (10%); throat pain (16%); jaw/face pain (16%); clenching (12%); and grinding (20%).

The only frequent (weekly or daily) symptoms reported were jaw joint sounds (12%), clenching and grinding (52% and 20%, respectively).

WAD patients before accident

Symptoms of low frequency (every year or month) were reported by 38% of the patients. Most commonly reported were jaw joint sound (14%), clenching and grinding (27% and 12%, respectively).

Before the accident no frequent symptoms (eating difficulties, jaw/face symptoms or pain) were reported by the WAD group except for frequent clenching and grinding (16% and 22%, respectively).

WAD patients after accident

After the accident the WAD patients reported frequent (weekly or daily) symptoms after the accident for all the items in the questionnaire. A majority also reported difficulties in jaw opening, biting and chewing (Fig. 1). Furthermore, many WAD patients avoided tough food, big pieces of food and yawning due to fatigue/pain. They reported taking breaks during eating and cutting food into small pieces to be able to eat and swallow it (Fig. 2). A majority reported clenching and grinding, dysfunction and pain (Table 2).

Differences between groups

There were no significant differences between healthy individuals and WAD patients before the accident, except for less clenching and grinding reported by the WAD subjects ($p = 0.03$) (Table 2).

The WAD group after the accident differed significantly from healthy for all items ($p < 0.0001$). For the WAD group, there were also significant differences between before and after the accident for all items ($p < 0.0001$) (Table 2).

Discussion

When the WAD group recalled their jaw-neck health status before the accident, a majority reported no or few symptoms of jaw and face pain and dysfunction, in accordance with the reports from the healthy controls. In contrast, after the accident, the WAD patients experienced pain and dysfunction during mouth opening, biting, chewing, swallowing and yawning, and felt fatigue, stiffness and numbness in the jaw-face re-

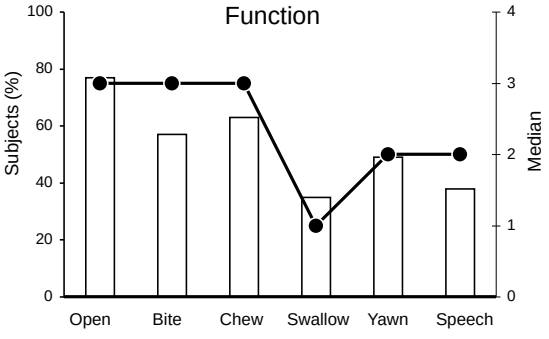

Figure 1. Difficulties in jaw function reported in the WAD group (n=50) after the accident. Percentage (bars) of frequent difficulties (weekly/daily; score 3/4), and median score (●)for the different items.

gion. Furthermore, a majority also reported avoiding tough food, big pieces of food, and swallowing. Thus, there were significant differences between the WAD patients after the accident, and the healthy age and sex matched controls for jaw pain and dysfunction and eating behaviour. Altogether, these observations suggest an association between neck injury and impaired eating behaviour.

For both healthy individuals and the WAD patients before the accident, selfreported joint sounds and clenching were overall in line with previous studies (7, 8, 29). However, the WAD group before the accident recalled less clenching than was reported by the healthy group. Although patient based outcomes has been suggested as an appropriate measure of masticatory efficiency (14) the risk of memory bias among WAD patients cannot be ruled out. Underreporting preexisting mild symptoms could be due to the experience of severe symptoms following the trauma. Thus, previous joint sounds or clenching may easily be forgotten.

It has been shown that patients with neck pain and dysfunction may present with pain and dysfunction in the jaw-face region (2, 5, 27) and vice versa (3, 4, 6, 33). Pain- and dysfunction in the jaw-face region have been reported also in WAD. Although most individuals recover from an acute whiplash injury, a substantial number of individuals will develop a late whiplash disorder (16). Accordingly, although it has been reported that the incidence of jaw-face pain and dysfunction following acute whiplash injury is low (17, 26) chronic WAD patients report pain and dysfunction also in the jaw-face regions (15, 28, 31).

Figure 2. Eating difficulties reported in the WAD group (n=50) after the accident. Percentage (bars) of frequent difficulties (weekly/daily; score 3/4), and median score (●)for the different items.

Table 2. Medians for healthy and WAD groups before and after accident.

Group	Healthy	WAD	
		Before	After
Difficult to			
Open	0	0	3*
Bite	0	0	3
Chew	0	0	3
Swallow	0	0	1
Yawn	0	0	2
Speak	0	0	2
Avoidance			
Tough food	0	0	2
Small pieces	0	0	2
Fluids	0	0	0
Break	0	0	2
Abort	0	0	1
Meal	0	0	1
Swallow	0	0	1
Yawn	0	0	2
Social	0	0	1
Jaw dysfunction	0	0	3
Pain	0	0	3
Parafunctions	2	0	3

*Median values indicate frequency of reported symptoms: (0) No, never; (1) Yes, seldom, every year; (2) Yes, often, every month; (3) Yes, very often, every week; and (4) Yes, always, every day.

Findings in man (10) and animal (24, 36, 37) have suggested neuromuscular couplings between the jaw and neck regions in jaw function. Such couplings include the fusimotor muscle spindle system (1, 18, 30) which has been proposed to play an important role in the initiation and spread of musculoskeletal pain and dysfunction (25). Similar mechanisms have been demonstrated for the jaw neck motor system (1, 18, 30) and there is support for an intersegmental cervicotrigeminal pain connection (19). Furthermore, there is evidence of a reduced endurance during chewing in WAD patients, and that these patients report fatigue and pain during chewing more often than healthy subjects (22). Recent research has also shown that immobilization of the head-neck in healthy individuals can impair jaw function (23). These findings underline the concept of a functional coupling between the jaw and head-neck motor systems (11, 13) and suggest that reduced head-neck mobility can impair chewing ability and therefore eating behaviour. Our present findings of jaw pain and dysfunction and altered eating habits in WAD patients are in line with the evidence of jaw-neck sensory motor connections demonstrated in human and animal studies. Furthermore, we have reported that chewing boluses of larger size and harder texture require not only larger mandibular movements but also larger head-neck movements (21). In the present study, the WAD patients reported troubles eating "tough" food and large boluses after the accident. They had to cut the food into small pieces to be able to chew and swallow it and sometimes had to take breaks during meals. These eating difficulties affected patients' lives as they sometimes had to cancel social activities due to fatigue and pain. Overall, our present findings indicate that neck injury can result in disturbed eating behaviour. However, observations from recent studies on rehabilitation of impaired jaw-neck function in WAD according to a new approach suggest that mobility in terms of increased amplitude and speed and coordination of both mandibular and head-neck movements can be improved (9, 13, 35), which in turn could improve eating behaviour.

In conclusion, the present findings suggest an association between neck injury and impaired jaw function and therefore disturbed eating behaviour. A clinical implication is that examination of jaw function should be recommended as part of the assessment and rehabilitation of WAD patients.

Acknowledgement
Supported by the Department of Odontology and the Faculty of Medicine, Umeå University, the Public Dental Health Service, Västerbotten, Sweden, and RTP (The Swedish Association of Survivors of Traffic Accidents and Polio).

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Ectopic maxillary canines and root resorption of adjacent incisors

Does computed tomography (CT) influence decision-making by orthodontists?

KRISTER BJERKLIN[1], LARS BONDEMARK[2]

Abstract

◎ The purpose of this investigation was to evaluate whether access to computed tomography (CT) influences orthodontists' decision-making about management of incisor root resorption due to ectopic maxillary canines.

The study base comprised orthodontic specialists and active members of the Swedish Orthodontic Society: 182 orthodontists under 65 years of age, who had been registered specialists for at least one year and were providing specialist treatment for regular orthodontic patients. A questionnaire was sent out, comprising 8 questions about management and decision-making in cases of ectopic maxillary canines with root resorption of adjacent incisors and 7 questions about practice profile. The orthodontists were asked whether they altered their treatment decisions when CT was available as a diagnostic tool.

The response rate was high, 86%. Sixty of the orthodontists had access to CT. Sixty-one percent of the 97 orthodontists without access to CT stated that, in cases with space deficiency, they seldom or never considered extraction of a lateral incisor with suspected root resorption if the resorption was not discernible on intra-oral or panoramic radiographs.

It was evident that even in cases of root resorption of lateral incisors due to ectopic canines, the orthodontists' management decisions were not particularly influenced by availability of CT diagnostic data. In the extraction cases 55% of the orthodontists considered extraction of the affected incisor first when root resorption was severe, i.e. involving the pulp and 37% when the resorption reached half way to the pulp. In cases without space deficiency 82% preferred to extract these resorbed lateral incisors not until the resorption reached the pulp.

Key words

Decision-making, eruption disturbances, maxillary canines, root resorption, computed tomography

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Svenska ortodontisters beslutsfattande avseende ektopiska överkäkshörntänder och resorption på laterala incisiver med och utan tillgång till CT undersökning

KRISTER BJERKLIN, LARS BONDEMARK

Sammanfattning

◉ Syftet med denna studie var att undersöka om tillgång till CT undersökningar påverkade ortodontisternas beslutfattande hos patienter med resorption på överkäksincisivernas rötter på grund av ektopiskt läge hos hörntänderna.

Materialet bestod av 182 ortodontister som var registrerade i Svenska Ortodontiföreningens matrikel. Ortodontisterna skulle vara kliniskt verksamma och ha arbetat som ortodontister under minst 1 år och vara under 65 år gamla. Ett frågeformulär skickades ut som innehöll 8 frågor om beslutfattande vid fall med ektopiskt placerade överkäkshörntänder och rotresorptioner på angränsande incisiver och med fokus på huruvida de ändrade i sin behandlingsplan då de hade tillgång till CT undersökning eller inte. Ytterligare 7 frågor avsåg klinikprofil.

Svarsfrekvensen var hög, 86%. Sextio av de tillfrågade ortodontisterna hade tillgång till CT undersökningar och 55% av dessa föredrog att extrahera laterala incisiver i stället för premolarer i extraktionsfall först då de kunde konstatera att rotresorption intill pulpan förelåg på laterala incisiver.

Av de 97 ortodontister utan tillgång till CT undersökning angav 61% att i fall med platsbrist övervägde de sällan eller aldrig extraktion av laterala incisiver även då de misstänkte rotresorption på intraorala eller panorama röntgen.

Sammanfattningsvis påverkades inte svenska ortodontisters beslutsfattande avseende ektopiska överkäkshörntänder och resorption på laterala incisiver i så stor utsträckning av resultaten från CT undersökningarna. 37% extraherade resorberade laterala incisiver då resorptionen gått halvvägs till pulpan Först när rotresorptionen var omfattande, dvs. in i pulpan övervägde 55 % av ortodontisterna extraktion av de resorberade incisiverna. I icke platsbristfall föredrog 82% av ortodontisterna att resorptionen skulle gå in till pulpan innan de beslutade att extrahera de laterala incisiverna.

Introduction

Ectopic eruption of maxillary permanent canines is frequently encountered in clinical orthodontic practice. The prevalence of impacted canines is between 1.0-2.2% (5,7,8,11,15,16). Early detection and intervention are important in order to minimize root resorption on adjacent incisors.

The outcome and prognosis for treatment of ectopic eruption or impaction of maxillary canines can be complex and depends on a variety of factors, such as the position and angulation of the canine as well as the distance the tooth has to be moved. Case management must also take into account possible root resorption of the neighboring teeth (9). Moreover, in many patients there is associated crowding in the dental arch, for which extraction therapy will be required. In such cases the possible presence and severity of resorption of the roots of the adjacent incisors should be determined before deciding which tooth/teeth to extract. However, in almost 50% of cases, root resorption due to ectopically positioned maxillary canines is not detectable on intra-oral or panoramic radiographs, and complementary computed tomography (CT) investigation is required to confirm the diagnosis (9) (figure 1).

Before recommending a preferred treatment approach for the individual patient, the clinician considers the advantages and disadvantages of alternative treatment options. This decision-making process is interactive and includes the scientific evidence in support of proposed diagnostic methods, the prognosis and outcomes for various treatment approaches and the clinician's knowledge and experience (6,14). The main goal is to enhance correct judgment and decision-making, and thereby promote improvement of patient care. One way to improve the decision-making process is to study how clinicians respond to well-defined tasks.

The aim of this study was to determine whether the availability of CT data influences orthodontists' decision-making about management of incisor root resorption associated with ectopic maxillary canines.

Material and method

Study base

The study base comprised all specialists and active members of the Swedish Orthodontic Society who have current e-mail and postal addresses in the society's register. Specialists working predominantly with syndromes, cleft palate patients or administration, were excluded. The following inclusion criteria

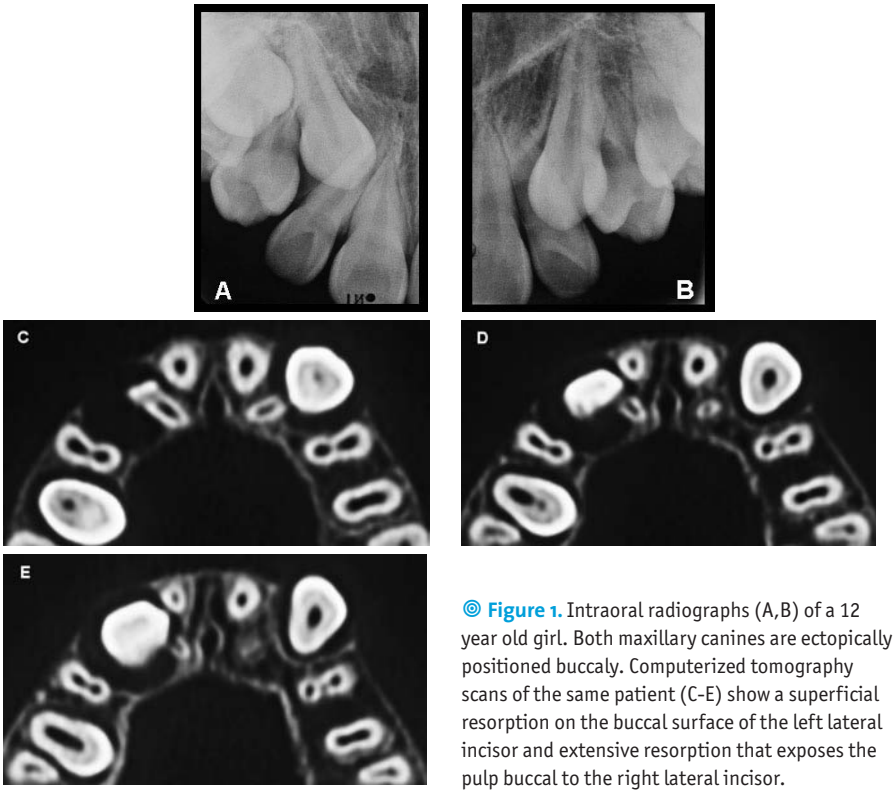

Figure 1. Intraoral radiographs (A,B) of a 12 year old girl. Both maxillary canines are ectopically positioned buccaly. Computerized tomography scans of the same patient (C-E) show a superficial resorption on the buccal surface of the left lateral incisor and extensive resorption that exposes the pulp buccal to the right lateral incisor.

applied: the orthodontic specialists had to be under 65 years of age, be treating regular orthodontic patients in the Public Dental Health Service, as private practitioners or at universities in Sweden and to have at least one year's clinical experience as a specialist. In all, 182 orthodontists met the inclusion criteria: 94 males (mean age 54.6 years, SD 8.04, range 30.0-65.0 years) and 88 females (mean age 52.8 years, SD 8.15, range 33.0-65.0 years).

Data were collected by means of a questionnaire distributed to the 182 orthodontists by regular mail or e-mail during September 2005. Those who had not responded within three weeks were sent a reminder and if no response was received after further 3 weeks, a final reminder was issued. Thereafter, no further attempt was made to contact those who had failed to respond. A coded list of the selected orthodontists was compiled and the study was registered in accordance with the Swedish law of personal integrity (PUL).

Questionnaire

The questionnaire comprised 15 questions. Seven questions concerned gender, age, number of years as a specialist, location and type of clinic, the number of orthodontists in the clinic or practice and frequency of therapy meetings. The remaining 8 questions were as follows:

- *How many ectopically positioned maxillary canines would you treat in a year?*
- *If you have decided to extract the maxillary lateral incisor because of root resorption, how often do you extract the contra lateral tooth for symmetry? (response options: never; seldom; sometimes; often; always)*
- *Of cases you have treated by extraction during the past five years, how many ectopic or impacted maxillary canines have you decided to extract in preference to any other tooth in the dental arch?*
- *When you detect an ectopic or impacted maxillary canine, do you supplement conventional radiography with computed tomography (CT)? (response options: yes; no)*

If you use CT:

- *In an extraction case, how extensive must the root resorption of the maxillary lateral incisor be for you to consider its extraction in preference to any other tooth in the dental arch? (response options: superficial resorption; resorption half way to the pulp; resorption involving the pulp)*
- *In a non-extraction case, how extensive must the root resorption of the maxillary lateral incisor be for you to consider its extraction in preference to any other tooth in the dental arch? (response options: superficial resorption; resorption half way to the pulp; resorption involving the pulp)*

If you do not use CT:

- *In an extraction case where you suspect root resorption of the maxillary lateral incisor, how often do you consider its extraction in preference to any other tooth in the dental arch? (response options: never; seldom; sometimes; often; always)*
- *In a non-extraction case where you suspect root resorption of the maxillary lateral incisor, how often do you consider its extraction in preference to any other tooth in the dental arch? (response options: never; seldom; sometimes; often; always)*

Statistical methods

All data were analyzed using SPSS (14.0). Chi-square test was used to determine differences between categorical variables, while t-test was used for continuous variables with approximately normal distributions to test the significance of mean differences. Mann-Whitney U-test was used for continuous variables not normally distributed. Significance was set at $P < .05$.

Results

Responses were received from 157 (83 males and 74 females) of the 182 orthodontists (86.3%).

In cases of ectopic or impacted maxillary canines, 73 orthodontists declared that they supplemented the conventional radiographic examination (intra-oral radiographs); 79 did not. Five orthodontists did not answer the question. Of the 73 orthodontists who used supplementary radiographic examination, 60 used computerized tomography (CT) and 13 used further intra-oral or extra-oral radiographs.

In space deficiency cases, 33 (55%) of the 60 orthodontists with access to CT stated that they considered extraction of the lateral incisor instead of a premolar when root resorption of the lateral incisor involved the pulp and 37% considered extraction when the resorption extended half way to the pulp. The corresponding figures in cases without crowding were 82% and 16%, respectively (Table 1).

Sixty-one percent of the 97 orthodontists without access to CT stated that in cases of space deficiency they would seldom or never consider extraction of a lateral incisor with suspected root resorption if the condition could not be diagnosed on the intra-oral or panoramic radiographs. In cases uncomplicated

Table 1 Criteria for extraction of lateral incisors with root resorption
Decision-making by 60 orthodontists (29 males and 31 females) with access to CT, based on severity of root resorption in the middle third or apical half of the root

Severity of root resorption	In cases with space deficiency %	In cases without space deficiency %
Superficial	8	2
Half way to the pulp	37	16
Into the pulp	55	82

Table 2 Criteria for extraction of lateral incisors with root resorption
Decision-making by 97 orthodontists (53 males and 44 females) without access to CT

	Suspected root resorption on lateral incisors but not really possible to diagnose on intra-oral or panoramic radiographs		Resorption, visible on intra-oral or panoramic radiographs
	In cases with space deficiency %	In cases without space deficiency %	%
Never	19	59	3
Seldom	42	34	23
Sometimes	35	7	43
Often	4	0	26
Always	0	0	5

by space deficiency, 93% of the orthodontists stated that they would seldom or never extract the lateral incisor (Table 2). If the root resorption on the lateral incisors was visible on intra-oral or panoramic radiographs, 26% seldom or never considered extraction; 43% would sometimes consider extraction of the resorbed incisor (Table 2).

A majority (72%) of those without access to CT declared that in cases of crowding, the degree of resorption assessed on the intra-oral or panoramic radiographs and/or the oral surgeon's assessment of the resorption at the time of surgical exposure of the canine was the main basis for considering extraction of a lateral incisor in preference to any other tooth. Moreover, 15 % of the orthodontists were of the opinion that agenesis of the contralateral incisor or a lateral incisor with a short root or peg- shaped crown were reasons for extraction. The type of occlusion, symmetry, the potential to achieve space closure, and patients' preferences were cited by 13% of the orthodontists as the main factors in considering extraction of the lateral incisor.

In cases where one lateral incisor was extracted because of root resorption, the contralateral tooth was always extracted by 1.5% of the orthodontists, often by 17%, sometimes by 51%, seldom by 28% and never by 2.5%.

It should be noted that during the last 5-year-period, 79% of the orthodontists have made a decision to remove ectopically positioned canines in fewer than 10 cases, 20% have removed between 10 and 30 canines, and 1% of the orthodontists between 30 and 50 canines.

In cities with more than 150,000 inhabitants, 30% of the orthodontists seldom or never extracted the contralateral incisor for symmetry (P=0.031). This was significantly different from orthodontists in smaller communities. No significant differences were found with respect to gender, age of the orthodontist, number of years as a specialist or any of the other background variables covered by the questionnaire.

Discussion

In incisors adjacent to ectopically positioned maxillary canines, there is only gradual progression of root resorption and the prognosis for the resorbed teeth seems quite favorable (10). Thus a majority (55%) of the orthodontists with access to computerized tomography (CT) stated that in cases where extraction was necessary to relieve crowding, they would consider extraction of the resorbed tooth in preference to a healthy premolar only if the resorption had involved the pulp. In cases without space deficiency however, 82% of the orthodontists would prefer to extract lateral incisors, first when the resorptions reached the

pulp (Table 1). Moreover, among orthodontists without access to CT, a minority (31%) stated that they would often or always extract an incisor with root resorption discernible on intra-oral or panoramic radiographs (Table 2). This is in accordance with the findings from a previous study of management of 3 separate cases of ectopic maxillary canines (3).

On the other hand, another study disclosed that when conventional radiographic examination was supplemented by CT, the treatment plans were modified in 43.7% of cases. In those with crowding as well as root resorption, 53.8% of the treatment plans were altered (4).It was also found that out of 30 lateral incisors considered highly likely to have root resorption, CT disclosed no resorption in 28. Furthermore, in 15 cases where the treatment plan was either "no extraction" or "extraction of the first premolars", the CT investigation disclosed severe resorption on 19 lateral incisors which were subsequently extracted (4). Thus, there is clearly an advantage in using a supplementary diagnostic tool such as CT for an evident and true picture of the condition of the teeth before making a decision about extraction. Intra-oral or panoramic radiographs are generally inadequate for diagnosing incisor root resorption associated with ectopic maxillary canines, compared with detection by CT, only about 50% of cases are detectable on intra-oral and panoramic radiographs (9).

However, conventional CT was not originally developed for 3D dental diagnostic application and it is important to note that this technique has been used only occasionally, because of the high radiation exposure. Instead, limited cone beam CT has been introduced for dental use (1), and this technique has proved successful for 3D diagnosis, not only of impacted teeth (13), but also for diagnosis of periapical pathology (12). The limited cone beam CT can be recommended for disclosure of incisor root resorption associated with ectopic maxillary canines.

In the present study the responses by the orthodontists suggest that they do not fully utilize the diagnostic information about root resorption available from CT. Instead they base their decision-making on the knowledge that resorption does not tend to progress after intervention to reposition or extract the ectopic canine. However, in cases where extraction is necessary, from the patient's perspective it would be preferable to retain an unaffected tooth than one so severely compromised by root resorption that the pulp could be involved.

Data from this and a previous study (3) indicate that many Swedish orthodontists prefer to retain incisors with severe root resorption. It can be speculated that proportionally many Swedish orthodontists are aware that many incisors with undisclosed root resorption can function without problems for many years, and that these teeth even tolerate orthodontic forces. One study addresses this topic and has found that severely resorbed incisors do function well long-term and do not continue to resorb once the impacted canine is treated appropriately (2).

The response rate to the questionnaire was high (86.6%), and the results are therefore representative of Swedish orthodontists´ decision-making about management of incisor root resorption caused by ectopic maxillary canines. Analysis of the non-responders disclosed no significant differences from responders with respect to age, gender or years of specialist experience. However, respect for personal integrity precluded more detailed comparison of the two groups.

Based on the responses received, the possible association between decision-making and gender, age and practice profile was analyzed. However, no clear picture emerged and only small differences were found, except that orthodontists in cities with more than 150,000 inhabitants significantly less frequently extracted the contralateral maxillary lateral incisor when the other had to be removed because of root resorption. One explanation for the general consensus among the specialists may be that in the majority of Swedish clinics, the orthodontists meet for regular therapy planning seminars of their cases and in Sweden very few orthodontists work in solo practice. This also means that orthodontists who have recently completed their postgraduate studies very rarely start work in clinics with only one orthodontist.

Conclusions

In managing root resorption of lateral incisors associated with ectopic canines, orthodontists make decisions with little regard to CT diagnosis. Only 37% of the orthodontists considered extraction of the incisor when the resorption was half way to the pulp in subjects with space deficiency and 16% in subjects without space deficiency. Not until the resorption was severe, involving the pulp, 55% of the orthodontists considered extraction of the lateral incisor instead of a premolar in extraction cases. In cases without space deficiency 82% of the orthodontist extracted resorbed lateral incisor first when the resorption reached the pulp.

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Cross-cultural adaptation and validation of the Oral Impacts on Daily Performances (OIDP) in Swedish

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Abstract

◎ *Objectives* The aim was to assess the validity and reliability of a Swedish version of the Oral Impacts on Daily Performance (OIDP) index measuring oral health-related quality of life. *Material and methods* After translation and cultural adaptation, a 3-site sample of 204 adults (20-86 years) was interviewed using the OIDP. Moreover, the study included a self-administered questionnaire and a clinical examination. *Results* A total of 39.7% reported at least one oral impact on daily life. The most common performances affected were eating and cleaning teeth (both 20.6%). Oral effects on psychological performances caused the highest impacts. No gender or age differences were demonstrated with respect to having at least one impact. However, among those affected, women, old and young subjects scored higher than men and other ages, respectively, on the OIDP. The face and content validity were deemed good in pilot interviews with laypersons and dental professionals. The construct validity was confirmed, as the OIDP score was consistently associated with self-perceived oral health OR 2.13 (95% CI 1.10-4.10) and other self-rated variables, e.g. satisfaction with oral health OR 2.43 (CI 1.34-4.41), also when accounting for age, gender and socio-economic differences. Associations were estimated using logistic regression. Lacking 10 or more teeth was associated with a higher OIDP score, which supports the criterion validity of the instrument. In a test-retest analysis Cohen's kappa was 0.77. *Conclusions* The Swedish version of the OIDP appears to be a valid and reliable measure for assessing oral impacts on daily performances.

Key words

OIDP, oral health, psychometrics, quality of life, Swedish

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En kulturell anpassning och validering av en svensk version av OIDP, ett instrument för munhälsorelaterad livskvalitet

ANNA-LENA ÖSTBERG, PIA ANDERSSON, MAGNUS HAKEBERG

Sammanfattning

◎ Syftet med studien var att analysera validiteten och reliabiliteten av en svensk version av Oral Impacts on Daily Performances (OIDP), som är ett av de vanligaste instrumenten internationellt för att mäta munhälsorelaterad livskvalitet. Det är baserat på en begrepps- och teoriram som har utvecklats inom världshälsoorganisationen (WHO), vilken är indelad i tre nivåer: 1) kliniskt registrerat munstatus och biofysiska följder av sjukdomar, 2) "intermediate impacts", exempelvis smärta, obehag, funktionsnedsättning och missnöje med utseendet; 3) "ultimate impacts", dvs nersatt förmåga och handicap. OIDP fokuserar på den tredje nivån och syftar till att mäta individens egen upplevelse av muntillståndets inverkan på det dagliga livet. De nio frågorna i instrumentet översattes till svenska och därefter tillbaka till engelska för att kunna jämföras med originalet. Pilottester genomfördes i flera steg, där formuleringar och innehållet i instrumentet bedömdes som goda. Därefter intervjuades 204 personer i åldrarna 20-86 år (70% deltagande), på tre olika orter i Sverige, med användning av instrumentet. Deltagarna besvarade dessutom ett frågeformulär om bland annat socioekonomiskt status och hälsorelaterade frågor samt undersöktes kliniskt. Totalt 39.7% rapporterade någon inverkan av munhälsan på det dagliga livet. De vanligaste aktiviteterna som påverkades var att äta och att göra rent tänderna (båda 20.6%). Psykologiskt relaterade aspekter orsakade störst inverkan. Det var ingen ålders- eller könsskillnad vad gäller att uppleva någon inverkan. Bland de som upplevde att munhälsan påverkade det dagliga livet, hade dock kvinnor samt äldre och yngre högre värden på OIDP, det vill säga mer besvär. OIDP var genomgående associerat till olika aspekter av självupplevd munhälsa, till exempel nöjdhet med tändernas utseende, OR 2.43 (CI 1.34-4.41), även när hänsyn togs till ålder, kön och socioekonomiska skillnader, vilket tyder på god begreppsvaliditet i instrumentet. Att sakna 10 tänder eller mer var associerat till ett högre OIDP-värde, vilket stödjer instrumentets normativa validitet. Tjugosex individer återintervjuades med OIDP efter cirka tre veckor i en re-test, och resultatet stämde väl med de ursprungliga intervjuerna (Cohen's kappa=0.77). Detta tyder på god reliabilitet. Sammanfattningsvis uppvisar denna svenska version av det munhälsorelaterade instrumentet OIDP acceptabel validitet och reliabilitet för att mäta munhälsans inverkan på individens dagliga liv.

Introduction

Oral health and various oral conditions can be registered professionally by dental personnel or be experienced by the individual. In oral epidemiology, an oral health index is often used for the purpose. A great number of indices for clinically assessed oral health have been developed from the 1930s and onwards (20, 4, 9). However, the limited ability of clinical measures to capture comprehensive oral health has been increasingly recognized (25). The significance of the mouth for the quality of life of the individual is then emphasized.

The development and testing of instruments for oral health-related quality of life (OHQoL) is a steadily growing field of research. During recent decades, a number of such instruments have been presented, mainly in English-spoken countries (10). The instruments are most often multi-dimensional, estimating functional, social and psychological aspects (31). As their usage is dependent on the prevailing social and cultural context, a careful adaptation and validation of translated instruments is necessary (16). Some of the most common indices have been translated to Swedish and have been validated (23, 17).

The Oral Impacts on Daily Performances (OIDP) has been developed to measure the impact of oral conditions on an individual's everyday life (2). The conceptual foundation of the instrument is the World Health Organization's (WHO) International Classification of Impairments, Disabilities and Handicaps (ICIDH), which was adapted for dentistry by Locker in 1988 (25). The conceptual framework is divided in three levels: 1) clinical registered status and biophysical consequences of diseases; 2) intermediate impacts, for instance pain, discomfort, functional limitations and dissatisfaction with the appearance; 3) ultimate impacts, i.e. reduced capacities and handicap. The OIDP focuses on the third level, aiming to measure the individual's own experiences of oral impacts on daily performance. The OIDP has been used in adults in different countries and cultures, including Great Britain, Greece, Thailand, Tanzania, Uganda, Norway and Iran (35, 41, 36, 28, 6, 5, 13). The usefulness of the index was shown in patients with specific problems, such as trauma and malocclusion (11, 12). A specific version for children has been developed (15).

The OIDP is one of the most frequently used instruments in research into OHQoL, and there is a need to provide a Swedish version. The aim of the present study was to perform a cross-cultural adaptation and linguistic validation of the OIDP for the Swedish language and test the psychometric properties of the Swedish version of the instrument with the ultimate purpose of providing it for utilization in research and clinical work.

Materials and methods

Measures

The original OIDP instrument included eight daily performances (2), whereas later versions comprised additional performances (3, 40). In this study, nine physical, psychological and social aspects of daily performances were questioned. The participants were asked whether, during the past six months, they had experienced any difficulties with the following activities due to problems with their mouth or teeth (or dentures): eating and enjoying food; speaking and pronouncing clearly; going out (for example to shop or visit someone); cleaning teeth (or dentures); sleeping and relaxing; smiling, laughing and showing teeth without embarrassment; maintaining emotional state (for example becoming more easily upset than usual); carrying out a major work or social role; and enjoying the contact of other people. Respondents who answered "yes" to any item were asked whether the problems were regular or only for part of the period. The frequency was rated 1-5: for those affected on a regular basis from 'less than once a month' to 'every day or nearly every day', and for those affected only part of the period from '5 days or less' to 'more than 3 months'. Finally, the severity of the effect on everyday life was examined with the following ratings: 'no effect' (0); 'a very minor effect (1); 'a fairly minor effect' (2); 'a moderate effect' (3); 'a fairly severe effect' (4) or 'a very severe effect' (5). Nine performance scores were calculated by multiplying frequency and severity scores. To obtain the OIDP score for an individual (OIDPsc), the sum of the nine scores was divided by the possible maximum performance scores: nine performances X maximum frequency score (5) X maximum severity score (5) = 225, and multiplied by 100 to provide a percentage score, equalling the OIDPsc. The OIDPsc was dichotomized for the validity analyses: having "at least one daily performance affected" versus "no daily performance affected". The median value of the OIDPsc was used as an alternative dichotomization cut-off point for the group that reported at least one daily performance affected.

The adaptation and validation process of the OIDP was performed according to principles described by *Guillemin et al.* (16) and *Acquadro et al.* (1). The face and content validity of the instrument were

primarily assessed by the Swedish research team (the authors). The instrument was forward translated into Swedish independently of the three authors and one bilingual professional translator. Primary pilot interviews were then conducted with a convenience sample of 12 adults (7 women, 5 men) in the target population, resulting in minor wording modifications. The resulting version was back-translated into English, independently by two professional translators, both authorized according to European Union regulations. The differences between the translators' versions and to the original English version were small and considered insignificant. After some minor amendments, a consensus version was approved for secondary pilot interviews. Fifteen native speakers of the target language with a reasonable range in age, sex and socio-economic status (9 women, 6 men) were individually in-depth interviewed about the comprehensibility of the items. Finally, this version was discussed in a small group of health professionals. No modifications were required. During the initial process, close contact and discussions were maintained with the original research team at University College London (Dr Georgios Tsakos).

To test criterion and construct validity, complementary measures of global self-perceived oral health (dichotomized as 'very good'/'good' versus 'average'/'bad'/'very bad'), satisfaction with dental appearance (dichotomized as 'very satisfied'/'satisfied' versus 'neither'/'not very satisfied'/'not satisfied at all'), chewing ability (dichotomized as 'without difficulties' versus 'with caution'/'not at all'), troubles in the mouth during the last year (dichotomized as 'yes' versus 'no'/'do not remember') and reason for last dental attendance (dichotomized as 'regular visit' versus 'pain'/'other acute problems') were gathered by means of a self-administered questionnaire. Socio-economic data were also requested. Educational level was dichotomized into those who had 9 years of education or less and those with a longer education. Ethnic origin was defined as being born abroad or not. Marital status was classified as married/cohabitant or not. A medical anamnesis preceded a clinical examination. For this study, the number of teeth was used as a proxy for clinical oral health in the analysis. A dichotomization was performed: 0-9 teeth missing versus 10 or more teeth missing (5).

Study sample and ethical approval

The sample comprised patients in three age strata to represent a range in population characteristics (20-39 years, 40-59 years, ≥60 years) from three clinics in general dentistry, situated in Southern and Central Sweden. The three clinics represented a range of socio-economic (SE) profiles, according to education, employment, ethnicity, and social allowances: one city suburb (low SE), one mid-size town (medium SE), and one small town (high SE). Those giving another country of origin all spoke Swedish. The participants were consecutively recruited in connection with their routine dental examination and examined from November 2006 to June 2007, for each of the three clinics part of this period. The sample size was in accordance with recommendations by Kline (21). Of 295 patients invited, 205 participated (70%). The reasons for not participating were refusal (n=17), having moved (n=25), lack of time (n=20) and no contact (n=28). One person was not interviewed for the OIDP instrument and was excluded from further analyses. Re-test interviews for the OIDP questionnaire were carried out over the telephone by the same data collector as the first time with every eighth participant (n=26, 13%) within a time limit of 3 weeks.

The data collection was carried out by calibrated personnel: for the OIDP interview, two calibrated dentists (one study site) and one dental hygienist for each of the other sites, and for the clinical examination three other calibrated dental hygienists (one for each study site). The Research Ethics Committee of Karlstad University, Sweden, approved the study.

Procedure

Those invited were informed orally and in writing, and written agreements to participate were obtained. The interviewer-administered OIDP and the self-administered questionnaire were completed in a separate, quiet room before the clinical examination was performed.

Statistical analysis

All statistical analyses were done using the SPSS software package, PC version 14.0. Descriptive and analytical statistical methods were used. Test-retest reliability was estimated by calculating the intraclass correlation coefficient (ICC) for the OIDPsc and weighted Cohen's kappa for the OIDPsc, using the data from the 26 participants who were re-interviewed within a 3-week period. To test construct and criterion validity, the associations between the OIDPsc versus global self-perceived oral health and other variables were examined using $\chi 2$-test and Mann-Whitney's U-test. Multivariate logistic regressions estimated the impact of possible confounders

on the association between self-reported measures and the OIDPsc. Statistical significance was assumed when P<0.05 or when the 95% confidence interval excluded 1.0.

Results

The characteristics of the participants according to sociodemographic and clinical data are presented in Table 1. The mean age was 47.3 years (SD 16.9). The participants were fairly evenly distributed in the three age groups. Most respondents (88.2%) were well dentated and lacked less than 10 teeth. The mean number of teeth was 27.2 (SD 4.7). The majority perceived their oral health to be good or very good (76.2%). The study sample was recruited from patients with the habit of regular dental check-ups. Nevertheless, 37.8% reported some troubles in their mouth over the past year, and 17.5% stated that the reason for their last dental visit was symptoms or acute problems.

OIDP scores

Of the 204 subjects, 81 (39.7%) said that they had at least one oral impact as defined in the OIDP. Another 9 individuals (4.4%) reported at least one difficulty, but were not affected in their daily life. The mean overall OIDPsc was 4.5 among those affected. The corresponding median value was 2.7, demonstrating a highly positively skewed distribution of the OIDPsc (range 0.4-24.4).

The prevalence, frequency and severity of affected oral performances questioned in the OIDP inventory are shown in Table 2. The most common performances to be affected in the total sample were eating (20.6%) and cleaning teeth (20.6%). Oral affects on psychological performances resulted in the highest impacts.

There was no significant difference between the genders in the prevalence of having at least one oral impact (women 42.1%, men 37.1%: P=0.468). However, among those affected, women more often than men had an OIDPsc above the median value (among affected women 77.6%; among affected men 54.5%: P=0.033). Likewise, there was no difference between the three age groups with respect to having at least one oral impact, but among those affected the youngest and the oldest respondents more often had a score above the median value (Table 3).

Validity of the OIDP

The face and content validity of the translated and adapted Swedish OIDP instrument was assessed in

Table 1. Sociodemographic and clinical characteristics of the study population.

Variable		Number %
Age in years	20-39	72 (35.3)
	40-59	79 (38.7)
	60-	53 (26.0)
Gender	Female	115 (56.4)
	Male	89 (43.6)
Education	>9 years	162 (79.8)
	≤9 years	41 (20.2)
Country of origin	Sweden	192 (94.6)
	Not Sweden	11 (5.4)
Marital status	Married/cohabitant	130 (64.0)
	Unmarried/not cohabitant	73 (36.0)
Missing teeth	0-9	180 (88.2)
	≥10	24 (11.8)

Table 2. Prevalence, frequency and severity of affected oral performances.

Performance	Per cent persons affected Total N=204	Mean (SD) frequency of those affected* n=81	Mean (SD) severity of those affected* n=81
Physical performances			
Eating	20.6	2.6 (1.4)	2.6 (1.4)
Speaking	3.9	2.4 (1.8)	2.5 (1.3)
Cleaning teeth	20.6	3.1 (1.6)	1.6 (1.3)
Psychological performances			
Sleeping	6.8	3.4 (1.6)	2.9 (1.2)
Smiling	5.9	3.3 (1.6)	2.5 (1.1)
Emotional stability	5.9	2.2 (1.7)	3.1 (1.0)
Social performances			
Going out	1.0	2.5 (0.7)	2.0 (2.8)
Work or major role	2.0	2.0 (1.8)	2.5 (2.1)
Contact with others	2.0	1.5 (0.6)	2.3 (1.3)

* options 1-5

Table 3. Prevalence of impacts according to age.

Age group	Per cent persons affected in the total sample* Total N=204	OIDPsc ≥ median value Per cent of those affected* n=81
20-39 years	38.9	71.4
40-59 years	37.2	51.7
≥ 60 years	45.3	83.3
	P=0.623	P=0.044

* Differences between age groups tested with χ^2

interviews with native speakers of the target language prior to the psychometric testing (in the step-by-step process described in the Methods section). Furthermore, the group of oral health professionals approved the final version.

The data analysed regarding the OIDP questionnaire displayed no dropouts, which supports the face validity of the Swedish version of the instrument. The amount of internal missing values on individual items in the self-administered questionnaire was similarly low, 0-2.4%.

The construct validity of the Swedish OIDP was tested by examining its associations with a number of self-reported variables, reflecting constructs similar to oral health-related quality of life (Table 4). The OIDPsc, expressed as having at least one oral impact, discriminated between those who perceived they had good oral health and those perceiving average or bad oral health. Likewise, the discrimination ability was good between respondents who were satisfied and who were not satisfied with their dental appearance. Moreover, the instrument discriminated between respondents with bad and good chewing ability, between those reporting problems in the mouth and those who did not, and between patients with and without symptoms or acute problems. Logistic regression analyses adjusted for age, gender, educational level, ethnic origin and marital status confirmed the stability of the instrument's discrimination ability for the self-reported data that were demonstrated in the bivariate Mann-Whitney tests. A sub-analysis exploring the association between the item on chewing ability and the OIDP item concerning eating problems demonstrated a Spearman correlation coefficient R=0.34 (P<0.001).

The criterion validity of the instrument was evaluated through examining the OIDPsc in subjects lacking 10 own teeth or more (58.3% had at least one impact) and subjects lacking less than 10 teeth (37.2% had at least one impact). The results of χ2–test provided evidence of moderate discriminative validity for the instrument between the groups (P=0.047).

Reliability of the OIDP

The reliability of the instrument was assessed in a test-retest procedure using re-interviews with 26 individuals. The overall kappa coefficient for the OIDPsc was 0.77. The intraclass correlation coefficient for average measures was 0.79 (95% CI 0.36-0.84) and for single measures, 0.65 (CI 0.36-0.83). The bivariate correlation coefficient between the original OIDPsc and the re-test OIDPsc was 0.76 (Spearman rank correlation, P<0.001).

Discussion

In the present study, the oral health-related quality of life scale, the OIDP, was translated and culturally adapted for the Swedish language, and its psychometric properties were successfully tested.

The adaptation and validation process was carefully performed according to recommended principles (16, 1, 38). The cultural adaptation required minor adjustments to the questionnaire. However, the number of items was discussed. The original OIDP inventory contained eight items corresponding to their equals in our study (2). In later studies, the inventory was supplemented with items about light physical activities and going out (for instance to shop or visit somebody), and some items were split, for example the item about sleeping and relaxing (40). Based on the interviews with individuals from the target population, a decision was made to include the items from the original version, but to supplement them with the item on going out. In summary, the original OIDP and the Swedish OIDP correspond well, and the conceptual dimensions based on the ICIDH are preserved (25).

The three sites were chosen to provide a varied geographic and socio-economic background in Sweden, not to test the differences between them. Although the consecutive selection of respondents could entail bias, this sampling enabled the collection of clinical data. Thus, for this first evaluation of the Swedish OIDP, the results could be reasonably generalized. The participation rate in this study was

Table 4. Construct validity. Discrimination ability of the OIDP instrument between high- and lowscoring respondents in self-reported measures. Statistical significance, odds ratios (OR) and 95% confidence intervals (CI) for having at least one oral impact on daily performance.

Self-reported measure	Rating	N (%)	Having at least one oral impact N (%)	Mann-Whitney Z	Mann-Whitney P	OR	CI
Global self-perceived oral health	Good	154 (76.2)	55 (35.7)			1	
	Average or bad	48 (23.8)	26 (54.2)	-2.915	0.004	2.13*	1.10 – 4.10
						2.08†	1.06 – 4.09
Satisfaction with dental appearance	Satisfied	131 (65.2)	43 (32.8)			1	
	Neither or not satisfied	70 (34.8)	38 (54.3)	-3.130	0.002	2.43*	1.34 – 4.41
						2.67†	1.44 – 4.98
Chewing ability	Good	182 (90.1)	67 (36.8)			1	
	Not good	20 (9.9)	14 (70.0)	-2.800	0.005	4.01*	1.47 – 10.9
						3.46†	1.20 – 9.99
Troubles in the mouth	No	125 (62.2)	38 (30.4)			1	
	Yes	76 (37.8)	43 (56.6)	-3.660	<0.001	2.98*	1.65 – 5.40
						3.37†	1.81 – 6.29
Reason for dental attendance	Regular	165 (82.5)	58 (35.2)			1	
	Symptoms/acute problems	35 (17.5)	22 (62.9)	-2.989	0.003	3.12*	1.47 – 6.65
						3.17†	1.46 – 6.88

* crude association

† association adjusted for age, gender, SES (educational level, ethnic origin, marital status)

in accordance with other recent studies (17, 29).

The prevalence of impacts was moderate (39.7%), compared with previous studies. In a British national health survey, more than half of the respondents reported some effects of oral problems (32). In the validity and reliability test of the Norwegian OIDP, the prevalence of impacts was merely 18 per cent. However, that study was based on telephone interviews, and the different administration techniques might influence the response (8). The original OIDP was constructed for face-to-face interviews, which was the form used in the present study. Apart from the administration mode, factors such as the context and age of the respondents might influence the prevalence of impacts (36, 40, 30).

The impact scores were not normally distributed in our study, revealing that a minor proportion of the sample experienced the majority of impacts. This is accordance with other studies (6, 33). The floor effect of the OIDP scores in our study might be discussed as a mirror of the generally good dental health in Sweden (14). However, the scale's capability to capture all variation could be limited.

The impacts measured among those who were affected were greater in the young and in the old participants. For natural reasons, the burden of dental disease is greater among the old, and the oral impacts in this age group can be expected to be high (5). However, the result in the younger age group is interesting and might appear contradictory, as dental health among young people in Sweden has consistently improved (39, 18). Similar findings were made in UK and Canadian contexts (33, 27). Young people can have special problems, such as symptoms from piercings (37). The findings might also be discussed in terms of different expectations in the young and in the old. There was no difference between men and women regardless of whether they were affected or not. However, the affected women scored higher on the OIDP. It might be more socially accepted for women to admit the extent of their oral impacts (19).

The Swedish OIDP showed good discriminant properties for the single-item global self-perceived oral health, which has been proven as a robust measure and often used for the purpose (5, 33, 7). The associations between the Swedish OIDP and other subjective measures were consistent and significant. Furthermore, the reason for dental attendance was related to the OIDP. All these associations showed good stability with respect to age, gender and other

confounders. In summary, these findings support the construct validity of the Swedish OIDP.

Responding to a questionnaire that includes a time aspect, as in the OIDP, which enquires about oral impacts during the previous 6 months, could entail memory bias (38). The period of 6 months was based on chronic pain studies and was thus considered appropriate for the ultimate oral impact questions in the OIDP (2). This was supported by the good test-retest reliability demonstrated in the present study (22).

The number of teeth is a frequently used proxy for oral health. Information about missing teeth was collected in a clinical examination, which supports the accuracy of the registration. The discriminant ability of the Swedish OIDP between those who had lost 10 teeth or more compared with those who had retained more teeth was verified. This concurs with other studies, which have shown that tooth loss of about 10 teeth or more reduces both mastication ability and quality of life (24, 34, 26). Furthermore, in the Norwegian validation of the OIDP, the cut-off point at which tooth loss had a significant influence on quality of life was the same (5).

According to the basic principles of health promotion, the provision of quality of life measures for different contexts and languages could be regarded as an issue of equity (42). Therefore, it was important to adapt and validate the widely used OIDP for use in the Swedish language. In conclusion, we found that this Swedish version of the OIDP index has acceptable psychometric properties. However, tests in random samples and different patient groups are needed. Moreover, further studies should include longitudinal designs.

Acknowledgements

The study was supported by The Swedish Dental Society, Göteborg Dental Society (Sigge Persson's & Alice Nyberg's Foundation) and the Council for Medical Care Research in South Sweden, all gratefully acknowledged. The authors also want to thank the staff that assisted in the data collection, especially Gunn Karlberg, Carina Mårtensson and Margaretha Olsson.

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Relationships between psychosocial work environmental factors, personality, physical work demands and workload in a group of Swedish dentists

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Abstract

◉ The aim of the study was to investigate, in a group of 77 Swedish dentists (36 males, 41 females) working in dental clinics, possible effects of psychosocial work environmental factors, personality traits, and social desirability tendencies on their reporting of their workload and of the physical demands placed on them.

Participants were given questionnaires for assessing their workload, the physical and psychosocial demands of their job, their social support at work, and their control over their work situation, using a 10-cm visual analogue scale (V.A.S.). The Eysenck Personality Questionnaire (EPQ) was also given to assess neuroticism and extraversion and the Marlowe-Crown SD-scale to measure tendencies to answer questions in a socially desirable manner.

As in two earlier studies of ours, very high assessments were made of workload, physical work demands and social support. Higher assessments of workload and of physical work demands were found in those assessing the psychosocial work demands placed on them to be higher. Those assessing the work load of their job as higher also considered themselves to have less control over their work situation and were less extraverted.

Despite these dentists perceiving themselves as being faced with a stressful work situation involving a high workload, strong physical and psychosocial demands being placed on them and their having a low degree of control over their work situation, the high degree of social support they experienced may have made their work situation less stressful.

Key words

Workload, physical demands, psychosocial work factors, personality, dentists.

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Samband mellan psykosociala arbetsmiljöfaktorer, personlighet, fysiska krav i arbetet och arbetstyngd bland svenska tandläkare

BO ROLANDER, ULF STENSTRÖM, DIRK JONKER

Sammanfattning

◎ Syftet med denna studie var att undersöka samband mellan psykosociala arbetsmiljöfaktorer, personlighetsfaktorer, behov av att vara tillags och rapporterade upplevelser av fysiska krav och arbetstyngd hos en grupp svenska tandläkare (36 män och 41 kvinnor).

I en enkät fick deltagarna besvara frågor med hjälp av en 10-cm lång visuell analog skala (V.A.S) gällande upplevelser av arbetstyngd, fysiska och psykosociala krav, socialt stöd och egenkontroll avseende arbetssituationen. Eysenks personlighets formulär (EPQ) användes för att mäta grad av neuroticism och extraversion. Marlowe-Crown´s SD-skala användes för att registrera behovet av att vara tillags.

I överensstämmelse med två av våra tidigare studier upplevde tandläkarna även i denna studie mycket höga fysiska krav och stor arbetstyngd. De tandläkare som upplevde de största fysiska kraven och den högsta arbetstyngden upplevde också de högsta psykosociala kraven. De som rapporterade den högsta arbetstyngden upplevde också ett litet beslutsutrymme och var dessutom mindre extraverta. Trots att tandläkarna rapporterade hög grad av fysisk och psykosocial belastning, stor arbetstyngd och litet beslutsutrymme så upplevde man sig ha ett starkt socialt stöd, vilket kan tänkas bidra till att göra arbetssituationen mindre stressande.

Introduction

In an earlier study of ours (15), a group of dentists (n = 73) who were working in dental clinics reported having a very heavy workload and there being strong physical demands placed on them, their mean assessments of these on a 10-point visual analog scale (V.A.S.) being 8.97 and 9.60, respectively. The prevalence of musculoskeletal complaints was also found to be high, particularly for the neck and shoulders, in line with what was reported in a recent study by *Lindfors et al* (10). The pain intensity at these locations the dentists in our study reported was lower than expected, however, there also being only weak correlations (r = 0.04 to r = 0.30) between perceived physical work demands, workload and the pain intensity reported, a matter that could not be explained satisfactorily. However, a group of dental hygienists investigated in the same study, whose results for perceived workload and physical work demands were quite similar to those of the dentists, showed considerably higher positive correlations (r = 0.42 to r = 0.73) between workload, physical work demands and perceived pain intensity in the neck, shoulders, and lower back. To better clarify the relations involved, two new studies were carried out (16, 17), involving only those dentists (n = 27) from the study who had scored higher than 9.5 on both physical work demands and workload. These studies were designed to assess the physical working conditions more objectively by use of the PEO-flex (16) (Portable Ergonomic Observation is video-based observation method for frequency analysis and for the analysis of poture and movements during work.) technique in the one case and the sEMG (17) (surface electromyography technique is a method that registers electrical signs of muscular activity (ARV), accumulated periods of muscular rest as well as muscular fatigue during work.) in the other. The PEO-flex observations showed the dentists to generally perform their clinical work in a sitting position, with their heads bent forward nearly half the time. Only weak to moderate correlations between the observed level of physical demands (the PEO-flex results) and the perceived workload level were found. The study employing sEMG showed the dentists to have percentages of accumulated muscular rest periods that were rather close to those of female cashiers and supermarket employees, at the same time as they exhibited high muscular activity levels (ARVb %) during work, which could be thought to contribute to the high workload and strong physical work demands reported. Although the two studies in which PEO-flex and sEMG, respectively, were employed provided some explanatory support for the high workload levels and physical work demands reported, it was decided to carry out still a further study to examine the extent to which the Demand-Control-Support (DCS) job-strain model of *Karasek & Theorell* (14), described below, might help explain these high ratings, as well to investigate the possible effects of certain personality traits on the ratings in question. According to *Karasek & Theorell's* (14) model, such psychosocial workplace factors as strong psychosocial work demands, low levels of social support and a feeling of having very limited control over one's work situation could be expected to increase the dentists' sense of having a heavy workload and of strong physical demands being placed on them. Within the framework of this model, certain personality traits – or general ways of responding in a wide variety of situations – might also be expected to affect the degree to which the effects just described occurred. For example, persons high in neuroticism, a pervasive dimension of personality marked by negative emotions, self-consciousness, and a low degree of mastery or self-efficacy, could be expected to use more maladaptive coping strategies, and accordingly to experience a heavier workload and greater physical demands being placed on them, than those who are more emotionally stable (5,21). In contrast, persons high in extraversion (5), a personality trait involving the tendency to be sociable, active and optimistic, and to be strongly inclined to experience positive affects, could be expected to use more adaptive strategies for coping with the work environment. The aim of the present study was to analyse whether. in a group of dentists employed in public dental clinics, such psychosocial work environmental factors as the feeling of being subjected to strong psychosocial demands in one's work, and of having only limited social support at work and little influence over one's work situation, as well as possessing a high degree of neuroticism and a low degree of extraversion, tend to be linked with the feeling of having a very heavy workload and of being subjected to very strong physical demands in one's work. A certain check on the validity of the results obtained is provided by taking account of social desirability tendencies to answer questions in a manner aimed at achieving social approval, instead of simply giving true and honest answers to questions.

Material and method

Subjects

A group of 121 of the 152 dentists working at dental clinics in the county of Jönköping, Sweden agreed to participate in the study, 24 of whom had also participated in the earlier studies of ours described above (15, 16, 17). Some of the 31 dentists who did not participate were engaged in an educational programme that hindered their taking part, and others had technical difficulties with the web programme for data collection described below. Insufficient information was available for conducting an adequate analysis of the characteristics of this drop-out group. After the exclusion of participants who had failed to fill out the questionnaire described below, a final sample of 77 dentists, 36 of them males and 41 females, remained. The mean age of this sample was 48 years (95% CI 46 to 50 years, range 25 to 64 years), and their mean period of employment was 18 years (95% CI 16 to 21 years, range 0.5 to 39 years). Sixty-six percent of those in the sample worked at least full-time (40 hours/week), 44 percent doing frequent overtime work. Ninety-nine percent were employed permanently. No significant differences for any of the variables were obtained between the final sample and those who failed to fill out the questionnaire (n=44), except that this latter group had been employed for a longer period of time (mean=18.09 years, 95% CI 15.47 to 20.71 years as compared with mean=13.27 years, 95% CI 9.63 to 16.92 years, $p = 0.03$).

Questionnaire

The questionnaire was distributed to the participants on the web by means of the program Esmaker Nx. It contained items concerning 1) demographic data, 5 items; 2) physical demands (e.g., "Does your work normally include tasks that require good vision?") and workload (e.g., "Are monotonous positions or constraints on moving freely common in your work?"), 7 items; 3) social support at work (e.g., "How helpful and cooperative do you experience your fellow workers as being?"), psychosocial work demands (e.g., "Is the psychosocial workload you're faced with more than you feel you can handle properly?"), and control over one's work (e.g., "Are you able to influence how your work is organized and how you carry it out?"), 14 items; it likewise contained 4) the Eysenck Personality Questionnaire (EPQ-r) and 5) the Marlowe Crown SD-scale, both described below. The assessments for 2) and 3) were made on a 10-cm visual analogue scale (V.A.S.), low values indicating good working conditions, except in the case of social support and control over one's work situation, for which high values indicated good working conditions. The items for 2) and 3) were selected on the basis of factor analyses reported in an earlier study of ours (15).

The personality questionnaire

The Eysenck Personality Questionnaire (EPQ) was employed for assessment of neuroticism (24 items, e.g.,"Are your feelings easily hurt?"; "Do you often feel ´fed up`?"; "Are you an irritable person?") and extraversion (23 items, e.g., "Are you a talkative person?"; "Do you have many friends"; Would you call yourself happy-go-lucky?"). The response format to each of the items is "Yes" or "No", higher scores indicating stronger neuroticism and stronger extraversion, respectively.

The Social Desirability Scale

The Marlowe-Crown SD-scale (MCSD) was used to measure social desirability tendencies. This scale consists of 33 items (e.g., "I never hesitate to go out of my way to help someone in trouble", "I can remember "playing sick" to get out of something", the latter item being reversed in scoring). A higher score indicates stronger social desirability tendencies (minimum = 0, maximum = 33).

Statistics

Statistical analyses included mean, dispersion in terms of the 95 percent confidence interval (95% CI), range and calculations with two-tailed t-tests for independent samples, Mann-Whitney U-tests, Pearson correlation coefficients and Spearman rank correlations and multivariate regressions analyses. Unless the difference between the results of the parametric and the non-parametric method was to be examined, only results of parametric methods are presented. A significance level of $\alpha=0.05$ was employed, the statistical calculations being carried out using SPSS, version 15.0.

Results

Descriptive data for physical demands, workload, and the psychosocial and personality variables for the group of 77 dentists is presented in Table 1. Note that particularly high values were obtained for physical demands, workload and social support. There were no significant differences between males and females regarding any of the variables.

Correlations between the physical demands and workload variables and between these and the other variables are presented in Table 2. There was no significant gender differences in terms of the correlations obtained. There were rather clear correlations between physical demands, workload and psychosocial work demands.

Two multiple regression analyses were carried out, physical demands being treated as the dependent variable in the one and workload as the dependent variable in the other. Psychosocial work demands was the variable with the highest level of explained variance in relation to physical demands (Table 3).

Psychosocial work demands was found also to be the variable with the highest level of explained variance in relation to workload (Table 4).

Table 1. Descriptive data in terms of means, 95 percent confidence intervals (95% CI) and range.

n=77	Mean	CI95%	Range
Physical demands (1-10)	9.57	9.44-9.70	7.8-10.0
Workload (1-10)	8.56	8.19-8.92	1.7-10.0
Social support (1-10)	8.05	7.73-8.37	2.4-10.0
Psychosocial work demands (1-10)	6.91	6.55-7.28	2.6-10.0
Control over work situation (1-10)	6.59	6.20-6.99	2.3-10.0
Neuroticism (0-24)	7.82	6.56-9.09	1.0-23.0
Extraversion (0-23)	12.22	11.09-13.34	1.0-21.0
Social desirability (0-33)	18.25	17.21-19.29	8.0-31.0

Table 2. Pearson correlation coefficients of physical demands and workload with each other and with psychosocial work environmental factors, personality traits, and social desirability.

n=77	Workload	Social support	Psychosocial Social work demands	Control of one's work	Neuroticism	Extraversion	Social Desirability
Physical demands	0.51**	0.08	0.44**	0.03	0.02	-0.02	-0.05
Workload		0.09	0.42**	-0.25*	0.22	-0.25*	0.07

*=p<0.05 **=p<0.01

Table 3. Multiple regression analysis using physical work demands as the dependent variable, standardized Beta coefficients and p-values being shown.

n=77 Variables added to the model	Standardized Beta coefficients	p
Social support	0.18	0.12
Psychosocial work demands	0.50	<0.001 ***
Control over one's work situation	0.10	0.40
Neuroticism	0.03	0.83
Extraversion	0.10	0.41
Social desirability	-0.04	0.75

Overall adjusted R2 =0.17

Table 4. Multiple regression analysis using workload as the dependent variable, standardized Beta coefficients and p-values being shown.

n=77 Variables added to mode	Standardized Beta coefficients	p
Social support	0.22	0.05
Psychosocial work demands	0.40	<0.001 ***
Control over one's work	-0.22	0.04*
Neuroticism	0.17	0.13
Extraversion	-0.14	0.22
Social desirability	0.13	0.20

Overall adjusted R2 =0.27

Discussion

Several theories concerning relations between workload and physical demands, on the one hand, and psychosocial work-related factors, on the other, have been developed. The theory employed in the present study in examining these relations was the Demand-Control-Support model (DCS) of *Karasek &Theorell* (14), account being taken of the psychosocial work environmental factors of psychosocial demands, social support, and the assessed possibilities of influencing one's work situation. In addition, relations to personality traits and to social desirability tendencies were taken into account.

As in our earlier studies (15, 16), very high values were obtained for perceived workload and physical work demands. There was also a reasonably strong positive correlation between these two variables. Higher workload scores were found among those who made higher estimates of the psychosocial demands their work involved, felt they had less control over their work situation, and were less extraverted. Making higher estimates of the psychosocial work demands one was faced with was also found to be related to the reporting of strong physical work demands. At the same time, the personality variable of neuroticism, a variable that showed rather low values in the group of dentists studied here, showed no relation to either workload or physical work demands. Neither perceived social support nor social desirability correlated to an appreciable extent with perceived workload or physical demands. The lack of any appreciable correlation of workload and physical demands with social desirability speaks strongly for neither of these first two variables, which are of central interest here, being affected appreciably by any tendency to answer questions in a socially desirable way.

Reasonably high values were also evident for psychosocial work demands, the variable that showed the strongest relationship to both workload and physical work demands. These high ratings by the dentists suggest them to often be faced with a highly stressful and demanding work situation, one which in the long run could have a negative impact on their health and well-being. The relationship between high levels of psychosocial work demands and adverse physiological reactions in the human body is well supported in the literature. In the Bristol Stress and Health at Work Study (22) stressors of this type were found to be more pronounced in a "high stress" group. In other studies, strong psychosocial demands have been found to increase the risk of bodily and mental health problems (1, 3, 8, 9, 11-13, 18, 19, 23-26) and to be conducive to strenuous work techniques being adopted (1) and to work-induced cognitive impairments developing (23).

Having a sense of control over one's work situation was a factor that the dentists rated reasonably high, the reporting of a lesser degree of workload also being found to be related to it. Having control over one's work situation is claimed to have a buffering effect against the dangers of a potentially harmful work situation (14, 23).

Although social support is known to be one of the most important environmental resources of the individual and its stress-buffering effect is well-documented (23, 27), it is rather surprising that, in contrast to what could be hypothesized in connection with the DSC model of *Karasek & Theorell* (14), perceived social support showed no appreciable relationship to workload or physical demand assessments. However the marked degree of social support the dentists felt they had at work can be thought to have contributed considerably to making their work situation less harmful.

Although these examples of relations between psychosocial demands and health risks mentioned above, dispositional characteristics such as coping, not measured in this study, are of great importance considering the interplay between workload, psychosocial work demands, and health. For example, persons who have a richer repertoire of coping strategies and are able to shift more readily between problem-focused and emotionally focused coping strategies, and to do so in an adaptive way are better off when exposed to potentially harmful working conditions (2, 7, 20). Being more sociable, active, optimistic, and inclined to experience positive affects, and thus being more extraverted, can have strongly beneficial effects on the individual in its leading to the use of more adaptive strategies for coping with the work environment. Extraversion was found here to be related to the reporting of lesser workload. It has also been found that extraverted individuals show a greater likelihood of seeking support when faced with a stressful situation (28). Finally as in two earlier studies of ours, very high values on a 10-point V.A.S. scale were reported for perceived workload and physical work demands. The group of dentists studied here, perceived a stressful work situation involving a high workload and high physical work demands, in conjunction with strong psychosocial work demands and a low degree of control over their work situation. Nevertheless, the high degree of so-

cial support they reported may have gone far in reducing the harmfulness of their work situation.

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