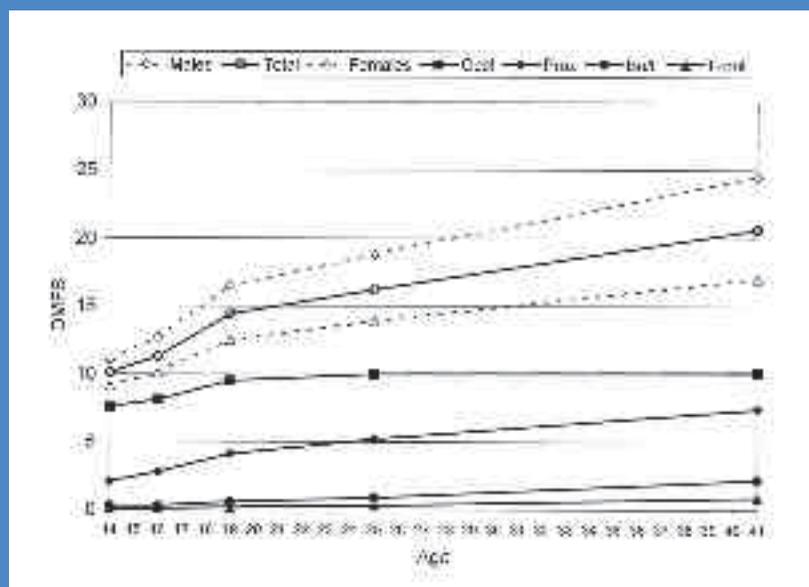


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A longitudinal study of dental health from the age of 14 to 41

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Instructions to authors

Introduction

Swedish Dental Journal, the scientific journal of The Swedish Dental Association and the Swedish Dental Society, is published 4 times a year to promote practice, education and research within odontology. Manuscripts containing original research are accepted for consideration if neither the article nor any part of its essential substance has been or will be published elsewhere. Reviews (after consultations with the editors), Case Reports and Short Communications will also be considered for publication. All manuscript will be exposed to a referee process.

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Book:

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Comparison of individual prediction of treatment outcome made by a TMD specialist and a TMD-trained general dental practitioner in patients with temporomandibular disorders

BERTIL SUNDQVIST¹, BENGT WENNEBERG², TOMAS MAGNUSSON^{3,4}

Abstract

© The aim of this study was to investigate if a TMD-trained general dental practitioner could individually predict actual treatment outcome in selected patients diagnosed with temporomandibular disorders (TMD) with similar results as a TMD specialist. The patients were examined, individually predicted, treatment planned, treated and had their treatment outcome evaluated by the therapist, respectively.

Out of 2618 patients referred to a TMD specialist clinic, 1086 patients started treatment. They were all divided into *Muscle* or *Mainly TMJ* symptoms. Prediction of the treatment outcome as *Good* or *Dubious* was based on the patient's history, the clinical and, sometimes, radiological findings. The degree of improvement was graded using a Numeric Rating Scale 0 - 100. A clinically important improvement, defined as an improvement of initial complaints of 50% or more, was judged as a correct prediction of Good treatment outcome. Seven-hundred-sixty-nine patients treated by the TMD specialist (Sample 1) was compared with 164 patients treated by the TMD-trained general dental practitioner (Sample 2).

For patients with *Muscle* symptoms in Sample 1, a 50% improvement or more was reached by 93% of those predicted *Good* and 57% of those predicted *Dubious*. The corresponding figures in Sample 2 were 100% and 82%, respectively. In Sample 1, patients with *Mainly TMJ* symptoms reached a 50% improvement or more in 94% of those with prediction *Good* and 73% of those predicted *Dubious*. In Sample 2 the figures were 100% and 87%, respectively.

A TMD-trained general dental practitioner could individually predict treatment outcome with similar results as a TMD specialist in selected patients diagnosed with TMD. Whether the method is possible to generalize has to be investigated further.

Key words

Clinical trial, craniomandibular disorders, occlusal adjustment, occlusal splints, quality improvement, prediction.

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Jämförelse av individuell prediktion av behandlingsresultat mellan en specialist i bettfysiologi och en bettfysiologiskt tilläggsutbildad allmänpraktiker hos patienter med störd käkfunktion

BERTIL SUNDQVIST, BENGT WENNEBERG, TOMAS MAGNUSSON

Sammanfattning

☉ Syftet med studien var att undersöka om en bettfysiologiskt tilläggsutbildad allmänpraktiker kunde prediktera faktiska behandlingsresultat på individnivå vid störd käkfunktion med likvärdigt resultat som en specialist i bettfysiologi när specialisten valt ut patienterna. Patienterna undersöktes, predikterades individuellt, terapiplanerades, behandlades och fick behandlingsresultatet utvärderat av respektive terapeut.

Av 2618 patienter som remitterats till en specialistklinik för bettfysiologi påbörjade 1086 behandling. Patienterna indelades i två grupper; käkmuskelbesvär eller huvudsakligen käkledsbesvär. Den individuella prediktionen av behandlingsresultatet God respektive Osäker baserades på anamnes, kliniska och, ibland, radiologiska fynd. Besvärsförbättringen utvärderades med en verbal numerisk skala 0 – 100. En meningsfull förbättring definierades som en besvärslindring, jämfört med behandlingsstart, på 50% eller mer, vilket betraktades som en korrekt prediktion God. Sjuhundrasextionio patienter behandlade av specialisten i bettfysiologi (Sample 1) jämfördes med 164 patienter behandlade av allmänpraktikern (Sample 2).

Av patienterna med käkmuskelsymtom i Sample 1, rapporterade 93% av dem som predikterats God och 57% av de som predikterats Osäker en förbättring på 50% eller mer. Motsvarande siffror i Sample 2 var 100% respektive 82%. Bland dem med huvudsakligen käkledsrelaterade besvär nåddes en förbättring på 50% eller mer i Sample 1 av 94% vid prediktionen God och 73% vid prediktion Osäker. I Sample 2 var motsvarande siffror 100% respektive 87%.

En bettfysiologisk tilläggsutbildad allmänpraktiker kunde prediktera individuella behandlingsresultat med liknande resultat som en specialist i bettfysiologi på, av specialisten, utvalda patienter. För att avgöra om metoden är generaliserbar krävs ytterligare studier.

Introduction

Health care organizations worldwide want to know “what works, for whom, when, and at what costs” (37). Quality improvement means development in the measurement of processes and outcomes together with strategies to implement these measures into programs to be generalized in health care. As evidence accumulates, the system of health care needs to learn the mechanisms of quality improvement that are possible to generalize and can be applied and disseminated throughout the health care organizations (37). We have recently presented the results regarding the possibility to predict individually the treatment outcome in patients diagnosed with temporomandibular disorders (TMD) examined, predicted and treatment planned by a TMD specialist and treated by TMD-trained general dental practitioners (40). If it is possible for a TMD-trained general dental practitioner also to examine, individually predict treatment outcome, plan, perform and evaluate the treatment with similar results as a TMD specialist in selected TMD patients, the method may be generalizable to other clinics/practitioners.

It has been claimed that most patients with TMD can and should be treated by general dental practitioners (7). Little is known about how effective general dental practitioners are in treating TMD. Most general dental practitioners in Sweden do not have routines for making TMD diagnoses, deciding therapy, or judging treatment results, but they seem to be familiar with interocclusal appliance therapy (44). However, the indications for therapy in general dental practice, and the decision making process for the choice of different interocclusal appliances, is not well documented (24).

The evidence based medicine began with *Ernest Amory Codman* (20), also called “a man ahead of his time and perhaps ours” (25). He was a Boston surgeon who, during the time period 1911 - 1916, recorded diagnostic and treatment errors in order to improve the end result of the patients care (27). Occlusal treatments are similar with surgical techniques since they may be reproduced fairly constantly with clear definitions of treatment goal. Occlusal treatments may therefore be suitable for quality improvement research.

The hypothesis of this study was that a TMD-trained general dental practitioner, on his own hand, could predict individual treatment outcome in patients diagnosed with TMD with similar results as the prediction made by an experienced TMD specialist,

if the TMD specialist had selected the patients and they both, independently of each other, examined, individually predicted, treatment planned, treated and evaluated treatment outcome. The aim of this study was to evaluate whether this was possible.

Material and methods

The patient sample comprised all 2618 patients referred to the specialist clinic for stomatognathic physiology in Sollefteå/Sundsvall, County Council of Västernorrland, Sweden during the time period 1999 - 2004. All referrals were evaluated by one and the same TMD specialist, and they were separated into two groups: 1; obvious TMD patient to be handled either by the TMD specialist or by a TMD-trained general dental practitioners, and 2; other patients to be handled by the TMD specialist. Ten per cent of the patients rejected an examination because of e.g. spontaneous remission of symptoms, ongoing other treatment and economic reasons. Patients without the co-existence of subjective symptoms and clinical signs of TMD (32%) were also excluded from the investigation. The inclusion and exclusion criteria and the clinical examination methods have been presented in detail previously (39).

Another 13 patients were excluded after the first examination since they were diagnosed with temporomandibular joint (TMJ) clicking without pain and/or locking and no other signs or symptoms of TMD, cases known to have *Poor* treatment outcome (8). Three-hundred-forty-six patients received a treatment plan and the treatment was performed by general dental practitioners. Another 77 patients rejected the suggested treatment.

Based on signs and symptoms of TMD, the remaining 1086 patients were allocated to 2 subgroups using, in principle, the same criteria as defined by Okeson (29) and described in detail previously (40). *Muscle-group*; symptoms and signs of myogenous origin without any symptoms or signs from the TMJs, and *Mainly TMJ-group*; symptoms and signs of mainly arthrogenous origin, respectively.

All patients were also subjected to an individual prediction of treatment outcome made by the TMD specialist (n=890) or by the TMD-trained general dental practitioner (n=196). The prediction was based on all data collected at the first examination, and, in some cases, information from radiographic examinations. The following grades of prediction were used:

Good – high possibility to have an improvement of 50% or more of symptoms after treatment.

Dubious – some possibility to have an improvement of 50% or more of symptoms after treatment.

Poor - hardly any possibility to have an improvement of 50% or more of symptoms after treatment.

Assigned to the prediction-group *Good* were all patients with clinical signs of palpatory tenderness and/or dysfunction in the TMJs and/or masticatory muscles corresponding to TMD symptoms known to respond positively to treatment such as locking or dislocation of the TMJs, pain on movement of the mandible, pain in face or jaws, or difficulties to open the mouth wide (47), as well as patients with tension type headache localized to the temples and/or forehead (14).

The classification of the patients that were determined *Dubious* is here described only in short since it has been reported in detail recently (41):

Subgroup 1: patients suffering from TMD symptoms with no significant improvement at a 4-year follow-up (47).

Subgroup 2: patients with TMD symptoms with prediction *Good* but also illness or diseases known to affect masticatory muscles and/or TMJs (6, 11, 22, 43, 49).

Subgroup 3: patients with clinical and/or radiological signs that might affect treatment outcome; e.g. TMD symptoms but no clinical signs corresponding to the symptoms, i.e. unilateral symptoms and bilateral signs of TMD or vice versa, or patients with gross structural changes in the TMJs due to general diseases or previous fractures, making it impossible to reproduce the retruded contact position (RCP) (31).

Subgroup 4: patients with TMD symptoms with prediction *Good* but also with negative predictors identified in the continuous quality improvement process at our TMD clinic e.g. psychological/psychosocial/psychiatric factors, (3, 13, 32, 48, 51) general illness or disease that affects muscle and/or joints (4, 15, 16, 18, 21, 28, 30, 36) previous trauma in the region of the symptoms (17) and, in patients with internal derangement; sleeping position on the stomach (10) and/or nail biting.

Determined *Poor* were patients with TMJ clicking without pain and/or locking and no other signs or symptoms of TMD (8), patients with orofacial pain and/or headache but no clinical signs of TMD, and patients with tinnitus, impaired hearing, and/or dizziness, without TMD symptoms known to have a good long term treatment outcome (47). This group was not offered any treatment, and they were thus excluded from the investigation.

The individualized treatment performed either by the TMD specialist or the TMD-trained general dental practitioner followed a strict protocol that has been described in detail earlier (39). In short, mostly conservative treatment methods have been utilized such as interocclusal appliances and/or selective occlusal grinding (7).

The definitions of treatment goal was 1; a “well seated” interocclusal appliance, 2; a standardized vertical dimension of the appliance, 3; occlusal stability in RCP, a position defined according to Beyron (5).

A “well seated” interocclusal appliance was defined as an appliance with no visible space between the inner aspects of the appliance and underlying teeth and no tilting or rocking when loaded. The vertical dimension of the interocclusal appliance was defined as a flat plane in the front area irrespective of the type of occlusion with the exception of cases with an anterior open bite. In such cases, the height was fixed to 1-2 mm thickness of the acrylic in the area of the primary contact in RCP. When selective occlusal grinding was performed, it followed the principles described by *Ash & Ramfjord* (2). The treatment goal for occlusal stability was defined as a stable occlusion in RCP on the interocclusal appliance and/or in the dentition measured with double folded 12 μ thin plastic foil in a clamping tweezer. Treatment outcome was evaluated when the treatment goal had been stable for 2 months.

The TMD-trained general dental practitioner had been working at the specialist clinic one day per week during the time period 1998 - 2004. He examined, individually predicted, treatment planned and started treatment in 196 patients. The TMD specialist made the same in a total of 890 patients. All patients were asked not to commence any other treatments or medications that might influence the TMD symptoms during the course of TMD treatment.

At the objective treatment goal, all the patients were asked to grade the degree of improvement of their initial symptoms in the masticatory muscles and/or TMJs i.e. TMJ clicking, headache, feeling of fatigue in jaws or cheeks, pain in face and jaws, difficulties in opening the mouth wide, pain on movement of mandible, tongue pain, chewing difficulties, swallowing difficulties, locking or dislocation of mandible, and/or TMJ crepitation (47). The improvement was recorded in per cent by using a Numeric Rating Scale ranging from 0 - 100 (19). To evaluate the treatment outcome, a 2-graded scale based on the numeric ratings was used. Grade 1: improved 50% or more, Grade 2: improved less than 50%, no change

or impairment of initial symptoms. An improvement of the initial complaints of 50% or more after treatment has been judged to be a relevant change, a clinically important improvement (12), and this was also the cutting point for a correctly predicted treatment outcome (prediction *Good*). The patients were not aware that this limit was the criteria for judging a treatment outcome to be positive.

The patients who were examined, individually predicted, treatment planned, treated and had their treatment outcome evaluated at the objective treatment goal by the TMD specialist were labeled **Sample 1**, and the patients who went through the same procedure performed by the TMD-trained general dental practitioner were labeled **Sample 2**. The agreement between predicted and actual treatment outcome in Sample 1 and Sample 2 was compared.

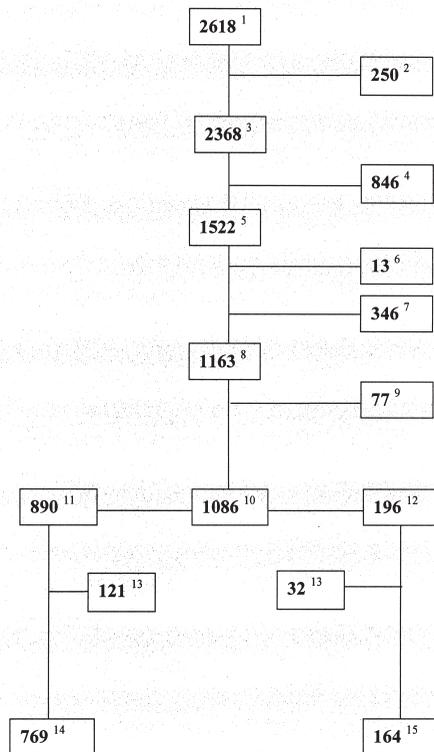
Statistical methods

To test for differences between groups, the chi-square test has been used (35). The levels of significance used were: $p \geq 0.05$, N.S. (not significant), $0.01 \leq p < 0.05$, $0.001 \leq p < 0.01$, and $p < 0.001$.

Results

During the course of treatment, 121 patients (14%) in Sample 1 and 32 patients (16%) in Sample 2 discontinued the treatment ($p = N.S.$). Reasons to discontinue treatment were e.g. inability to wear the appliance, not coming to scheduled appointments, or moved out of the district. A flow diagram of the patient material is shown in Figure 1.

Four-hundred-seventy-five patients in Sample 1 (62%) and 77 patients in Sample 2 (47%) were allocated to *Muscle-group*. The corresponding figures in the *Mainly TMJ-group* were 294 (38%) and 87 (53%), respectively. The difference between the two samples was statistically significant ($p < 0.001$). The distribution of the patients according to subgroup, gender, and age is presented in Table 1. When comparing Sample 1 and 2, there was no statistically



© **Figure 1.** Loss of participants. 1: All referred to the clinic. 2: Rejected examination. 3: Examined. 4: Patients without signs or symptoms of TMD. 5: Patients with signs and symptoms of TMD. 6: Patients with TMJ clicking, not offered treatment because of poor prediction of treatment outcome. 7: Patients treated by general dental practitioners. 8: Patients fulfilling inclusion criteria. 9: Patients rejecting suggested treatment. 10: Patients examined, diagnosed with TMD, individually predicted, treated and evaluated either by a specialist in TMD or one TMD-trained general dental practitioner. 11: Patients who commenced treatment by TMD specialist. 12: Patients who commenced treatment by the TMD-trained general dental practitioner. 13: Patients who discontinued treatment. 14: Patients who completed treatment performed by the TMD-specialist (Sample 1). 15: Patients who completed treatment performed by the TMD-trained general dental practitioner (Sample 2).

© **Table 1.** Comparison of the patients with Muscle or Mainly TMJ symptoms according to gender and age in Sample 1 and 2. Percentage distribution.

Age in Years	Muscle Sample 1			Muscle Sample 2			Mainly TMJ Sample 1			Mainly TMJ Sample 2		
	Female n=381	Male n=94	Total n=475	Female n=59	Male n=18	Total n=77	Female n=245	Male n=49	Total n=294	Female n=68	Male n=19	Total n=87
0-19	6	9	7	12	33	17	21	35	23	10	11	10
20-39	34	35	34	36	22	32	33	31	33	35	11	30
40-59	45	38	44	44	39	43	28	22	27	32	26	31
60-	14	18	15	8	6	8	18	12	17	22	53	29

© **Table 2.** Main treatment/treatments for patients in Sample 1 and 2. Percentage distribution.

Treatment	Sample 1			Sample 2		
	Muscle n=475	Mainly TMJ n=294	Total n=769	Muscle n=77	Mainly TMJ n=87	Total n=164
Only acute treatment	0	1	1	0	0	0
Appliance night wear	38	33	36	27	24	27
Appliance and occlusal adjustment	46	46	46	57	55	57
Only occlusal adjustment	11	13	12	9	11	9
Onlays full time	2	2	2	3	2	3
New complete or partial dentures	1	1	1	3	6	3
FPDs, orthodontics and/or orthognathic surgery	2	3	2	1	1	1

© **Table 3.** Distribution of patients who fulfilled treatment in Sample 1 and 2 according to predicted and actual treatment outcome in subgroup Muscle and Mainly TMJ symptoms. Percentage distribution within brackets.

Degree of improvement	Muscle group Sample 1 n=475		Mainly TMJ group Sample 1 n=294		Muscle group Sample 2 n=77		Mainly TMJ group Sample 2 n=87	
	Prediction		Prediction		Prediction		Prediction	
	Good	Dubious	Good	Dubious	Good	Dubious	Good	Dubious
≥50%	201 (93%)	147 (57%)	183 (94%)	72 (73%)	49 (100%)	23 (82%)	57 (100%)	26 (87%)
<50%	14 (7%)	113 (43%)	12 (6%)	27 (27%)	0 (0%)	5 (18%)	0 (0%)	4 (13%)
	p<0.001		p<0.001		p<0.01		p<0.01	

significant difference in gender distribution neither in subgroup *Muscle* nor in subgroup *Mainly TMJ*. When comparing the age distribution in subgroup *Muscle*, the patients in Sample 1 were statistically significantly older than *Mainly TMJ* patients (*Muscle*; mean age: 44 years, range: 5-85, *Mainly TMJ*; mean age: 39, range: 10-87, respectively; $p < 0.001$). In Sample 2, the figures were reversed; *Muscle* patients were statistically significantly younger compared to those with *Mainly TMJ* symptoms (*Muscle*; mean age: 39 years, range: 12-72, *Mainly TMJ*; mean age: 46, range: 15-79, respectively; $p < 0.01$).

When comparing the age distribution in the two *Muscle* groups and *Mainly TMJ* groups, respectively, the difference between Sample 1 and 2 was statistically significant for both subgroups ($p < 0.05$; $p < 0.05$, respectively).

In subgroup *Muscle*, 215 out of 475 (45%) were predicted Good in Sample 1, and the corresponding figure in subgroup *Mainly TMJ* was 195 out of 294 (66%, $p < 0.01$). In Sample 2, subgroup *Muscle*, 49 out of 77 (64%) were predicted Good, compared to 57 out of 87 (66%) patients in subgroup *Mainly TMJ* ($p = \text{N.S.}$). The difference between Sample 1 and 2 was statistically significant in subgroup *Muscle* ($p < 0.05$) but not in subgroup *Mainly TMJ*.

The different treatment modalities performed

are presented in Table 2. No statistically significant difference in treatment panorama could be found between Sample 1 and 2, neither in subgroup *Muscle* nor in subgroup *Mainly TMJ*.

The average number of visits were similar in Sample 1 and 2; 7 (range 2-25) and 8 (range; 2-20), respectively, with no difference between subgroup *Muscle* and subgroup *Mainly TMJ*.

The comparison between Sample 1 and 2 in respect of predicted and actual treatment outcome in subgroup *Muscle* and subgroup *Mainly TMJ* is presented in Table 3. When comparing prediction Good and actual treatment outcome in subgroup *Muscle* in the 2 samples, there was no statistically significant difference. For patients predicted Dubious, statistically significantly more patients in Sample 2 had an improvement of 50% or more compared to Sample 1 ($p < 0.01$). In subgroup *Mainly TMJ*, there were no statistically significant differences between the 2 samples neither for those predicted Good nor for those predicted Dubious.

A correct prediction of treatment outcome (Good ≥50% improvement, Dubious <50% improvement, respectively) in subgroup *Muscle* was made in 314 out of 475 patients in Sample 1, and in subgroup *Mainly TMJ* the corresponding figures were 210 out of 294 patients (66% and 71%, respectively, $p = \text{N.S.}$). The

figures in Sample 2 were 54 out of 77 patients in subgroup *Muscle*, and 61 out of 87 patients in subgroup *Mainly TMJ* (70% and 70%, respectively. $p = \text{N.S.}$).

Also when comparing the figures for a correct prediction in Sample 1 and 2 for subgroup *Muscle* (66% and 70%, respectively) and subgroup *Mainly TMJ* (71% and 70%, respectively), no statistically significant differences were found.

Discussion

The age and gender distribution of the present patient material, as well as the proportion between patient groups *Muscle* and *Mainly TMJ*, were in accordance with a recent study (1) with a predominance for females (81%) and for *Muscle* symptoms (56%).

Patients in subgroup *Muscle* symptoms in Sample 1 were on average older than those in Sample 2, but in subgroup *Mainly TMJ* symptoms the figures were reversed. The reason for the age difference in subgroup *Muscle* is that it turned out that the TMD specialist had treated proportionally more Dubious *Muscle* cases than the TMD-trained general dental practitioner, and the Dubious *Muscle* cases were on average 4 years older compared to those predicted Good.

The reason for the age difference in subgroup *Mainly TMJ* is that all patients 19 years and younger with TMD complaints have high priority at the TMD clinic, and TMJ related problems are common in adolescents (52). The TMD-trained general dental practitioner worked only one day per week at the clinic, thus the TMD specialist had more opportunities to take care of high priority patients.

It has been estimated that occlusal factors are causative in 10-25% for specific TMD diagnoses (33). Because of these fairly low explanatory values, occlusal adjustment is not recommended as an initial routine treatment (2). However, occlusion can not be ruled out as a predisposing, initiating and/or perpetuating factor in the individual TMD patient (1). In the present sample, this treatment modality was judged to be warranted in 59% of the patients, and in the vast majority of cases it was used as an adjunct therapy to interocclusal appliances.

In Sample 2, the proportion of patients with *Mainly TMJ* symptoms was larger compared to Sample 1 (53% and 38%, respectively). A probable reason for this was that the patients to be treated by the general practitioner were selected by the TMD specialist. From the information in the referrals it was easier to select patients with *Mainly TMJ* symptoms suitable to be treated by the general practitioner compared to

patients with *Muscle* symptoms. In Sample 2, more patients in subgroup *Muscle* that were predicted Dubious reached an improvement of 50% or more compared to *Muscle* patients in Sample 1. The reason was probably the same as previously discussed; patients selected as "difficult cases" were handled by the TMD specialist.

There was an overall better treatment outcome for Dubious cases in subgroup *Mainly TMJ* compared to subgroup *Muscle*. A better treatment outcome in TMD patients with TMJ-related symptoms compared to muscular problems has previously been shown (34). The reason for this difference might be that some of the negative predictors have a greater impact on actual treatment outcome in patients with *Muscle* symptoms compared to patients with *Mainly TMJ* symptoms. This needs to be investigated further.

A useful instrument in quality improvement research is the Plan-Do-Study-Act (PDSA) cycle (23). Prediction is one starting point in the PDSA cycle (26). Robust study designs with rigorous compliance to data collection and implementation can provide understanding of how PDSA quality improvement interventions work in the real situation. Stable processes are candidates for quasi-experimental designs and control charts for measuring interventions (38). A planned experiment is a change to a system in a controlled manner with the purpose of learning. The PDSA cycle and sequential experimentation to develop, test, and implement changes will result in improvement of services (26). The method used in this report is similar with the PDSA cycle.

Many factors other than medical care may influence treatment outcome. One factor that must be considered when observations before and after treatment are compared is the risk for the logic error, *ergo propter hoc*, i.e. after this, therefore, because of this. Spontaneous regression to the mean (50), as well as placebo effects (45), must also be considered. Precautions must thus be taken for several reasons, if valid conclusions are to be drawn from a quality improvement study (9).

It can be questioned if the treatment goal a "stable occlusion in RCP" is an objective or a "quasi objective" factor (42), but since RCP is "the only repeatable and reproducible reference position" of the mandible (5), we judge that this position can be used as an objective goal for treatment.

With the method used in the present study, a TMD-trained general dental practitioner managed to predict treatment outcome and to achieve the

same treatment results with the same accuracy and results as an experienced TMD specialist both for TMD patients with *Muscle* symptoms and patients with *Mainly TMJ* symptoms. However, to compare *one* general dental practitioner with *one* TMD specialist is not the same as claiming the method to be generalizable. The method needs to be tested by other general dental practitioners and TMD specialists. Such studies are in progress.

Most TMD treatment modalities are said to be suitable to be used by general dental practitioners (7), but little is known about TMD treatment outcome when performed by general dental practitioners. In a recent study it was concluded that "interested and suitably trained general dental practitioners can manage four out of five TMD patients with reversible treatment in their own practice" (46). The present report support this opinion.

Is there a need for TMD specialists? Taking the presented results into account, the question is justified. However, the patients treated by the TMD-trained general dental practitioner were all selected by a TMD specialist. Furthermore, TMD-trained general dental practitioners have estimated the need for TMD-specialist assistance to be 2% of the population, while only 0.2% get TMD specialist treatment (53).

In conclusion: A TMD-trained general dental practitioner could predict individual treatment outcome with similar results as a TMD specialist in selected patients diagnosed with TMD. Whether the method is possible to generalize has to be investigated further.

Acknowledgement

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A longitudinal study of dental health from the age of 14 to 41

CLAES-GÖRAN CROSSNER¹, LENNART UNELL²

Abstract

© The aim of present study was to longitudinally follow dental health from the age of 14 to 41. Originally an entire age group attending one of the compulsory schools in the city of Örebro, Sweden was selected and 115 children born in 1962 were included in the study. At the last examination 27 years later, 73 (63%) individuals, 35 males and 38 females, could still be located and were willing to participate. The drop out analysis did not show any statistical difference between the drop-outs and this final material. All participants had experienced a comprehensive whole population based preventive dental care, free of charge, during the first 19 years of their lives, and after that the increment of dental diseases had been limited. Only two individuals were diagnosed with chronic periodontitis at 41, and 70 % of all DMFS registered at 41 were present already at 19. This positive development during adulthood seemed to be unrelated to socio-economic status. In addition, the dental health at 41 did not seem to be obviously influenced by if the participants, as adults, had paid yearly visits to the dentist or not, and there was no evidence supporting that regularly seeing a dental hygienist or using daily inter-dental cleaning would improve dental health. The most obvious difference in dental health at 41 was due to gender where e.g. the experience of proximal caries and bleeding after probing were twice as frequent in males as in females. Based on the results of the present study it can be concluded that uncritically abandoning whole population preventive strategies might not be in the best interest of public dental health. Furthermore, if already existing dental care resources should be reallocated for a better long-term dental health investment it should be on the expense of the young adults to the benefit of the young teenagers (as population sub-groups) and not the other way around based on individual indications.

Key words

Care utilization, dental caries, periodontal diseases, oral health, social determinants

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En longitudinell uppföljning av tandhälsan från 14 till 41 års ålder

CLAES-GÖRAN CROSSNER, LENNART UNELL

Sammanfattning

⊙ Avsikten med denna studie har varit att longitudinellt följa tandhälsan i det permanenta 28-tandsbettet hos den första åldersgrupp som erhöll en komplett populationsinriktad preventiv tandvård under sina 19 första levnadsår. Vården gavs enligt dåtidens gängse normer vid en väl utvecklad folktandvårdsorganisation med utåtriktad verksamhet mot såväl MVC, BVC, förskola som grundskola och gymnasium. Samtliga erbjöds också regelbunden kontroll och fullständig behandling hos tandläkare minst en gång per år. Primärt utvaldes en hel åldersgrupp högstadielärover vid en grundskola i Örebro att delta. Det ursprungliga materialet utgjordes av 115 14-åringar födda 1962. Vid den sista undersökningen 27 år senare var det möjligt att återfinna 73 (63 %) individer, 35 män och 38 kvinnor nu 41 år gamla, som hade medverkat vid samtliga tidigare undersökningstillfällen och som fortfarande var intresserade av att komma för undersökning. Enligt bortfallsanalysen var denna slutliga grupp också fortfarande representativ för det ursprungliga materialet. Generellt sett var sjukdomsutvecklingen efter 19 års ålder mycket låg. Endast två individer hade börjat utveckla en manifest kronisk parodontit vid 41 års ålder och 70 % av alla DMF-tandytor som registrerades vid 41 års ålder fanns redan vid 19-årsundersökningen. Trots den låga sjukdomsutvecklingen var karies i detta material emellertid fortfarande en generell sjukdom som över tid drabbade samtliga individer. Den positiva utvecklingen av tandhälsan under vuxen ålder föreföll vara oberoende av socioekonomisk status och inte heller märkbart påverkad av om man som vuxen hade besökt tandläkare årligen eller ej. Vidare förelåg det i den här studien inga belägg för att vare sig regelbunden uppföljning hos tandhygienist eller daglig approximal rengöring skulle ha någon signifikant påverkan på tandhälsan hos vuxna upp till 40 års ålder. Den mest uppenbara skillnaden i tandhälsa i detta material förelåg mellan könen, där t.ex. männen vid 41 års ålder i medeltal hade dubbelt så höga värden för approximal karies och gingival blödning efter sondering. Sammanfattningsvis antyder resultaten från denna studie att det kan ifrågasättas om den mer eller mindre okritiska nedskärning av det populationsinriktade profylaxarbetet som har skett i Skandinavien under senare tid verkligen ligger i tandhälsans intresse. Vidare framgår det att om redan befintliga tandvårdsresurser skall omorganiseras för att uppnå en bättre tandhälsa bör det ske på gruppnivå inom populationen och då på bekostnad av de unga vuxna till förmån för de unga tonåringarna.

Introduction

Dental caries and periodontal diseases are among the most common human diseases worldwide (15). Using modern terminology they are both typical so called "lifestyle diseases" mainly depending on food habits and oral hygiene procedures. Today, we have fairly good knowledge of the origin as well as the pathogenesis of these diseases and in theory they are both rather easy to prevent. In consequence, during the second half of the 20th century, through a more preventive oriented dental care, there are numerous reports of a continuously improved dental health in Western industrialized countries (5, 11, 14, 16). By the end of the 20th century, however, at least as far as dental caries is concerned, there has been a documented stagnation in this improvement (17, 24). Most probably, the same goes for the periodontal diseases as well (5, 11), but as the vast majority of available epidemiological research is performed on children and adolescents the literature on periodontal improvement is much more scarce. During the recent decades this stagnation in dental health improvement has called for a change in preventive programs from a whole population strategy to a high-risk strategy (18). This implies that due to a low but very uneven distribution of the disease in the society individual-based preventive measures directed to the persons who are at the greatest risk will increase the cost-effectiveness of preventive care. Furthermore, at least in the Scandinavian countries where dental care for children and adolescents is provided free of charge by the government, as a consequence of the relatively low incidence of disease many dental health administrators are presently advocating to combine a high-risk preventive strategy with prolonged recall intervals for children and teenagers. The rationale for such a decision seems mainly to be to try to improve the economy by making children's "free of charge" dental time and resources available for adults who will pay for their dental care.

The aim of the present study was to longitudinally follow the dental health of a group of Swedish teenagers from the completion of the permanent 28-tooth-dentition to the age of 41. This was the first age group receiving a complete whole population based preventive dental care program free of charge, from birth to the age of 20, in accordance with generally accepted norms at the time by the Swedish Public Dental Health Service (PDHS).

Material and methods

Originally an entire age group (118 14-year-old child-

ren born in 1962) attending one of the compulsory schools in the city of Örebro, Sweden was selected. This particular school was chosen as it represented children with different socio-economic backgrounds from the city as well as from the adjacent country side. The baseline examination was performed at a mean as well as median age of 14 years 7 months and follow-up recordings were repeated at the ages of 15 years 10 months (2), 19 years 0 month (3), 25 years 2 months (4) and finally at 40 years 11 months. In the following these recordings are referred to as 14, 16, 19, 25, and 41 years respectively. Three teenagers dropped out before the first follow-up examination, leaving 115 original participants, 57 males and 58 females, to be included in the study. At the last examination 27 years later, 73 (63%) individuals, 35 males and 38 females, could be tracked down and were still willing to participate. This final material has taken part in every examination throughout the entire study-period. They have all approved their participation by written consents and the study design has been approved by the Ethics Committee of Örebro County Council.

The parents of all participants were offered regular information at Child Health Centers concerning food habits, oral hygiene, fluorides, sucking habits, etc. From the age of 3 to 20 they have been called for yearly examinations by their dentists at the PDHS and provided with needed preventive and restorative dental care. This included oral hygiene instructions, dietary information, use of fluoride varnish and recommendations concerning additional home care (e.g. fluoride tablets) whenever these measures were considered necessary. Oral rinsing with 0.2% NaF-solution was carried out in school every two weeks. From pre-school at the age of 6 and throughout the following 9 years of compulsory school the participants as well as their parents were offered dental health promoting lectures/information on a regular basis. Up to the age of 20 all these dental health promoting measures and treatment services including orthodontics were free of charge. After the year of their 19:th birthday, however, they automatically dropped out of this whole population preventive dental care program and had to arrange for their dental care by themselves, either by staying within the PDHS or by visiting a private practitioner. During the main part of the study-period the treatment fees for adults have been the same for both categories of dentists, but since 1999 the authorities do no longer regulate the fees for dental care in Sweden.

Clinical recordings

All clinical recordings during the entire study period have been performed by the authors and conducted under optimal conditions provided by modern dental clinics. The examinations included recordings of the number of teeth in the 28-tooth-dentition, dental caries, gingivitis, gingival bleeding after probing, gingival pockets depths, sub-gingival calculus and proximal loss of attachment. Every clinical examination has been supplemented with posterior bitewing radiographs and every radiograph has been read and agreed on by both authors using a viewer and magnifying glass.

Diagnostic criteria

Dental Caries -- Recording of dental caries (DMFT and DMFS) was performed according to the criteria specified by Koch (12). In this longitudinal study initial caries lesions have not been included in the "D"-values as they are considered, at least to some extent, to be reversible (21). The incidence of recurrent decay was very low at every examination, and as it does not influence the DMF-values "secondary caries" was not included in this study. All recordings of dental caries during the entire study-period have been carried at by the same author (C-GC).

Periodontal status -- The inflammatory state of the gingiva was estimated in accordance with the criteria proposed by Loe & Silness (13). Recordings were performed mesially, buccally and lingually on each tooth and the mesial value was doubled before analyzing the data. Gingivitis was accounted for by recording the number of sites with gingival score ≥ 2 . Gingival pocket depths were measured with a graduated probe (Williams No.4. Ash). At the age of 19 the depths were measured mesio- and disto-buccally and values distally of the second molars were excluded if a deep pocket in this area was found in connection with the eruption of a third molar. At the ages of 25 and 41 the same measurement was made

on 6 sites on each tooth, disto-buccally, buccally, mesio-buccally, disto-lingually, lingually and mesio-lingually. Only pockets ≥ 4 mm were recorded. As an additional registration at 25 and 41 all sites showing bleeding after probing, were recorded. Sub-gingival calculus and loss of attachment were recorded on bitewing radiographs only. Sub-gingival calculus was registered when clearly visible proximally. Loss of attachment was recorded when bone destruction was diagnosed marginally, and the distance from the cemento-enamel junction to the alveolar bone exceeded 2 mm. It was measured with a transparent ruler and included all clearly visible areas from the first premolar mesially to the second molar distally. All recordings of the periodontal status during the entire study-period have been carried out by the same author (LU).

Anamnestic data

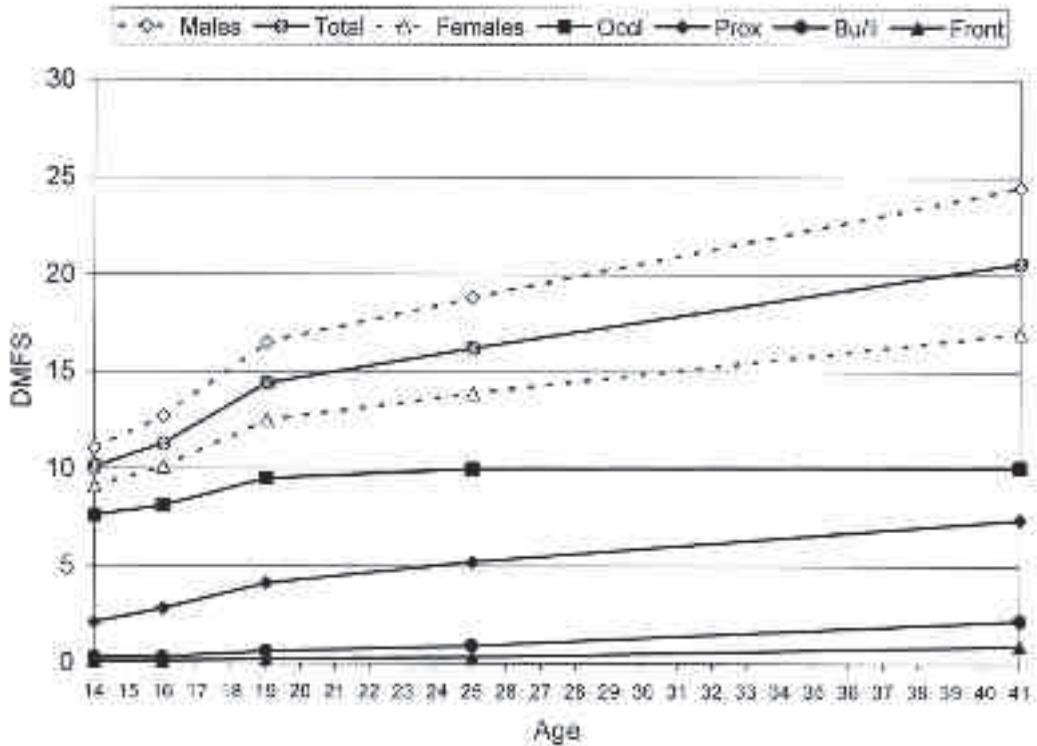
General health conditions at the ages of 14, 16 and 19 were collected from the regular records of the PDHS. At 25 these anamnestic data were supplemented with questions concerning the regularity of dental check-ups after the age of 19 and if the participant had stayed within the PDHS or visited a private practitioner. At 41 more detailed standardized questions were asked concerning; education, occupation, type of employment or entrepreneur, working hours, civil status, perceived general health, use of medications, tobacco habits, satisfaction with their dentition concerning function as well as appearance, oral hygiene habits, name of regular dentist, regular visits to dental hygienists, intervals between dental care visits and experience of dental fear within the compulsory dental care system for children and adolescents at the PDHS.

Statistics

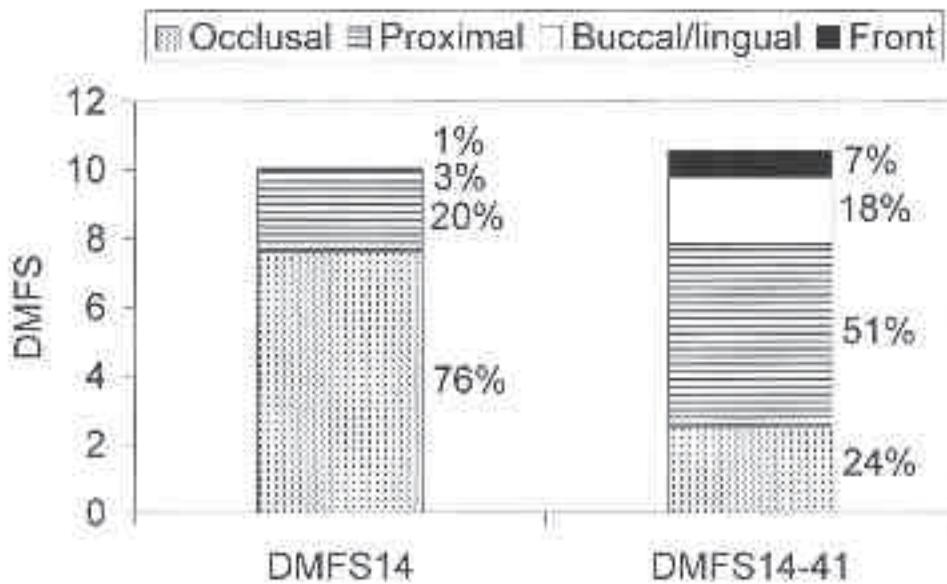
All statistical analyzes were performed with SPSS

© **Table 1.** Mean values and standard deviations (SD) for DMFT and for DMFS in total and on occlusal, proximal and buccal/lingual surfaces of molars and premolars and on all surfaces of incisors and canines in the maxilla and mandible at the ages of 14, 16, 19, 25 and 41. The range is given for the total DMFS value.

Age	DMFT		DMFS				
	Mean \pm SD	Total Mean \pm SD	Range	Mol. & premol.			Inc. & can. Max.+Mand. Mean \pm SD
				Occlusal Mean \pm SD	Proximal Mean \pm SD	Bucc./ling. Mean \pm SD	
14	7.7 \pm 2.9	10.1 \pm 5.1	1-32	7.6 \pm 2.7	2.1 \pm 3.0	0.3 \pm 0.6	0.1 \pm 0.4
16	8.4 \pm 2.9	11.3 \pm 5.9	1-35	8.1 \pm 2.8	2.8 \pm 3.7	0.3 \pm 0.6	0.1 \pm 0.4
19	9.8 \pm 3.9	14.4 \pm 8.4	1-50	9.5 \pm 3.1	4.1 \pm 4.9	0.6 \pm 1.7	0.2 \pm 0.6
25	10.4 \pm 3.5	16.2 \pm 9.0	1-53	10.0 \pm 3.0	5.2 \pm 5.8	0.9 \pm 1.9	0.3 \pm 0.9
41	11.0 \pm 4.1	20.6 \pm 11.2	1-53	10.1 \pm 3.1	7.4 \pm 6.4	2.2 \pm 2.4	0.9 \pm 1.5



© Figure 1. Caries increment between the examinations at the ages of 14, 16, 19, 25 and 41 in total and for males and females. The total increment is also given for occlusal (Occl), proximal (Prox) and buccal/lingual (Bu/li) surfaces of molars and premolars and on all surfaces of incisors and canines in the maxilla and mandible (Front).



© Figure 2. Caries experience at the age of 14 (DMFS 14) and caries increment between the ages of 14 and 41 (DMFS 14-41), with a distribution in percentage on occlusal, proximal and buccal/lingual surfaces of molars and premolars and on all surfaces of incisors and canines in the maxilla and mandible (Front).

13.0 for Windows using Student's t-test and Pearson Chi-Square test. Statistical significance was set at $p \leq 0.05$.

Drop-outs

All available data have been analyzed and no statistical differences could be identified between the 42 drop-outs and the 73 final participants. Possibly, however, a weak tendency towards an inferior dental health among the drop-outs could be noted. E.g. the baseline total DMFS-value at the age 14 was 11.9 ± 7.9 for the drop-outs compared to 10.1 ± 5.1 for the final material. The corresponding figures for the baseline values of the number of sites with gingival score ≥ 2 at the age of 16 were 7.1 ± 7.9 and 5.9 ± 6.3 respectively.

Results

Dental caries.

The experience and increment of dental caries, in total as well as subdivided into different tooth surfaces, are presented in Table 1 and Figures 1 and 2. Already at the baseline examination there was a gender difference in caries prevalence, females having the lower value. This difference escalated consistently during the entire study period (Figure 1) and became statistically significant at the age of 19. At 41 the mean DMFS score proximally on molars and premolars was twice as high for males in comparison to females (10.0 ± 7.0 resp. 5.1 ± 4.9 , $p < 0.001$).

Due to a few congenitally missing premolars together with some extractions for orthodontic reasons the mean number of molars and premolars included in the DMFS scores in this material was 15.3. Of all available occlusal surfaces 34% were still intact at the age of 41, while the corresponding figure for the proximal surfaces of molars and premolars was 76% (Table 1). The vast majority of the remaining tooth surfaces were still healthy and accounted for 15% of the total caries experience at 41 (Table 1). At the age of 41 only 3 teeth within the whole material

were lost as a result of caries.

On average 11 DMF-teeth were recorded at the age of 41 and 70% of these teeth were decayed already at 14 (Table 1), while 735 (49 %) of the total number of 1506 DMFS recordings registered at 41 also were affected at the age of 14. At 14, however, the occlusal surfaces accounted for 76% of the average DMFS-value (Figure 2), and 75% of all the caries involved occlusal surfaces at 41 were decayed or filled already at the age of 14. Only 7% of all available proximal surfaces on molars and premolars were decayed at 14, and carious lesions on remaining tooth surfaces were limited to very small numbers (Table 1, Figure 2).

The total caries increment between 14 and 19 years of age was stable and rather evenly distributed between occlusal and proximal surfaces (Figure 1). After the age of 19, however, new carious lesions developed at a slower but still very stable rate throughout the remaining study period. This was mainly due to a steady increase of proximal lesions (Figure 1), and 51% of the total caries increment from the age of 14 to 41 took place proximally (Figure 2). The only tooth surfaces showing a tendency of an increasing caries increment after the age of 25 were the buccal and lingual surfaces on molars and premolars (Figure 1). No participant was completely caries free at the age of 14 (Table 1) and 69 (95%) individuals experienced new decay during the 27-year study period. After the age of 19, however, 11 (15%) participants did not develop any new carious lesions and the maximum total DMFS score from the age of 19 to 41 was 20.

Periodontal status

Gingivitis expressed as total numbers of sites with score ≥ 2 can be seen in Table 2. The mean value peaked at the age of 19 and was lowest at 41. The males consistently showed a higher degree of gingival inflammation compared to the females and this gender difference was statistically significant at the ages of 19 and 41 (Table 2).

Table 2. Mean values and standard deviations (SD) for the number of sites with gingival score ≥ 2 in total and for males and females at the ages of 14, 16, 19, 25, and 41. The range is given for the total mean value and the p-value for the statistical difference between the sexes

Age	Number of gingival scores of ≥ 2				
	Total		Males	Females	p-value
	Mean \pm SD	Range	Mean \pm SD	Mean \pm SD	
16	5.9 \pm 6.3	0-24	5.9 \pm 6.3	5.8 \pm 6.3	N.S
19	7.0 \pm 8.8	0-35	10.1 \pm 10.8	4.1 \pm 5.2	<0.01
25	5.0 \pm 8.6	0-55	5.4 \pm 6.1	4.7 \pm 10.4	N.S
41	3.3 \pm 8.1	0-44	5.6 \pm 11.0	1.2 \pm 2.5	<0.05

Gingival pocket depth of ≥ 4 mm was found in 21 % of the participants at the age of 19, but only in low numbers and the total mean value was below 0.5. At the age of 25 pockets of ≥ 4 mm could be registered in 81 % of the participants and the mean value had increased to 6.5 ± 10.6 with a range of 0 – 68. However, at 41 the mean value had decreased again to 2.7 ± 6.5 with a range of 0 – 35, and at that age 60 % showed no sign of pockets of ≥ 4 mm. Males consistently showed higher values but this gender difference was never statistically significant. The presence of gingival pockets of ≥ 4 mm was positively related to high numbers of sites with gingival score ≥ 2 ($p < 0.001$) at the ages of 19 and 25 as well as at 41.

Bleeding after probing was registered in all but two participants at the age of 25 with a mean number of 10.0 ± 8.2 (range 0–44), and the number of bleeding points was significantly correlated to the number of sites with gingival score ≥ 2 ($p < 0.001$). At the age of 41 the number of individuals showing no sign of bleeding had increased to 20 (27%), but the mean value of bleeding points had still increased to 12.0 ± 18.8 (range of 0–82). At 41 bleeding after probing was more than twice as common in males (16.9 ± 24.1) compared to females (7.5 ± 10.3) ($p < 0.05$).

Sub-gingival calculus was registered in 9 participants at the age of 16. The corresponding figures for the ages of 19, 25 and 41 were 15, 13 and 4 respectively.

Loss of attachment was diagnosed in one subject, but not the same individual, at the ages of 16 and 19, while at 25 it was registered in 7 participants. In these ages, however, no generalized loss of attachment could be found and the recordings were verified on single sites only. At the age of 41 5 subjects were registered with loss of attachment and two of them fulfilled the criteria to be diagnosed as generalized chronic periodontitis with 6 respectively 12 sites of marginal bone loss. Both subjects were males and none of them had shown any local site of attachment loss or any other indication of periodontitis at earlier examinations, but at the age of 41 they had 75 and 44 registrations of gingival bleeding.

Anamnestic data

The baseline total mean DMFS value at the age of 14 for the 43 (59%) individuals with no post high school education was 11.2 ± 5.1 compared to 8.4 ± 4.9 for the remaining material with higher education ($p < 0.05$). This difference was significant at the same level at the age of 16 as well, but after that there were

no statistically significant differences in any variables of dental caries due to education. Concerning periodontal status the only significant difference between low and high education occurred for the mean values of sites with gingival score ≥ 2 at 19 (9.4 ± 10.1 resp. 3.6 ± 5.0) ($p < 0.01$).

The different occupations of the participants were categorized according to the Socio Economic Classification (SEI) in Sweden (25) and resulted in 19 “blue collar workers”, 9 “lower white collar workers”, 32 “higher white collar workers”, 7 “entrepreneurs” and 6 “adult students”. These occupation categories were dichotomized in every possible way but no statistically significant differences could be found for any of the recorded variables of dental caries and periodontal status throughout the entire study period. This was still the case when occupation was combined with full time or part time (< 35 hrs/week) working hours (61 and 11 participants respectively, 1 was unemployed).

All but two participants were married or cohabiting and only two individuals reported themselves as not healthy. Six were on daily medication, but no deviant values could be found for these persons, neither concerning dental caries nor periodontal status. Only 5 (7%) were daily smokers, while 57 (78%) stated that they had never smoked. The corresponding figures for moist snuff were almost identical, 6 and 58 respectively.

Everyone was either very satisfied (44) or satisfied (29) with the function of their teeth and stated that they could chew all different kinds of food. Four participants, however, were not satisfied with their dental appearance.

Everyone reported daily use of toothbrush and 67 (92%) brushed their teeth more than once a day. Fluoridated toothpaste was also used daily by everyone but one person who used it once a week only. Daily inter-dental cleaning was performed by 19 (26%) participants, 12 using toothpicks and 7 using dental floss. There was no gender difference concerning daily inter-dental cleaning and no statistically significant difference between this group and the rest of the material, neither regarding dental caries nor periodontal status.

Yearly, or more frequent, regular dental visits were reported by 39 individuals, while 30 paid a visit for dental care every second year. The remaining 4 participants visited a dentist on an emergency basis only. Of those who paid regular visits to the dentist at least every two years, 43 were still patients within the PDHS at the age of 41, while 26 (38%) had preferred

to change to a private practitioner. No statistically significant differences could be noted in any of the variables concerning dental health, neither between the group receiving dental care every two years and those who visited the dentist more often, nor for the patients attending the PDHS in comparison to those who had chosen the private sector. 13 (18%) individuals stated that they paid regular visits to a dental hygienist. Compared to the rest of the material no significant difference for any of the recorded dental health variables could be found for this group, neither concerning dental caries, nor periodontal status.

Dental fear during their childhood/school dental care period was experienced by 24 (33%) participants, and by 7 of them at several occasions. This experience, however, had not resulted in any notable differences in dental health or attendance to dental care later in life.

Discussion

Being able to keep track of and persuade 63 % to participate over a 27-year study period must be considered acceptable and the drop out analysis did not show any statistical differences between the drop-outs and the final material. Furthermore, the distribution of the final material among the different levels of education and occupation categories was in accordance with the total Swedish population (26), and the caries experience as well as the periodontal status at the age of 41 was similar to other reports of comparable samples (11). These are facts indicating that the present material was no extreme group. On the contrary, although rather small it might still be fairly representative for the population born in Sweden at that time (1962) including comparatively few immigrant parents. For further benefit of the credibility of the present study the same two investigators had performed all the examinations throughout the entire 27-year study period, using the same criteria, the same kind of examination probes, and having saved and kept all radiographs for longitudinal calibration purpose.

In agreement with other recent studies (20) the status of dental health proved to be better in females than in males. This gender difference was notable already at the age of 14 and escalated slowly but steadily throughout the entire study period, and at 41 the experience of proximal caries and bleeding after probing were twice as common in males as in females.

More than two thirds of the DMFT score and half

of the DMFS score registered at the age of 41 were recorded already at 14, and after having left the free of charge and preventive oriented dental care at the age of 20 the increment of dental caries must be considered as low. Even for the most extreme individual it was less than one new lesion yearly. The majority of new lesions after 20 were registered on proximal surfaces and the DMFS increment on buccal and lingual surfaces of molars and premolars during this period was mainly not due to caries but to restorations of buccal tooth brushing defects and the placement of some crowns. Over time, however, even in this material with a low incidence, dental caries was proven to be a very general disease. Everyone had experienced dental decay at the age of 14, and only 4 individuals did not develop any new lesions during the 27-year study period.

The socio-economic influence on dental health, often reported to be an important risk indicator (9, 10, 15), could be verified at the beginning of this investigation. Those who stated higher education at the age 41 showed a significant lower incidence of caries as teenagers up to the age of 16, but later in life, as adults, neither education, nor occupation seemed to be related to caries, gingivitis or periodontitis.

Gingival pockets recorded in teenagers/young adults did not seem to be an indication for future development of periodontal disease. They were, however, significantly correlated to the number of sites with gingival score ≥ 2 and should rather be interpreted as a sign of gingivitis due to edema of the marginal gingiva, and according to today's knowledge gingivitis and periodontitis should be looked upon as two separate entities (19, 23). A single site of loss of attachment registered on radiographs could not either be used as an indicator for an onset of periodontal disease. In the present material, as has been shown in other studies on dentally educated populations (1, 11), the first signs of a manifest chronic periodontitis were seen around the age of 40. As a matter of fact, none of the two subjects diagnosed with chronic periodontitis at 41, had had any earlier clinical or radiographic recordings indicating an initiating disease.

Bleeding after probing seemed to change over the adult years. At 25 it was a more general finding registered in all but two participants being a sign of gingivitis, while at the age 41 27 % showed no bleeding, and still the mean value had increased. Most likely, as a result of an improved oral hygiene during adulthood the gingival health had improved verified by a decrease in the number of sites with gingival

score ≥ 2 , in the number of deep pockets and in the number of individuals with no gingival bleeding. At the same time the mean value of bleeding points increased due to a smaller group with a very high bleeding index, maybe indicating an early sign of a developing periodontal disease. This was indeed true for the two subjects diagnosed with chronic periodontitis.

In the present material no differences in dental health could be verified depending on if the participants had stayed within the PDHS or if they after the age of 19 had preferred to choose the private sector. Interesting findings were that there was no evidence supporting that daily inter-dental cleaning would improve dental health, and that it did not seem to matter if the participants as adults had paid yearly visits to the dentist or not. Furthermore, regularly having seen a dental hygienist between the ages of 20 and 40 did not seem to notably have influenced the dental health.

It can be concluded that increment of dental diseases from the age of 20 to 41 had been limited, and that this positive development during adulthood, in the present material representing a homogeneous Swedish population with almost no immigrants, seemed to be unrelated to socio-economic status. The present study, however, is a longitudinal epidemiologic survey with no available control group and consequently it would not be possible to state that this positive development during adulthood was due to the whole population preventive strategy based dental care, free of charge, which these participants had experienced during the first 19 years of their lives. On the other hand, it is quite reasonable to assume that the preventive dental care/education they had received as children and teenagers might have had a lifelong impact regardless of socio-economic conditions and the frequency and type (public/private, dentist/dental hygienist) of the dental care they had required as adults. Another good example indicating a positive effect of the population-based health care given to this generation was the very low usage of tobacco.

The prerequisite for a successful high-risk strategy is to be able to accurately identify the subjects who are at high risk and to find methods that are appropriate, effective and feasible in bringing down the elevated risk for these subjects (8). From clinical experience as well as by reviewing the literature (7) it seems difficult to make an acceptable risk assessment and maybe even harder to turn around individual risk indicators such as poor knowledge, un-

awareness, cultural attitudes, compliance, lifestyle, etc. So far, according to our knowledge, there are no convincing reports on a long lasting successful cost-effective high-risk strategy program in dentistry. On the contrary, by abandoning many whole population preventive measures in the Scandinavian PDHS such as information to parents at Child Health Centers, weekly reminders on dental health in combination with fluoride rinses in schools, yearly recall examinations, etc. there is evidence for a reversal in the decline of dental caries among children (6). This recent development (or rather lack of development) supports the opinion that oral health inequalities will only be reduced through the implementation of effective and appropriate oral health promotion policies, while individual treatment services never will successfully tackle the underlying cause of oral diseases (22).

In spite of the relatively low incidence and increment in the present material, over time, dental caries was proven to be a very general disease more or less affecting everyone. Consequently, regardless of the scientific evidence of the effect of the whole population preventive strategy it must be considered questionable to uncritically abandon a by clinical experience well functioning dental care system to the benefit of an individual high-risk strategy that so far has failed to be proven successful (7). To liberate dental care resources for adults on the expense of the age group with the highest incidence of disease seems to be a short-term approach based more on economical than odontological indications and profit. Since the individual risk factors can not be accurately identified an implementation of a high risk preventive strategy should not be focused on risk individuals but rather on high risk groups within the population (8). According to the present results, if already existing dental care resources should be reallocated for a better long-term dental health investment it should be on the expense of the young adults to the benefit of the young teenagers (as population sub-groups) and not the other way around based on individual indications. Especially the 20 to 40-year-old females seemed to be doing very well on their own with only a minimal need for professional assistance as a supplement to their home care. The prerequisite, however, might most probably be a good whole population based preventive dental care/education earlier in life.

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Development and evaluation of a comprehensive screening for orofacial dysfunction

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Abstract

© The aim was to develop a comprehensive screening instrument for evaluation of orofacial dysfunction that was easy to perform for different health professionals without special equipment. *The Nordic Orofacial Test - Screening* (NOT-S), consisting of a structured interview and clinical examination, was developed with a picture manual illustrating the different tasks in the examination. It was first tested in a Swedish version, and later translated to other Nordic languages, and to English.

The interview reflected six domains, (I) Sensory function, (II) Breathing, (III) Habits, (IV) Chewing and swallowing, (V) Drooling, and (VI) Dryness of the mouth, and the examination included six domains representing (1) The face at rest, and tasks regarding (2) Nose breathing, (3) Facial expression, (4) Masticatory muscle and jaw function, (5) Oral motor function, and (6) Speech. One or more “yes” for impairment in a domain resulted in one point (maximum NOT-S score 12 points).

The mean NOT-S score (\pm SD) in 120 patients (3–86 yr), referred to five centers for specialized dental care or speech and language pathology in Sweden, Norway and Denmark, was 4.1 ± 2.6 , and 0.4 ± 0.6 in 60 control subjects (3–78 yr). The screening was easy to administer and the time spent 5–13 min. The scores from the clinic-referred sample differed significantly from the controls, and the sensitivity of the screening was 0.96 and specificity 0.63. Repeated evaluations of videotapes of 20 patients by 3 examiners, speech-language pathologists and dentists, with at least two-week intervals, showed inter- and intraexaminer agreement on the points given in the domains at respectively 83% and 92–95% which increased after recalibration to 85% and 95–99%. Kappa values for interexaminer agreement on the NOT-S scores were 0.42–0.44 (i.e. fair), and the method error was 5.3%. To conclude, NOT-S gave a reliable and valid screening for orofacial dysfunction.

Key words

Oral disability, screening, speech, mastication, swallowing.

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Utveckling och utvärdering av ett screeninginstrument för orofacial funktion

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Sammanfattning

☉ Syftet var att utveckla ett screeninginstrument för orofacial dysfunktion hos individer från tre års ålder som var möjligt att använda för olika yrkesgrupper inom tand- och sjukvård. *Nordiskt Orofacialt Test - Screening* (NOT-S) görs genom en strukturerad intervju och en klinisk undersökning som består av sex domäner vardera. Intervjudelen innehåller domänerna (I) Sensorik, (II) Andning, (III) Vanor, (IV) Tuggning och sväljning, (V) Dregling och (VI) Muntorrhet. I undersökningen ingår följande domäner: (1) Ansiktet i vila, (2) Näsandning, (3) Mimik, (4) Tuggmuskel- och käkfunktion, (5) Oral motorik och (6) Tal. Ett eller flera ja-svar inom en domän indikerar orofacial dysfunktion och ger en poäng (maximal poängsumma = 12). En bildmanual med illustrationer till testuppgifterna har utarbetats. Utprovningen av NOT-S genomfördes med en svensk version som senare översatts till övriga nordiska språk samt engelska.

I studien ingick 120 patienter (3-86 år) som remitterats till fem centra för specialisttandvård eller logopedi i Sverige, Norge och Danmark samt 60 friska kontroller (3-78 år). Medelvärdet (\pm SD) för patienternas poängsumma var $4,1\pm 2,6$ och för kontrollerna $0,4\pm 0,6$. Screeningen diskriminerade signifikant mellan patienter och kontrollpersoner. Den var lätt att genomföra och tog 5–13 minuter. Sensitiviteten uppmättes till 0,96 och specificiteten till 0,63. Inter- och intrabedömarreliabiliteten var 83% respektive 92-95% efter första prövningen men ökade till 85% respektive 95-99% efter rekallibrering. Reliabiliteten beräknades genom upprepade bedömningar av 20 videoinspelningar utförda med minst två veckors mellanrum av två logopedier och en tandläkare. Kappavärdena för interbedömarreliabiliteten var 0,42-0,44 och metodfelet var 5,3%.

NOT-S kan användas som ett instrument för att identifiera orofacial dysfunktion hos barn från 3 års ålder, ungdomar och vuxna. Screeninginstrumentet kan också påvisa hur omfattningen av orofaciala funktionsstörningar varierar mellan individer och mellan grupper. NOT-S är lättadministrerat och screeningen kan utföras av personer med olika yrkesbakgrund efter introduktion och kalibrering.

Introduction

Orofacial function is the result of complex integrated activities of the central nervous system and the neuromuscular system (e.g. 18, 19). It includes a multitude of vital actions such as breathing, chewing and swallowing, and acts as the basis for social interaction in terms of speech, emotional communication, facial expression and appearance. Thus, orofacial dysfunction can be severely disabling. Furthermore, impaired orofacial function is a common feature in many genetic and congenital disorders. It may also be acquired as a consequence of various diseases or trauma. Due to the complexity of these functions several health professions are involved in diagnosing orofacial dysfunction. In such interdisciplinary collaborations and multiprofessional settings there is a great need to establish a mutual language, and with increased demands for evidenced-based practice, also common measures in the evaluation of orofacial function.

Despite considerable efforts to establish common criteria in the assessment of orofacial function, currently, no widely used comprehensive classification of orofacial disability or screening test covering several orofacial functions is available. The obvious lack of common criteria in the assessment of orofacial function was shown in a survey of the different Scandinavian tests available, reported at the *Second Nordic Conference on Orofacial Therapy* in Gothenburg 2002. At this conference a working group was formed with the mission to develop a standardized, comprehensive evaluation instrument for the assessment of orofacial function, primarily as a basis for identification of the type and extent of disability, choice of treatment, and possibly evaluation of outcome. The screening is intended to be used when chewing, swallowing, speech or other orofacial functional difficulties are visible or suspected. A standardized, comprehensive orofacial screening may not only disclose problems in an individual, but also identify the type and frequency of orofacial disability in different syndromes and diseases as well as in different age groups.

The aim of the study was to develop a comprehensive screening instrument for the assessment of orofacial dysfunction and to evaluate its reliability on a test-retest basis. In addition, the ability of the screening to discriminate between disorders should be assessed by the application on a variety of patients with minor to major levels of orofacial disability. Due to the normal cognitive and motor development in children a lower limit at three years

of age was chosen for use of the screening (24).

The screening should fulfill the following criteria:

- Applicable for all individuals from the age of three years and older
- Possible to perform quickly in any examination setting without the use of special equipment
- Easy to use for health professionals with different professional backgrounds.

In addition, it should have a good reliability and give a rough discrimination between normal orofacial function and various degrees of orofacial disability.

Materials and methods

Screening

The first step in the working process was to identify areas of orofacial function where further examination was indicated or imperative. To establish these areas a large survey of the literature was performed (1, 2, 4-15, 17, 19- 31). Characterization of items and domains was based on epidemiological and clinical studies, generally recognized key points, common questions used in the clinic to identify orofacial problems, and generally agreed "clinical knowledge". This resulted in the identification of twelve different domains of orofacial function that needed to be addressed and assessed in the screening. Six domains were assessed through a structured interview, and six in a clinical examination. In the structured interview the domains (I) Sensory function, (II) Breathing, (III) Habits, (IV) Chewing and swallowing, (V) Drooling, and (VI) Dryness of the mouth are assessed, and in the clinical examination (1) The face at rest, and tasks regarding (2) Nose breathing, (3) Facial expression, (4) Masticatory muscle and jaw function, (5) Oral motor function, and (6) Speech. Each domain contained one to five items, thus reflecting the complexity of the specific function. If the answer to one of the questions or the performance on one of the tasks met the criterion for impaired function, the item was recorded as "yes". Any "yes" in a domain gave one point thus indicating a dysfunction in the scored domain. The highest possible total NOT-S score was 12.

The examiners were trained and calibrated by discussions and assessments from video recordings as performed by *Carlstedt et al.* (8). In the structured interview the examiner asked the questions in the *Screening form* (Figure 1), explained, and asked supplementary questions when necessary. The examiner also interpreted the replies based on answers and cri-

NOT-S interview		NOT-S examination	
I	Sensory function		
	A. Does brushing your teeth elicit a gag reflex? Does this happen almost every time? <i>Obvious discomfort such as queasiness, vomiting, or refusal (increased sensitivity).</i>	<input type="checkbox"/>	<input type="checkbox"/>
	B. Do you put so much food in your mouth that it becomes difficult to chew? Does this happen every day? <i>Doesn't know when the mouth is full (decreased sensitivity).</i>	<input type="checkbox"/>	<input type="checkbox"/>
	Breathing		
	A. Do you use any breathing support? <i>CPAP, respirator, oxygen, other.</i>	<input type="checkbox"/>	<input type="checkbox"/>
	B. Do you snore much when you sleep? Does this happen almost every night? <i>Snoring or apnoea. Does not apply to symptoms from asthma or allergies.</i>	<input type="checkbox"/>	<input type="checkbox"/>
II	Habits		
	A. Do you bite your nails, or suck your fingers, or other objects every day? <i>Use of a pacifier and sucking on the fingers is not assessed under 5 years of age.</i>	<input type="checkbox"/>	<input type="checkbox"/>
III	Chewing and swallowing		
	A. Do you suck or bite your lips, your tongue, or your cheeks every day? Do you bite your teeth together hard or grind your teeth during the day? <i>Does not eat with the mouth (nasogastric tube, gastrostomy or other). Skip question B-E.</i>	<input type="checkbox"/>	<input type="checkbox"/>
	B. Do you find it difficult to eat foods with certain consistencies? Exclude allergies and special diets such as vegetarian, vegan, and gluten-free.	<input type="checkbox"/>	<input type="checkbox"/>
	C. Does it take you 30 minutes or more to eat a main meal?	<input type="checkbox"/>	<input type="checkbox"/>
	D. Do you often cough during meals? <i>It happens at almost every meal.</i>	<input type="checkbox"/>	<input type="checkbox"/>
IV	Drooling		
	A. Do you get saliva in the corner of your mouth or on your chin almost every day? <i>Needs to wipe their mouth. Does not apply during sleep.</i>	<input type="checkbox"/>	<input type="checkbox"/>
V	Dryness of the mouth		
	A. Do you have to drink to be able to eat a cracker? B. Do you suffer from pain in the mucous membranes in your mouth or on your tongue? <i>Recurrent pain or burning sensation at least once a week. Does not apply to toothache or vesicles (ulster-like lesions) in the mouth.</i>	<input type="checkbox"/>	<input type="checkbox"/>
	Name/ID:	NOT-S interview	Sum
VI	Code for screening	X = yes 0 = no - = not assessed	Sum
	The NOT-S total score can vary from 0 to 12	If there are one or more X answers in a section, place a score of 1 in the box furthest to the right.	
NOT-S		Total score	<input type="checkbox"/>

1	Face at rest Watch the picture for one minute. Starting now. Observation for a total of 1 minute. Assess A-D.	<input type="checkbox"/>
	Picture 1	
	Description:	
	A. Asymmetry Concerns both the skeleton and soft tissues.	<input type="checkbox"/>
	B. Deviant lip position Open mouth or other deviations more than 2/3 of the time.	<input type="checkbox"/>
	C. Deviant tongue position Tip of the tongue visible between the teeth more than 2/3 of the time.	<input type="checkbox"/>
	D. Involuntary movements Repeated involuntary movements in the face.	<input type="checkbox"/>
2	Nose breathing	<input type="checkbox"/>
	A. Close your mouth and take 5 deep breaths through your nose (smell) Is unable to take 5 breaths in succession through the nose. If the patient cannot close their lips, the patient or the examiner can manually help the lips to close. Do not assess if the patient has a cold.	<input type="checkbox"/>
3	Facial expression	<input type="checkbox"/>
	A. Close your eyes tightly The facial muscles are not activated in a strongly symmetrical fashion.	<input type="checkbox"/>
	B. Show your teeth The lip and facial muscles are not symmetrically activated so that the teeth are easily visible.	<input type="checkbox"/>
	C. Try to whistle (blow) Cannot pout and round the lips symmetrically.	<input type="checkbox"/>
4	Masticatory muscle and jaw function	<input type="checkbox"/>
	A. Bite hard on your back teeth No marked symmetrical activity can be registered when two fingers are held on the jaw muscles (the masseter on both sides).	<input type="checkbox"/>
	B. Open your mouth as wide as you can Cannot open their mouth a distance corresponding to the width of the forefinger and the middle finger on the patient's left hand. If the front teeth are missing, use a three-finger width (the forefinger, and the middle and ring fingers) as a measure.	<input type="checkbox"/>
5	Oral motor function	<input type="checkbox"/>
	A. Stick out your tongue as far as you can Cannot reach outside of the Vermillion border of the lips with the tip of the tongue.	<input type="checkbox"/>
	B. Lick your lips Cannot use the tip of the tongue to wet the lips and cannot reach the corners of the mouth.	<input type="checkbox"/>
	C. "Blow up" your cheeks and hold for at least 3 seconds Cannot "blow up" the cheeks without air leaking out or without making sounds.	<input type="checkbox"/>
	D. Open your mouth wide and say ah-ah[a] No marked elevation of the uvula and the soft palate can be observed.	<input type="checkbox"/>
6	Speech	<input type="checkbox"/>
	A. Does not speak. Skip task B-C. Count out loud to ten	<input type="checkbox"/>
	B. Speech is unclear with one or more indistinct sounds or abnormal nasality. Under 5 years of age, exclude R, S, and TH sounds from the assessment.	<input type="checkbox"/>
	C. Say pataka, pataka, pataka Do not assess this in children under 5 years of age.	<input type="checkbox"/>
	Name/ID:	NOT-S examination
		Sum

© Figure 1. The English version of the Screening form for the NOT-S containing a structured interview (left) and a clinical examination (right), each consisting of six domains, was used together with a Picture manual. The form in English and in the Nordic languages (Danish, Finnish, Icelandic, Norwegian, and Swedish) can be downloaded free of charge from www.mun-h-center.se



© **Figure 2.** Examples from the *Picture manual* illustrating some of the tasks in the NOT-S examination. **A,** (3) Facial expression: Instruction: “Close your eyes tightly”; criterion: The facial muscles are not activated in a strongly symmetrical fashion. **B,** (4) Masticatory muscle and jaw function: Instruction: “Bite hard on your back teeth”; criterion: No marked symmetrical activity can be registered when two fingers are held on the jaw muscles (the masseter muscle on both sides). **C,** (5) Oral motor function: Instruction: “Stick out your tongue as far as you can”; criterion: Cannot reach outside of the Vermillion border of the lips with the tip of the tongue. **D,** (5) Oral motor function: Instruction: “Open your mouth wide and say ah-ah-ah [a]!”; criterion: No marked elevation of the uvula and the soft palate can be observed.

© **Table 1.** The scores from the NOT-S test in the control sample and clinic-referred sample presented according to the ICD-10 classification chapters. The mean, standard deviation (SD) and range of the scores are given for the whole group of patients and for each subgroup

ICD-10 classification	NOT-S scores					
	Total		Interview		Examination	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Control sample (60 subjects)	0.4±0.6	0-2	0.3±0.6	0-2	0.1±0.3	0-1
Clinic-referred sample (120 patients)	4.1±2.6	0-10	2.2±1.5	0-5	1.9±1.6	0-6
C. Neoplasms (4)	5.5±2.1	3-8	3.3±0.5	3-4	2.3±1.7	0-4
F. Mental and behavioural disorders (18)	4.6±3.1	1-10	2.3±1.8	0-5	2.3±1.5	0-5
G. Diseases of the nervous system (30)	3.7±2.4	0-9	2.1±1.4	0-5	1.6±1.5	0-5
H. Diseases of the ear and mastoid process (1)	0	0	0	0	0	0
I. Diseases of the circulatory system (3)	8.0±3.5	4-10	4.3±0.6	4-5	3.7±3.2	0-6
K. Diseases of the digestive system (8)	2.8±1.3	0-4	1.9±1.4	0-4	0.9±1.0	0-3
M. Diseases of the skeletal system and subcutaneous tissue (8)	2.0±0.8	1-3	1.9±1.0	0-3	0.1±0.4	0-1
Q. Congenital malformations, deformations and chromosomal abnormalities (28)	4.1±2.5	0-9	1.9±1.6	0-5	2.2±1.6	0-5
R. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (20)	4.7±2.7	1-9	2.1±1.3	0-5	2.6±1.6	0-4

teria, and filled in the assessment. In the clinical examination, the *Screening form* with instructions and criteria (Figure 1) was used together with a *Picture manual* (Figure 2) illustrating the different tasks. No other equipment was needed for the screening.

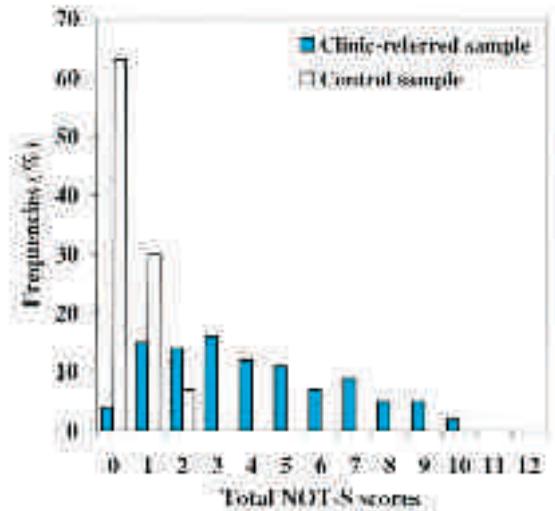
The screening instrument, the *Nordic Orofacial Test - Screening* (NOT-S), was first developed in a Swedish version. It was clinically tested simultaneously in Sweden, Denmark and Norway. Later it has been translated to the other Nordic languages (Danish, Finnish, Icelandic and Norwegian) and to English. The standard procedure of back translations was performed to control for identical content and linguistic quality.

Subjects

The screening with NOT-S was performed in 180 volunteers (120 patients in a clinic-referred sample and 60 healthy subjects in a control sample), by the five authors working at centers for specialized dental care or clinics for speech pathology in Scandinavia. The participants or their families gave their informed consent that collected data could be used anonymously for publication. The clinic-referred sample consisted of 61 female and 59 male consecutive patients aged 3-86 yr (Mean 26.3, Median 18.0), referred for examinations and treatment for different kinds of orofacial impairments due to genetic, congenital or acquired disorders, chronic diseases, or developmental delay. Their diagnostic classifications according to the ICD-10 (16) are shown in Table 1, and their specific diagnoses in the Appendix. The most frequent diagnostic classes were *G. Diseases of the nervous system* (30 patients, 25%), and *Q. Congenital malformations, deformations and chromosomal abnormalities* (28 patients, 23%). The control group consisted of 60 healthy volunteers, 35 females and 25 males, with similar age range (3-78 yr; Mean 30.4, Median 31.5) as the clinic-referred sample, and had no special knowledge of oral motor function or the screening procedure.

Statistics

The Kolmogorov-Smirnov test showed that the distributions of the total NOT-S scores in the clinic-referred sample and the control sample deviated from normality (Figure 3). The NOT-S scores from the two samples were compared with the Mann-Whitney U test to assess the discriminant validity with a level of statistical significance corresponding to $p < 0.05$. The sensitivity, i.e. the proportion of patients correctly identified by the test, and the specificity, i.e.



© Figure 3. Distribution of scores in the clinic-referred sample (120 patients) with a wide range of different diseases and in the control sample (60 healthy subjects) examined with NOT-S. Minimum NOT-S score was 0 and the possible maximum score 12. The scores from patients (M 4.1, SD 2.6; Median 4.0, upper and lower quartiles 6.0 and 2.0) deviated significantly ($p = 0.02$; Mann-Whitney U test) from controls (M 0.4, SD 0.7; Median 0.0, upper and lower quartiles 1.0 and 0.0).

the proportion of healthy subjects correctly identified by the test, were calculated on the basis of the NOT-S test results in all 180 participants, expressed as positive (≥ 1 point) and negative ($= 0$ points) screenings (3).

For assessment of reliability and method error of the NOT-S, 40 examinations of the patients were recorded by video, and viewed and scored twice with a minimum interval of two weeks by the three Swedish-speaking investigators and authors, representing the health professions dentistry and speech-language pathology. First, double measurements were performed in a series with 20 of the videotaped examinations and after recalibration in a series of another 20 videotaped examinations. The interrater and intrarater agreement of the points in the domains in the first and second series of videotaped examinations were calculated in percent. Kappa statistics were used to evaluate interexaminer agreement on the total NOT-S scores in the second series. Kappa values below 0.40 are considered to be poor, values between 0.40 and 0.75 fair, and above 0.75 excellent (3). Also the method error (s(i)%) of NOT-S scores was calculated for the second series as

$(s(i)/x_1) \times 100\%$, $s(i) = \sqrt{\sum d^2/2n}$ (Dahlberg's formula), where d defines the difference between duplicate measurements (x_1 and x_2) and n denotes the number of subjects.

Results

NOT-S was easy to administer and the screening time varied between 5 and 13 min. Young children and some of the adolescents and adults with cognitive and physical impairment needed assistance by parents or accompanying persons when answering the questions in the interview.

The screening was fully completed in 115 patients; in five patients one domain could not be addressed for various reasons, such as nose breathing in three patients with a cold. Total NOT-S scores, interview scores plus examination scores, from the control sample and the clinic-referred sample are presented in Table 1 corresponding to the ICD-10 classification chapters.

In the controls the total NOT-S score was 0 in 63% of the sample (38 subjects), 1 in 30% (18 subjects), and 2 in 7% (4 subjects). The total NOT-S score was 0, i.e. a negative screening, in 4% of the clinic-referred sample (5 patients), diagnosed as having tinnitus aurium, temporomandibular disor-

ders, facial pain, Down syndrome, and ectodermal dysplasia. No patients had points in all 12 domains. The highest NOT-S score was 10, which was found in three patients, two with sequelae from stroke (*I. Diseases of the circulatory system*) and one with mental retardation (*F. Mental and behavioural disorders*).

The relative distribution of points in the 12 domains was calculated for the whole group including the 120 patients, for the ICD-10 chapters consisting of more than five patients, and for the control sample (Table 2). The most frequent problem in the clinic-referred sample was within the domain (IV) Chewing and swallowing (75 patients, 63%) assessed from the interview, and the least frequent finding was in the domain (2) Nose breathing (7 patients, 6%) assessed from the clinical examination. In the control sample the most common domains with scores were (II) Breathing and (III) Habits.

The distributions of NOT-S scores in the 120 patients and in the 60 healthy controls are shown in Figure 3. The scores from the clinic-referred sample (range 0-10; M 4.1, SD 2.6; Median 4.0, upper and lower quartiles 6.0 and 2.0) deviated significantly ($p = 0.02$) from healthy controls (range 0-2; M 0.4, SD 0.7; Median 0.0, upper and lower quartiles 1.0 and 0.0). The sensitivity of NOT-S was 0.96, indicating

© **Table 2.** Relative distribution of points per domain for the ICD-10 classification represented with more than five patients (chapters F, G, K, M, Q and R), for all patients in the clinic-referred sample (All) and for the control sample

Domain	Clinic-referred sample (n)						Control sample (n)	
	ICD-10 classification chapter						All	
	F (18)	G (30)	K (8)	M (8)	Q (28)	R (20)	(120)	(60)
NOT-S interview	%	%	%	%	%	%	%	%
I Sensory function	50.0	23.3	37.5	12.5	32.1	50.0	35.8	3.3
II Breathing	33.3	26.7	12.5	37.5	39.3	40.0	30.0	11.7
III Habits	50.0	50.0	37.5	50.0	42.9	25.0	417	11.7
IV Chewing and swallowing	55.6	50.0	62.5	87.5	53.6	80.0	63.3	3.3
V Drooling	33.3	26.7	12.5	0.0	32.1	10.0	25.0	0.0
VI Dry mouth	0.0	36.7	25.0	0.0	21.4	5.0	21.7	1.7
NOT-S examination	%	%	%	%	%	%	%	%
1 Deviation with the face at rest	44.1	60.0	37.5	12.5	50.0	55.0	47.5	6.7
2 Nose breathing	11.1	3.3	0.0	0.0	3.6	10.0	5.8	0.0
3 Facial expression	27.8	23.3	12.5	0.0	28.6	55.0	30.8	0.0
4 Masticatory muscle and jaw function	16.7	20.0	12.5	0.0	21.4	20.0	20.0	0.0
5 Oral motor function	44.4	26.7	12.5	0.0	39.3	45.0	35.0	1.7
6 Speech	88.9	26.7	0.0	0.0	50.0	70.0	46.7	1.7

that most of the patients with orofacial impairment in the clinic-referred sample were identified, and the specificity was 0.63.

In the repeated evaluations of the 40 videotaped examinations the average interexaminer agreement on the points given in the domains was 83% and the intraexaminer agreement 92-95%, in the first series. Recalibration between the 3 examiners increased the agreement for the domains to 85% and 95-99%, respectively, in the second series. The interexaminer agreement was lowest within the domain (4) Masticatory muscle and jaw function. However, as manual palpation was the basis for assessment of masseter activity it was not possible to assess this item from the video recordings strictly in accordance with the criterion (Figures 1 and 2). The difference of the total NOT-S scores between the 3 examiners was 0-3 with an average of 1.05, and Kappa values for the interexaminer agreement were 0.42-0.44 (i.e. fair). The method error of the NOT-S score was 5.3%.

Discussion

Our results indicate that the newly developed screening, NOT-S, has a great potential to become a valuable tool for comprehensive screening of orofacial dysfunction and disability. It was developed and tested in the Swedish language, but with the careful back translations similar results are expected with the English version and those in the other Nordic languages. NOT-S was simple and quick to perform, and the picture manual facilitated the instructions to the patient and the understanding of the tasks. Even severely disabled individuals were able to participate in the screening, but needed help in answering the questions like most of the youngest children.

The NOT-S identified areas of orofacial dysfunction in need of further attention. The chosen domains seemed relevant when tested on a clinic-referred sample, representative of patients with orofacial dysfunction and disability. It might have been simpler if each domain had contained only one single item. However, most domains had to include several questions or tasks to obtain a reliable discrimination between normal function and dysfunction. For example the domains (IV) Chewing and swallowing and (5) Oral motor function embrace several sub-functions, thus one item does not cover this complexity. The test discriminated significantly between patients and controls, and the NOT-S scores also varied between different degrees of disability.

NOT-S had a low method error (5.3%), the intra-

and interexaminer agreement on points given in the domains was high after recalibration (95-99% and 85%), and the interexaminer agreement on the total NOT-S scores was fair (kappa values 0.42-0.44) despite the different professional backgrounds and the difficulties in assessing the masseter activity from a video recording (Figure 2B). Also, to be useful as a screening instrument, the test should identify a high proportion of the patients. The sensitivity of the NOT-S was high, 0.96, but the specificity was a little less than desired, 0.63, indicating a risk for false positive screenings.

In principle, with a point scored in one domain in the screening a more detailed evaluation of that domain, and if necessary a referral to a specialist may be considered. If two or more domains are affected it may be necessary to involve a team of experts for further assessments. However, it should be noted that about 7% of the healthy controls had two-points scores and 30% one-point scores, i.e. the so-called false positives. A majority of points in the healthy controls were obtained because of snoring (II Breathing) or biting habits (III Habits), see Table 2. Therefore, scores equal to or below 2 points should be carefully considered before a referral. Nevertheless, a few false positive screenings are preferable to a few false negatives. However, further studies to provide more normative data on typically developed and healthy individuals in all age groups could improve the evaluation of the test results and the basis for recommendations of further measures. With such supplementary investigations the screening could improve overall estimations of changes of the orofacial function with time or rough assessments of treatment effects.

In conclusion NOT-S allows different health professionals to perform a reliable and valid screening of orofacial function, but the examiners must be trained and calibrated before performing screening and interpreting the results.

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Appendix:

ICD-10 classifications

II. *C. Neoplasms (n=4)*

- C 01 Malignant neoplasm of base of the tongue (1)
- C 03 Malignant neoplasm of upper gum (1)
- C 04 Malignant neoplasm of floor of mouth (1)
- C 31 Malignant neoplasm of accessory sinuses (1)

V. *F. Mental and behavioural disorders (n=18)*

- F 07 Personality and behavioural disorders due to brain disease, damage and dysfunction (1)
- F 70 Mild mental retardation (2)
- F 79 Unspecified mental retardation; speech articulation disorder (2)
- F 80 Specific developmental disorders of speech and language (9)
- F 81 Specific developmental disorders of scholastic skills (1)
- F 84 Pervasive developmental disorders; Childhood autism (1)
- F 90 Hyperkinetic disorders; ADHD (2)

VI. *G. Diseases of the nervous system (n=30)*

- G 08 Intracranial and intraspinal phlebitis and thrombophlebitis (1)
- G 12 Spinal muscular atrophy and related syndromes; Amyotrophic lateral sclerosis (1)
- G 24 Dystonia; Orofacial dystonia (11)
- G 43 Migraine (1)
- G 50 Disorders of trigeminal nerve; Trigeminal neuralgia (1), Atypical facial pain (1)
- G 53 Cranial nerve disorder (1)
- G 71 Primary disorders of muscles; Duchenne muscular dystrophy (3), Dystrophia myotonica (1)
- G 80 Infantile cerebral palsy (6)
- G 81 Hemiplegia (1)
- G 90 Disorders of autonomic nervous system; Frey's syndrome (1)
- G 93 Other disorders of brain; Anoxic brain damage (1)

VIII. *H. Diseases of the ear and mastoid process (n=1)*

- H 93 Other disorders of ear, not elsewhere classified; Tinnitus aurium (1)

IX. *I. Diseases of the circulatory system (n=3)*

- I 67 Other cerebrovascular diseases; Cerebral aneurysm, nonruptured (1)
- I 69 Sequelae of cerebrovascular disease (2)

XI. *K. Diseases of the digestive system (n=8)*

- K 00 Disorders of tooth development and eruption; Oligodontia (1)
- K 07 Dentofacial anomalies; Temporomandibular joint disorder (6), Dentofacial anomaly not specified (1)

XIII. *M. Diseases of the musculoskeletal system and connective tissue (n=8)*

- M 06 Other rheumatoid arthritis; Rheumatoid arthritis of the TMJ (2)
- M 19 Other arthrosis; Arthrosis of the TMJ (4)
- M 79 Other soft tissue disorders, not elsewhere classified; Myalgia of masseter m. (2)

XVII. *Q. Congenital malformations, deformations and chromosomal abnormalities (n=28)*

- Q 05 Spina bifida (1)
- Q 20 Congenital cardiac malformation (1)
- Q 37 Cleft palate with cleft lip (2)

- Q 39 Esophageal atresia (1)
- Q 67 Congenital musculoskeletal deformities of head, face, spine and chest; Facial asymmetry (1)
- Q 77 Osteochondrodysplasia with defects of growth of tubular bones and spine; Spondyloepiphyseal dysplasia (1)
- Q 82 Other congenital malformations of skin; Ectodermal dysplasia (3)
- Q 85 Phakomatoses, not elsewhere classified; Tuberous sclerosis (2)
- Q 86 Congenital malformation syndromes due to known exogenous causes, not elsewhere classified; Fetal alcohol syndrome (1)
- Q 87 Other specified congenital malformation syndromes affecting multiple systems; Williams syndrome (1), Hemifacial microsomia (1), Kabuki makeup syndrome (1), Prader Willi syndrome (1), Beckwith Wiedemann syndrome (1), Marfan syndrome (1)
- Q 90 Down syndrome (6)
- Q 92 Other trisomies and partial trisomies of the autosomes; Cat-eye syndrome (1)
- Q 96 Turner syndrome (2)

XVIII. *R. Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (n=20)*

- R 13 Dysphagia (5)
- R 47 Speech disturbances; Dysarthria (2)
- R 48 Dyslexia and other symbolic dysfunctions; Apraxia (12)
- R 69 Unknown and unspecified causes of morbidity (1)

Experience of dental care for children with congenital heart disease among Swedish dentists

LINDA ROSÉN, CHRISTINA STECKSÉN-BLICKS

Abstract

© This study was conducted in order to examine the experience of and attitudes to dental care for children with congenital heart disease (CHD) among Swedish general dentists.

183 general dentists employed in the Public Dental Health Service in the counties of Västerbotten and Uppsala, and private practitioners listed with dentistry for children in the county of Västerbotten, Sweden, were enrolled in the study. Data were collected with a questionnaire with 18 questions.

Eighteen per cent of the dentists stated that they had received special education or information except the graduate training to treat children with CHD. Forty-eight per cent of the dentists had one or more patients with CHD. Seventy-two per cent of these stated that their CHD-patients had a caries problem. Statistically significant differences were displayed between answers on the questions “who in the dental team perform the major part of the dental care for children with CHD” and “what is your opinion on which personal category that should perform the major part of the dental care for this group of children” ($p < 0.001$). Among dentists whose clinical time mainly was used for dentistry for children, it was more common to treat children with CHD ($p < 0.001$) than for dentists with a lower degree of dentistry for children.

The study showed that the Swedish dental care for children with CHD today mainly is performed by dental nurses, dental hygienists and general dentists. This strongly differs from the dentist’s opinion on who should perform the major part of the dental care for this group of children. These findings taken together with the very low number of dentists that had received special education or information except the graduate training to treat children with CHD indicates that the Swedish dentists are unsettled and insecure in the dental treatment of children with heart defects. An early and close cooperation between specialists in pediatric dentistry, dentists with special training and general dentists is strongly desirable to support the dentists and facilitate the dental care for children with CHD.

Key words

Congenital heart disease, children, dentistry

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Allmäntandläkares erfarenheter av tandvård till barn med medfödda hjärtfel

LINDA ROSÉN, CHRISTINA STECKSÉN-BLICKS

Sammanfattning

⊙ Studien utfördes för att undersöka allmäntandläkares erfarenheter av och uppfattningar om tandvård för barn med medfödda hjärtfel (CHD). Etthundraåttiotre allmäntandläkare anställda inom Folktandvården i Västerbottens och i Uppsala län och privat-tandläkare som var listade med barntandvård i Västerbotten deltog. Data insamlades genom att de fick fylla i ett frågeformulär.

Arton procent av tandläkarna hade fått speciell utbildning eller information som gällde tandvården för denna patientgrupp utöver vad som givits i grundutbildningen. Fyrtioåtta procent uppgav att de behandlade en eller flera patienter med CHD. Sjuttio-två procent uppgav att CHD-patienterna hade karies. En statistiskt signifikant skillnad kunde visas mellan svaren på frågorna ”vilken yrkeskategori i tandvårdsteamet utför till största delen tandvården för barn med CHD” och ”vilken är din åsikt om vilken yrkeskate-gori i tandvårdsteamet som till största delen skall utföra tandvården för barn med CHD” ($p < 0.001$). Det var vanligare att behandla barn med CHD bland tandläkare som hade en stor andel barntandvård i sin tjänstgöring ($p < 0.001$).

Studien visade att tandvården för barn med CHD till största delen utförs av tandskö-terskor, tandhygienister och allmäntandläkare. Detta avviker starkt från allmäntandläkar-nas uppfattning om hur vården för denna patientgrupp skall organiseras. Tillsammans med att endast en liten andel tandläkare har speciell utbildning för att ta hand om denna patientgrupp understryker det att allmäntandläkare är osäkra på omhändertagandet av denna patientgrupp. Ett nära samarbete med specialister i pedodonti, special-utbildade allmäntandläkare och allmäntandläkare är nödvändigt för att underlätta och förbättra tandvården för denna patientgrupp.

Introduction

The prevalence of children successfully treated after various serious health conditions are increasing due to the progress of medical, surgical and anaesthetical methods (10). The increase of these groups also makes them a significant group in dentistry and many of these children have special needs due to their health conditions and/or medications. One of these groups is children born with abnormalities in the structural development of the heart and such defects occur in approximately 8:1000 live births. Of these, one-third consists of children with complex anomalies (1). The causality behind the alarmingly high caries prevalence shown in children with complex congenital heart disease (CHD) (4, 6, 11, 14) is an essential challenge to investigate. It has been highlighted that in many cases CHD-children in Sweden were offered more caries intervention than healthy children, but the care had been given when caries already were present (14), in spite of a system where all parents are offered a comprehensive dental care for their children from an early age with a strong caries-preventive approach. It has also been shown that parents of healthy children are more satisfied with the reception at the dental clinic than parents of children with complex CHD (5). It was therefore considered essential to ask dentists about their experience with this group of children.

Material and methods

The study had a descriptive design and was carried out during January to February 2006. We invited all general dentists employed in the Public Dental Health Service and all private dentists listed with dentistry for children in the counties of Västerbotten (n= 145) in the north of Sweden and all general dentists employed in the Public Dental Health Service in Uppsala (n=100) in the middle of Sweden. All specialists were excluded from the invitation. The invited dentists were sent written information about the purpose of the study and were asked to fill in a questionnaire. The questions were composed by the authors and pretested of 15 dentists. According to the pre-test a few changes were performed in the questionnaire before data collection. The questionnaire had eighteen questions, all in Swedish, concerning the dentist's experiences and attitudes to dental care for children with CHD as well as the dentist's age, gender and city of education. Each dentist was assigned a number for coming data processing. A prepaid return envelope was accompanying the questionnaire. The dentists were requested to return the ques-

tionnaire within two weeks. Despite reminders, there were 62 non-respondents and the final material thus consisted of 183 dentists (75 %), of which 40 % were males and 60 % were females. Seventy-two per cent of the dentists had their dental degree 16 years ago or earlier and 10 % between 2000 and 2006.

The dental care for children in Sweden are organised by the county councils and are free of charge. The parents can choose between dental care for their children organized within the Public Dental Health Service or by private clinics. Around 90 % of the dental care for children in Sweden is provided within the Public Dental Health Service.

Statistical Analysis

All data were processed by the SPSS software (12.0, SPSS Inc., Chicago III, USA). Pearson Chi-Square was used to test differences between groups. The level of statistical significance was set at 5%.

Results

Clinical time with dentistry for children

Eight per cent of the responding dentists had no clinical time at all with dentistry for children. Fifty-four per cent of the dentists used 1-24 per cent, 29 per cent used 25-49 per cent, 6 per cent used 50-74 per cent and 3 per cent used 75-100 per cent of their clinical time with dentistry for children. Female dentists reported more clinical time with dentistry for children ($p < 0.01$) than male dentists. Eighty-eight dentists (48%) stated that they treated one or more children with CHD, but no difference between sexes was displayed ($p > 0.05$). It was statistically significantly more common to treat children with CHD among dentist whose clinical time mainly was used for dentistry for children ($p < 0.001$) than for dentists with a lower degree of dentistry for children.

Education or information to treat children with congenitally heart disease

Eighteen per cent of the dentists stated that they had received special education or information except the graduate training to treat children with CHD. Among dentists who treated children with CHD only 13 per cent had received such education or information. Sixty-four per cent of the dentists had the opinion that information about which groups of patients that should be provided with antibiotic prophylaxis before invasive dental treatment was clear and distinct while 33 per cent had the opinion that the information not was. Three per cent had no opinion (Fig 1).

Knowledge of medical background of CHD-patients

Among dentists that reported that they treated CHD-patients (n=88) the knowledge of the diagnosis, medication, medical doctor, caries status and medicines that increases the caries risk are given in Table 1. The majority knew the diagnosis and the medicines used by their patients. Half of the group of dentist had been in personal contact with their CHD-patient(s) medical doctor. Seventy-two per cent reported that their CHD-patient(s) had caries but only 34 % knew that some medicines used by CHD-patients could increase the risk for caries. Younger dentist reported statistically significantly more often than older that medicines used by this group of patients could increase the caries risk (p<0.01).

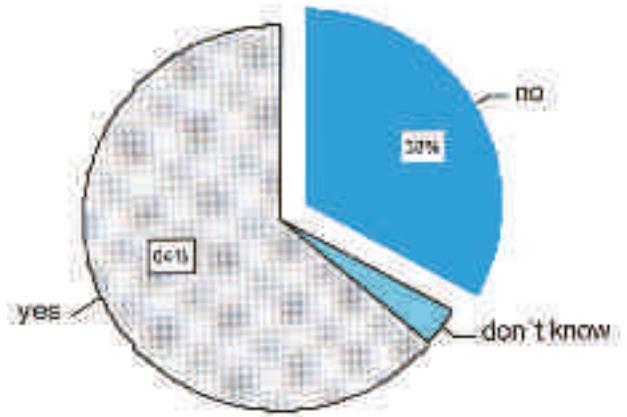
Organisation of dental care for CHD-patients

Thirty-three per cent of the dentists reported that the level of dental care for CHD-patients not differed compared to healthy children at their clinic and 3 per cent stated longer appointment time. Forty-two per cent reported that more caries prevention were given and 7 per cent reported shorter recall intervals while 16 per cent gave the answer that they did not know. There was a statistically significant difference between the answers on the questions “who in the dental team perform the major part of the dental care for children with CHD” and “what is your opinion on which personal category that should perform the major part of the dental care for this group of children” (p<0.001), (Fig 2).

Discussion

In the light of an unacceptable high caries experience in children with complex CHD and a dissatisfaction with the reception at dental clinics among the guardians of these children [5, 14] this study examines the experience of dental care for children with CHD among Swedish general dentists.

Seventy-five per cent of all general dentists em-



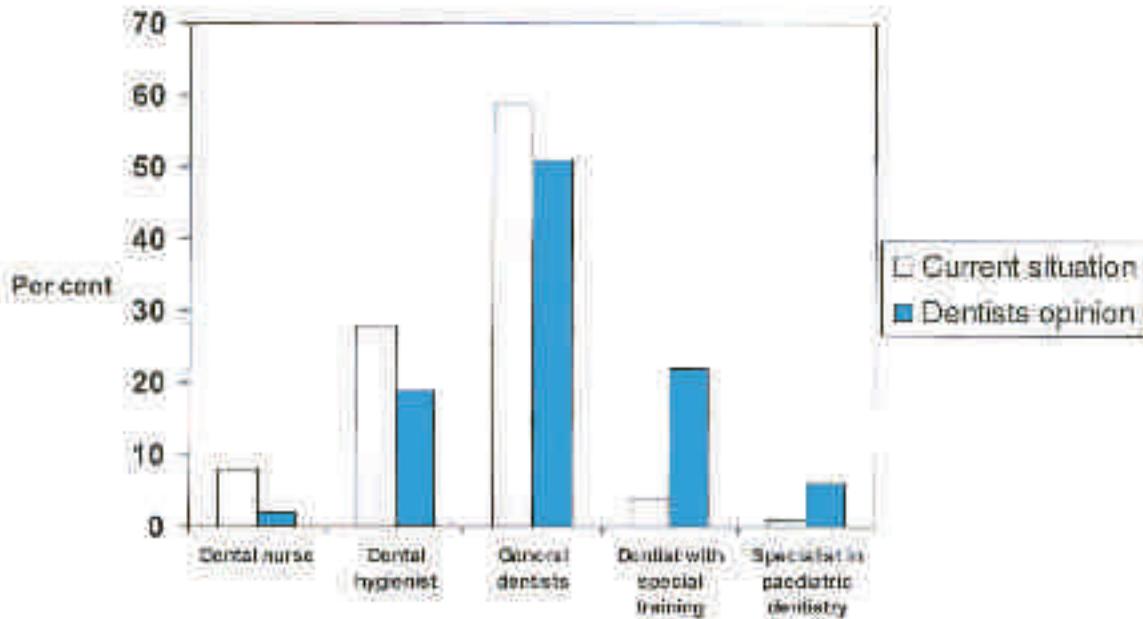
© **Figure 1.** Answers on the questions “is the information about which group of patients that should be provided antibiotic prophylaxis before invasive dental treatment clear and distinct” (%).

ployed in the Public Dental Health Service in the counties of Västerbotten and Uppsala, or in private clinics listed with dentistry for children in Västerbotten, Sweden participated. The non-responding rate after reminders is considered acceptable for a study based on a questionnaire (16). As the Public Dental Health Service does not differ from county to county the results of the study are considered applicable to Sweden in general. The findings should be generalised to the whole group of children with CHD of which complex anomalies consists of one-third (1) as it was considered difficult for the dentists to classify their CHD-patients due to limited information on medical background facts.

In this study, a large majority of the dentist had noticed caries in children with CHD. The magnitude of the observed caries problem remains unknown but earlier findings among children with complex CHD have shown an alarmingly high prevalence in

© **Table 1.** Knowledge of medical background factors of CHD-children among their dentists (n=88).

Question	Yes %	No %	Don't know %
Do you know the diagnosis of your CHD-patients(s)?	94	6	Not an alternative
Do you know the medicines used by your CHD-patients(s)?	98	2	Not an alternative
Do you know the name(s) of the child's/childrens medical doctor(s)?	63	37	Not an alternative
Have you been in contact with the child's/childrebs medical doctor(s)?	49	51	Not an alternative
Have your CHD-patient(s) caries?	72	17	11
Do you know if CHD-patients can have medicines that increase the risk for caries?	35	39	26



© Figure 2. Answers on the questions "who in the dental team perform the major part of dental care for children with CHD" and "what is your opinion on who should perform the major part of the dental care for this group of children" (%), ($p < 0.001$).

Sweden (14) as well as in other countries (4, 6, 11, 15). Complicated background factors such as nutrition, sugar containing medications and demanding family affairs are often associated with early dental health problems in children with severe CHD (4, 6, 7, 11, 14). Only one-third of the dentists knew that some of the cardiac medications particularly digoxin (Lanoxin®), but also diuretics increase the risk for caries. Digoxin is administered in a sucrose containing syrup and children taking this drug have been shown to have very high caries prevalence [14]. Unfortunately no alternatives are available at present.

Children with chronic diseases should be offered a dental treatment that meets their needs (2). Children with CHD have an increased vulnerability to stressful treatment procedures which implicates a strong reason to focus on caries prevention. If dental treatment is necessary, it must be adjusted to minimize painful and stressful situations as far as possible. Interestingly, although the increased cariological problem had been noticed by such a large number of dentists less than one half reported that more caries prevention was given to the CHD group compared to healthy children. Even more notable was that as much as one third reported that the level of dental care for CHD-patients did not differ compared to

healthy children at their clinic. These findings do not coincide with findings from a group of children with severe CHD collected from dental records where it was found that they were given more caries intervention than healthy controls (14). It may be that many dentists were not aware of the prevention given by dental nurses or dental hygienists to this group of children or it may be limited to children with severe CHD-children only.

For many children with CHD dentists are advised to provide antibiotic prophylaxis against endocarditis before invasive dental procedures (3). Two-thirds of the dentists had the opinion that information about which groups of patients that should be provided with antibiotic prophylaxis before invasive dental treatment was clear and distinct while one-third had the opinion that the information was not. The finding may be due to that the recommendations has been under debate (13) resulting in an increasing insecurity among clinicians.

According to the present results the dental care of children with CHD today mainly is performed by dental nurses, dental hygienists and general dentists. This strongly differs from the dentist's opinion on who should perform the major part of the dental care for this group of children. These findings ta-

ken together with the very low number of dentists that had received special education or information except the graduate training to treat children with CHD indicates that the Swedish dentists are unsettled and insecure in the dental treatment of children with heart defects. There is no reason to believe that dental nurses and dental hygienist are more secure due to their relatively shorter education. This insecurity among dental personals with this group of children displayed in this study from Sweden and in studies from the UK (8, 9) could be one of the reasons to why parents to children with severe CHD are less satisfied with the reception at the dental clinic than parents of healthy children (5). A majority of the dentists had their dental degree 16 years ago or earlier and with the increasing survival of children with CHD during recent years (12) and many other with serious health conditions (10) the present results points to the necessity for education about new medical groups in dentistry. It has earlier been suggested that children with CHD should be referred to a specialist in pediatric dentistry as early as possible and at this point an individual treatment plan based on risk assessment should be established (5). When this plan has been set, an early and close cooperation between specialists in pediatric dentistry, dentists with special training and general dentists is strongly desirable to support the dentists and facilitate the dental care for children with CHD.

In conclusion this study has shown that Swedish dentists are unsettled and insecure in the dental treatment of children with CHD. The dentist's opinion on which personal category that should perform dental care for children with CHD differed statistically significant from the current situation.

Acknowledgements:

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Evaluation of a Swedish version of the OHIP-14 among patients in general and specialist dental care

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Abstract

© The aim of this study was to investigate the Swedish version of an oral health-related quality of life (OHRQL) instrument, the short form of the Oral Health Impact Profile (OHIP-14), and to assess OHRQL among patients in general dental care and specialist clinics (periodontics, TMD and implant dentistry) in Göteborg, Sweden.

Consecutively selected patients were asked to answer the OHIP-14, the General Oral Health Assessment Index (GOHAI) and a questionnaire including socio-demographic, general health and oral health questions. 153 patients (50-89 years old) out of 237 (65%) returned the questionnaires.

Cronbach's Alpha among the OHIP items was high (0.93) and the corrected item-scale correlation varied between 0.51 and 0.79. The correlation between the OHIP-14 score and the GOHAI was high (-0.83) indicating good criterion validity. The mean additive OHIP-14 score was 22.6 (SD=10.5). Implant patients scored significantly higher than other patient groups with respect to missing teeth, dentures and mobile teeth. High scores were also associated with perceived poor general health and dissatisfaction with life-situation. The test-retest reliability was assessed in a separate sample (n=47) and the correlation coefficient was 0.85.

The Swedish version of OHIP-14 demonstrated good reliability and validity. The poorer OHRQL reported by the implant patients reflects the strong association found between OHIP score and dentures and missing teeth, while OHIP-14 did not show similar sensitivity to other impacts of oral disorders.

Key words

OHIP-14, oral health, psychometrics, quality of life, reliability, validation,

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Utvärdering av den svenska versionen av OHIP-14 i allmän- och specialisttandvård

CATHARINA HÄGGLIN, ULF BERGGREN, MAGNUS HAKEBERG, ANNA EDVARDSSON, MARINA ERIKSSON

Sammanfattning

© Syftet med denna studie var att utvärdera den svenska versionen av ett internationellt väletablerat Oral Hälso-Relaterat Livskvalitet- (OHRLK) instrument, Oral Health Impact Profile bestående av 14 frågor (OHIP-14)). Ytterligare ett annat syfte med studien var att med hjälp av OHIP-14 bedöma OHRLK hos patienter vid allmäntandvårdskliniker och specialisttandvårdskliniker (specialistkliniker för: implantatbehandling, parodontalbehandling och bettfysiologisk behandling).

Patienterna tillfrågades vid första besöket/undersökningstillfället på de olika klinikererna om de anonymt kunde tänka sig fylla i OHIP-14, ytterligare ett OHRLK-instrument (the General Oral Health Assessment Index, GOHAI) och ett frågeformulär innehållande frågor rörande sociodemografi, allmän hälsa och oral hälsa/status. Av 237 patienter besvarade 153 (65%) (ålder: 50–89 år, medelålder: 65 år) frågeformulären.

Cronbachs Alpha (0.93) visade på hög intern reliabilitet och homogenitet mellan de i OHIP-14 ingående frågorna. Korrelationen mellan OHIP-14 totalt och var och en av de ingående frågorna varierade mellan 0.51 och 0.79. Sambandet mellan OHIP-14 och GOHAI var starkt (-0.83). Medelvärdet för OHIP-14 (möjligt minimum: 14, maximum: 70) var 22.6 (SD=10.5). Implantatpatienterna rapporterade markant sämre OHRLK än övriga patientgrupper. OHIP-14 uppvisade signifikant högre värden relaterat till saknade tänder, proteser och tandmobilitet. Högre värden var även kopplat till sämre upplevd allmän hälsa och otillfredsställelse med livssituation. Test-retest-reliabiliteten beräknades i en annan testgrupp än huvudstudien och uppmättes till 0.85.

Sammanfattningsvis uppvisade den svenska versionen av OHIP-14 en god validitet och reliabilitet. Den signifikant sämre OHRLK rapporterad av implantatpatienterna avspeglar ett starkt samband mellan OHIP-14 och proteser och saknade tänder, medan OHIP-14 inte uppvisade någon liknande känslighet för effekten av andra orala problem.

Introduction

Following an increased awareness of the influences of oral disease and care on behavioural and social factors, assessment of Oral Health Related Quality of Life (OHRQL) has become an important issue in dental research. During the last two decades a variety of OHRQL instruments have been introduced. However, until now only two OHRQL instruments have been validated and published in their Swedish versions; the 12-item GOHAI [1] and the 49-item OHIP [2]. Therefore, in the present study another OHRQL instrument, the internationally well-established OHIP-14, was investigated in its Swedish version.

Assessing Oral Health Related Quality of Life (OHRQL) has public health importance because it can help allocating healthcare resources and to evaluate different health care systems or dental care efforts. OHRQL measurements are constructed to provide information about oral symptoms and related psychosocial and functional problems in dental public health perspectives as well as in clinical trials. Thus, when identifying and selecting a measure of OHRQL it is essential to use one with acceptable reliability and validity measuring the intended aims of the research. These aims may be descriptive, predictive, discriminative, or evaluative [3,4].

Other aspects to consider when selecting a measure of OHRQL are the demographic (e.g. the instruments' ability to measure different age groups) and clinical characteristics of the study population (e.g. the ability to detect if dentate or edentulous, single or multiple disorders, pain or functional disorders). In addition, the original language of the instrument and the culture where the instrument was developed also has to be taken into consideration. There may be a variation of lifestyle between original and target culture as well as language variation that lead to a need to decide if translation or adaptation of the measurement is the best alternative.

Since there are many factors to take into account when selecting an OHRQL instrument, there is a need to validate established instruments as well as to develop new instruments. During the last two decades a variety of OHRQL instruments have been introduced and evaluated regarding how well they fulfil different measurement goals. Some of the most well established instruments are the Oral Health Impact Profile including 49 questions (OHIP-49) [5], a short form involving only 14 questions (OHIP-14) [6] and the 12-item General Oral Health Assessment Index [7]. Lately a short form of OHIP has been de-

veloped addressing oral health among edentulous individuals [8]. The 49 item OHIP provides more comprehensive data and covers a wide spectrum of conditions associated to oral disorders and disease. Such an extensive instrument may not be appropriate in some settings. *Locker & Allen* [9] identified four reasons to use short forms: 1. in clinical settings a short form may be preferable since the time used to answer may be limited; 2. it decreases cost for data and administrative management; 3. the burden on the respondents is lowered, and; 4. the item non-response is decreased. Yet, the content validity of short-form measures is always compromised and different short forms are required for different purposes and patient populations [9].

The original OHIP-14 was developed from the OHIP-49 by a controlled regression procedure. Some shortcomings of the OHIP-14 have led to alternative methods for developing OHIP short forms e.g. the item-impact method and the item frequency method [9,10]. Using the item impact method *Locker & Allen* [9] developed an alternative OHIP-14 that had only two items in common with the original OHIP-14. When comparing these two instruments, they found that the original OHIP-14 was subject to marked floor effects, while the item-impact OHIP-14 had floor effects comparable to those of the OHIP-49. *Locker & Allen* concluded that the original OHIP-14 is better when the aim is to discriminate, while the item-impact OHIP-14 were to be preferred when the aim is to describe OHRQL on a population level and to detect changes over time [9]. The item frequency method version of OHIP designated S-OHIP(M) was developed in Malaysia following the cross-cultural adaptation of the original English language OHIP from Australia [10]. The S-OHIP(M) was developed to be used as a descriptive and discriminative measure in population studies but it may also be appropriate as an evaluative measure in clinical practice. Another short form measure, the 12 item GOHAI was primarily developed for the use in older populations, but has also been shown useful in adult populations [7]. In a comparison of OHIP-14 and GOHAI, *Locker* [11] revealed that the two measures were equally good at predicting overall psychological well-being and life satisfaction, while GOHAI identified more oral functional and psychosocial impacts than OHIP-14. Also, the floor effect was three times higher with the OHIP-14 than with the GOHAI. On the other hand, in two GOHAI studies a problem with understanding the directions of answers were found for certain samples, and there seems to be a

need to review some of the items of the original GOHAI questionnaire [12,1].

A reasonable degree of cross-cultural consistency was found when the OHIP-49 was compared between an Australian sample, a sample of English-speaking Canadians and a sample of French-speaking Canadians [13]. More recently, Chinese [14], Hebrew [15], Sinhalese [16] and Brazilian versions [17] of the OHIP-14 have been generated by processes of varying degree of refinement and presented psychometric properties similar to the English-language original.

To sum up, the psychometric properties of OHRQL instruments vary with the form of administration, language used, the character and culture of participants and the context in which the instrument are used. Thus, the instruments must be selected carefully and, if possible, tested before they are applied in a new context or situation to assess whether or not they are valid and reliable measures of OHRQL in the specific study intended for.

The aims of the present study were to evaluate a Swedish version of the original version of the OHIP-14 and to assess the ability of the index to disclose different OHRQL profiles among patients with varying oral problems/disorders/health.

Material and Methods

Study sample and procedures

During three weeks of data collection consecutively selected patients at eight general and specialist dental clinics, four general dental care clinics (GDC), one clinic for periodontal treatment (PD); one clinic for treatment of temporomandibular disorders (TMD); and two clinics for prosthodontic dental implant treatment (IMP) in Göteborg, Sweden were invited to participate in this study. After consent, patients were asked to complete the Oral Health Impact Profile-14 items (OHIP-14) and the General Oral Health Assessment Index (GOHAI). In addition, a questionnaire presenting socio-demographic, general health and oral health questions was administered. Of the 237 invited patients, 28 patients declined to take part, 56 failed to return the questionnaires and one had many items missing on the OHIP-14 (non-participation: 35% IMP, 19% PD, 35% TMD and 40% GDC). Thus, the participation rate was 152 (64%) patients. The number of respondents in each clinic group is presented in Table I.

Only patients 50 yrs of age or older were included in the study. Patients recruited at specialist clinics were administered the questionnaires prior to any

treatment and patients at general dental clinics at their first visit or at a recall visits. Patients, on emergency visits, were not asked to participate in the study. The two OHRQL instruments and the questionnaire were, by the participants choice, returned in a sealed envelope to each clinic's reception or sent in by mail. The study was anonymous and approved by the Ethics Committee of Sahlgrenska Academy, Göteborg University.

Instruments/questionnaire

OHIP-14

The short version of the Oral Health Impact Profile (OHIP-14) was originally developed for the English language [6] and has shown good reliability, validity and precision in Australia, the UK and Israel [6, 18, 15]. The OHIP-14 was translated from English to Swedish by two bilingual persons whose first language was Swedish and then the index was back-translated from Swedish to English by a bilingual person whose first language was English. Comparison between the original English and the back-translated version was made and only minor modifications were performed.

In the OHIP-14 participants are asked to recall how frequently during a given reference period (3, 6 or 12 months; in the present study=3 months) they had experienced any of the problems measured by the OHIP-14 index. The responses to the OHIP-14 items are to be scored on a Likert scale with five response categories for each question (never, seldom, sometimes, often and always) in an ascending point system (1-5).

Two methods are commonly used to calculate the scores. Additive scores (Add-OHIP-14) are obtained by summation of the response codes for the 14 items. Thus, there will be a range from 14-70 with the higher scores indicating poor OHRQL. The simple count method score (SC-OHIP-14) adds up the number of items given the responses 'sometimes', 'often' or 'always'. Using this approach, scores will range from 0 to 14 for the SC-OHIP-14.

GOHAI

The General Oral Health Assessment Index (GOHAI) was used in the present study only for validation purposes [7]. The GOHAI has been validated in studies in the US [7,19,20] as well as in Chinese, French and Swedish versions [21,12,1].

In the present study, alike the OHIP-14, subjects were asked how often during the past three months they have experienced oral health related problems.

© **Table 1:** Socio-demographic and dental status distribution of patients according to clinic/treatment group and total group.

Clinic/treatment	IMP ¹		PD ¹		TMD ¹		GDC ¹		Total			
	n	%	n	%	n	%	n	%	Total	%	χ^2	ρ
Participants: number	30		25		13		84		152			
Mean age: years	69.5		61.9		62.2		63.9		64.6		$\rho^4=0.023$	
SD	11.4		7.2		10.2		10.3		10.3			
Sex												
Male	9	30.0	10	41.7	3	23.1	37	45.7	59	39.9		
Female	21	70.0	14	58.3	10	76.9	44	54.3	89	60.1	3.9	0.270
Living in relation												
Yes	13	44.8	11	47.8	11	84.6	53	67.1	88	61.1		
No	16	55.2	12	52.2	2	15.4	26	32.9	56	38.9	9.2	0.027
³ Number of teeth; upper jaw												
0	9	36.0	1	4.2	2	16.7	4	4.9	16	11.2		
1-5	7	28.0	2	8.3	0	-	7	8.5	16	11.2		
>10	5	20.0	15	62.5	6	50.0	50	61.0	76	53.1	34.1	0.000
³ Number of teeth; lower jaw												
0	4	16.7	0	-	1	7.7	1	1.3	6	4.3		
1-5	6	25.0	2	8.0	0	-	4	5.0	12	8.5		
>10	4	16.7	18	72.0	8	61.5	54	67.5	84	59.6	33.1	0.000
² Tooth mobility												
Yes	12	42.9	9	36.0	1	7.7	11	13.3	33	22.1		
No	16	57.1	16	64.0	12	92.3	72	86.7	116	77.9	15.1	0.002
² Dentures; full or partial												
Yes	13	43.3	4	16.0	3	23.1	12	14.5	32	21.2		
No	17	56.7	21	84.0	10	76.9	71	85.5	119	78.8	11.5	0.009
Self-rating of general health												
Poor; n=10	3	10.0	3	12.5	3	23.1	1	1.2	10	6.8		
Fairly good; n=40	3	10.0	5	20.8	5	38.5	28	34.6	41	27.7		
Good; n=97	24	80.0	16	66.7	5	38.8	52	64.2	97	65.5	18.6	0.005
Satisfaction with life situation												
Dissatisfied; n=7	2	6.7	1	4.2	1	7.7	3	3.7	7	4.7		
Neither, nor; n=22	3	10.0	3	12.5	3	23.1	13	16.0	22	14.9		
Satisfied; n=118	25	83.3	20	83.3	9	69.2	65	80.2	119	80.4	2.2	0.903

¹IMP=implant therapy group, PD=periodontal treatment group; TMD=temporomandibular disorders group; GDC=general dental care group

²In one or both jaws.

³6-9 teeth included in the analysis but not in the table

⁴One-way ANOVA between treatment groups: $F=3.3$, $p=0.023$, Post Hoc: IMP>PD, $p=0.039$

The responses to the items of this index are also scored on a five-point Likert scale (always-never). Additive scores for the GOHAI were obtained by summation of the response codes for the 12 items after reversing the coding of the three positively worded items (items 3, 5, 7). The GOHAI scale thus ranges from 12-60. Contrasting OHIP, higher scores indicate better OHRQL.

Questionnaire

A self-administrated questionnaire included questions relating to *socio-demographic data* (sex, age and marital status); *oral status* in upper and lower jaw was reported as number of teeth (0, 1-5, 6-10, >10), presence of mobile teeth (yes/no), and presence of partial or full dentures and/or crowns and bridges; *Dental utilisation* was dichotomised as 'regular' = at least once a year or every second year and 'irregular'

= irregularly, only emergency dental care or never; *General health* and *Satisfaction with life situation* were answered on the five-point Likert scale ('very poor' – 'very good' and 'very unsatisfied' – 'very satisfied'; respectively).

Test-retest reliability

The test-retest reliability of OHIP-14 was tested in a separate non-patient sample. The reasons being that participants in the main study responded anonymously and that patient samples may be subjected to treatment that could change their oral conditions before the second administration of the index.

Sixty members of a (physical) handicap organization were invited to participate in the test-retest study. The response rate was 83% (n=50). Three weeks later the respondents were asked to complete the index once again and 48 (96%) returned the form. Of the 48 participants 29 were handicapped persons and 19 were accompanying family members or supporting persons. The most common handicaps were leg or back-problems (n=11) and stroke (n=5). None was institutionalised and all, but one blind individual, completed the index by themselves. Sixty percent were females. Mean age was 69.3 years (SD=13.0) ranging from 30 to 88 years of age.

There were no major differences between the main study sample and the test-retest sample (age, sex, mean OHIP score, regular dental care, self-rating of general health and satisfaction of life situation) except for proportion of dentures (main study sample: 21%; test-retest sample: 35%).

Statistics

If answers to ≤ 3 items were missing in the OHIP-14 or GOHAI questionnaires, these were replaced by the median of the OHIP-14 values and if > 3 were missing, the instrument was not included in the analyses (in the present study=one case).

In analyses involving ordinal data or/and the highly skewed OHIP-14 data, non-parametric tests were used. Cronbach's alpha and split-half reliability were calculated to assess the degree of internal consistency and homogeneity between the items. The stability was assessed by test-retest correlation (Spearman's correlation coefficients) and weighted Kappa.

Results

Characteristics of the subjects

Among the respondents, 59% were female (Table I). Subjects were between 50 and 89 years of age with

a mean age of 65 years (SD=10.3). Patients seeking implant therapy (IMP) were significantly older than patients referred for periodontal treatment (PD) (Table I). Among participants, 61% lived in a relationship and the rest were single or widowed. Since this was a patient sample, as many as 91% reported dental attendance at least every second year.

Removable prosthesis; complete or partial, in one or both jaws were carried by 21%. Full upper dentures (9%) were more common than full lower dentures (3%). Partial dentures were equally common (8%) in both jaws. A significantly higher proportion of IMP patients had full or/and partial dentures as compared to the other patient groups (Table I). The number of patients with more than 10 teeth in both jaws was 43%. Mobile teeth in one or both jaws were reported by 22% of the patients. More patients in the IMP and PD groups reported mobile teeth than those of the TMD and GDC groups (Table I).

Over 80% of the participants reported that they were 'satisfied' or 'very satisfied' with their general life situation. Only 5% reported their life situation as 'unsatisfied' or 'very unsatisfied'. No significant differences between patient groups were found. In general, patients were also satisfied with their general health. Although being older the IMP patients rated their general health as better ('good', 'very good') than the PD, GDC and the TMD patients (Table I).

Responses and scores to OHIP-14

The mean additive OHIP-14 score (Add-OHIP) was 22.6 (SD=10.5) with a median of 18.0 and a score range of 14-65 (Table 2). The Add-OHIP scores were not normally distributed (the Kolmogorov-Smirnov statistics=0.21, $p < 0.001$). The mean simple count score (SC-OHIP) was 2.6 (SD=3.5) with a median of 1 and the score ranged from the possible minimum of 0 to the possible maximum of 14. Thus, 43% answered 'seldom' or 'never' on all questions and 9% answered 'sometimes', 'often' or 'always' on more than half of the 14 items. The IMP-patients reported significantly poorer OHRQL than the other patient groups (Table II). However, there were no significant differences in scores between the GDC group and the TMD and PD groups for either Add-OHIP-14 or SC-OHIP-14 scores.

Table 3 shows the percentage of each OHIP-14 item that was answered with a 'sometimes', 'often' or 'always' for the separate patient groups and total group. The IMP group had the highest percentage for all 14 items. The six most commonly reported items were the same in the IMP, PD and GDC pa-

© **Table 2.** Number of patients and mean value, standard deviation (SD) and median for the Add-OHIP-14¹ and the SC-OHIP score according to clinic/treatment group.

Clinic/treatment	Add-OHIP-14 ¹				SC-OHIP-14		
	n	Mean	SD	Median	Mean	SD	Median
Implant dentistry (IMP)	30	32.4	14.3	31.0	6.0	4.6	6.0
Periodontics (PD)	25	20.4	8.8	18.0	2.2	3.3	1.0
TMD	13	22.0	7.8	19.0	2.2	2.7	1.0
General dental care (GDC)	84	19.6	7.0	16.0	1.5	2.4	0.0
Total	152	22.6	10.5	18.0	2.6	3.5	1.0

¹ Kruskal-Wallis test: $\chi^2=22.6$, $p<0.001$; Mann-Whitney U test: IMP > PD ($p=0.001$), TMD ($p=0.03$), GDC ($p=0.001$).

© **Table 3.** Percentage of patients reporting "sometimes", "often" or "always" on each item (SC-OHIP-14) according to the separate patient groups and total group. The most commonly reported items for each patients-group marked in bold print.

OHIP-14 item	IMP ¹ (%)	PD ¹ (%)	TMD ¹ (%)	GDC ¹ (%)	Total
1 Trouble pronouncing words ²	36.7	4.0	0.0	9.9	9.9
2 Sense of taste worse ²	33.3	12.0	7.7	15.8	15.8
3 Painful aching in mouth ³	40.0	12.0	15.4	19.7	19.7
4 Uncomfortable to eat foods ³	66.7	20.0	30.8	30.9	30.9
5 Been self-conscious ⁴	56.7	20.0	7.7	24.3	24.3
6 Felt tense ⁴	53.3	24.0	23.1	27.6	27.6
7 Diet been unsatisfactory ⁵	40.0	12.0	15.4	13.8	13.8
8 Had to interrupt meals ⁵	30.0	8.0	7.7	11.2	11.2
9 Difficult to relax ⁴	53.3	28.0	38.5	27.6	27.6
10 Been embarrassed ⁴	60.0	32.0	7.7	27.0	27.0
11 Been irritable with others ⁵	26.7	12.0	15.4	9.9	9.9
12 Difficulty doing usual jobs ⁵	20.0	4.0	15.4	7.9	7.9
13 Felt life less satisfying ⁴	60.0	28.0	30.8	27.0	27.0
14 Totally unable to function ⁵	20.0	4.0	7.7	5.9	5.9

¹IMP=implant therapy group, PD=periodontal treatment group; TMD=temporomandibular disorders group; GDC=general dental care group.

²Functional limitation item, ³Pain and discomfort item, ⁴Psychological impacts item, ⁵Behavioural impacts item.

tient groups and for the TMD group this was the case for four of the items.

Reliability

The Cronbach's alpha for the OHIP-14 index was 0.93 and the split-half reliability was 0.90. Both these measures indicate a high degree of internal consistency and homogeneity between the items. As shown in Table 4, corrected item-scale correlations varied between 0.51 and 0.79.

The test-re-test reliability was assessed on a separate sample and the correlation coefficient for the OHIP-14 was 0.85. For individual items, the weighted kappa coefficient varied between 0.44 and 0.83 and the Spearman's rank correlation coefficient ranged from 0.35 to 0.77 (Table 4).

Validity

No significant differences in Add-OHIP-14 score

were found for sex or age (Table 5). Subjects living in a relation reported somewhat better OHRQL, but the difference was not statistically significant (Table 5). Data in Table V reveal a strong association between OHIP-14 scores and dental status. Subjects with more than 10 teeth reported significantly lower OHIP-14 score than subjects with 5 teeth or less. Significantly lower Add-OHIP ratings were also reported by denture wearers (one or more removable prostheses) and by subjects with mobile teeth. Low OHIP-14 scores were associated with perceived poor general health and dissatisfaction with life-situation (Table 5).

The associations between the Add-OHIP score and the other OHRQL index, the GOHAI was high ($\rho=-0.83$) indicating good criterion validity. Self-reported oral health factors were statistically significant but less strongly correlated with the patient's OHIP-14 score ($\rho=0.19-0.41$), and so were 'percei-

© **Table 4.** Corrected item-scale correlation (n=152) and test-retest correlation for the OHIP items (n=48).

Item	Item-scale Correlation	Test-retest Correlation	
		Weighted Kappa	Spearman's Correlation
1 Trouble pronouncing words	0.62	0.70	0.74
2 Sense of taste worse	0.63	0.44	0.45
3 Painfull aching in mouth	0.51	0.57	0.69
4 Uncomfortable to eat foods	0.79	0.66	0.77
5 Been self-conscious	0.76	0.66	0.68
6 Felt tense	0.76	0.72	0.75
7 Diet been unsatisfactory	0.73	0.57	0.63
8 Had to interrupt meals	0.72	0.60	0.61
9 Difficult to relax	0.71	0.60	0.76
10 Been embarrassed	0.67	0.46	0.70
11 Been irritable with others	0.70	0.83	0.74
12 Difficulty doing usual jobs	0.68	0.59	0.35
13 Felt life less satisfying	0.79	0.69	0.76
14 Totally unable to function	0.62	0.71	0.74
Add-OHIP-14			0.85

ved general health' and 'satisfaction with life-situation' ($\rho = -0.42$ and -0.33 , respectively).

Discussion

The results of the present study show that the Swedish version of the OHIP-14 indeed has good psychometric properties. The analyses indicated a high level of internal consistency (0.93). The Cronbach's alpha coefficient was higher or similar to previous studies [6,14,18,19]. The corrected item-scale correlations further supported the homogeneity. The item-scale coefficients were high above the minimum level of 0.20, which has been recommended for including an item in a scale. In addition, the test-retest reliability score was high and in line with the Chinese version of the OHIP-14 [14].

The OHIP-14 index correlated highly to the other OHRQL index, the GOHAI indicating good criterion validity. Significant correlations were also found to the single item questions concerning general health and general life satisfaction, also implying satisfactory validity. Yet, neither the results of the Kruskal-Wallis test nor the Spearman correlation coefficient were impressive although significant for OHIP-14 and life-situation (Table 5). In a study by *Locker et al* [11], weak but statistically significant relations were also found between GOHAI, OHIP-14 and life-situation. They stated this was to be expected since oral health is only one of many potential determinants of quality of life in elderly.

In the present study statistically significant asso-

ciations were found for all the self-reported measures of dental status (mobile teeth, number of teeth, dentures) indicating good concurrent validity (Table 5). This corresponded to the results of the Hebrew version [15] where positive correlations between the OHIP-14 and dental status were found, while *Locker et al*. [11] reported contradictory findings in a population with a mean age of 83 years. In our younger Swedish patient sample, the functional and psychosocial self-evaluation of oral health seems to be more highly influenced by dental status.

Prior to the regression analysis approach used when *Slade* [6] extracted OHIP-14 from OHIP-49, statements relevant to denture wearing were excluded. Therefore, *Allen and Locker* [8] developed a modified short version (OHIP-Edent) of OHIP-49 to assess OHRQL in edentulous adults. However, in the present study the OHIP-14 score showed strong association to dentures (full and partial) in spite of the exclusion of statements relevant to denture wearing.

The 'floor effect' of OHIP-14 sum of scores has been discussed as a problem because it may compromise the ability to detect within-subject change [11]. However, compared to the result from a non-patient sample [11], a lower proportion of 'never' and 'seldom' ratings are found in the present patient study as in a study by *Robinson et al* [18]. The patient sample of the present study consisted of 50% special care patients and the *Robinson et al* study [18] consisted of dental emergency patients, indicating pre-

© Table 5. Concurrent and discriminant validity of OHIP-14 scores (ADD and SC) and selected independent variables.

	OHIP-14				Mann-Whitney	
	ADD		SC		z	p
	mean	median	mean	median		
Sex						
Male; n=59	22.1	18.0	3.5	2.0		
Female; n=89	22.8	18.0	3.6	2.0	-0.1	0.896
Age						
50-65 years; n=87	22.2	19.0	2.5	1.0		
≥66 years; n=61	23.0	17.0	2.8	1.0	-0.6	0.563
Living in relation						
Yes; n=88	20.7	17.0	3.0	0.0		
No; n=56	24.5	20.5	3.9	1.5	-1.8	0.074
Number of teeth						
¹ 0-5 teeth; n=33	29.4	25.0	4.8	4.0		
² >10 teeth; n=68	18.5	16.0	1.3	0.0	-4.4	0.000
¹ Tooth mobility						
Yes; n=34	27.7	26.0	4.4	3.0		
No; n=116	20.7	18.0	2.0	1.0	-2.3	0.020
¹ Dentures; full or partial						
Yes=32	28.0	26.0	4.4	3.0		
No=119	21.1	9.0	2.1	1.1	-2.8	0.006
³ Self-rating of general health					Kruskal-Wallis	
Poor; n=10	37.1	35.5	7.5	8.0	χ ²	p
Fairly good; n=40	23.6	20.5	2.7	8.0		
Good; n=97	20.7	17.0	2.1	2.0	25.8	0.000
⁴ Satisfaction with life situation						
Dissatisfied; n=7	33.3	28.0	5.3	4.0		
Neither, nor; n=22	25.1	22.5	3.5	2.5		
Satisfied; n=118	21.5	17.0	2.3	1.0	11.6	0.021

¹In one or both jaws. ²In both jaws

³General health: Mann-Whitney U-test > Neither, nor (p=0.002) and >Good (p=0.000)

⁴Life situation: Mann-Whitney U-test. Dissatisfied > Satisfied (p=0.003)

sence of oral disorders. Thus, the 'floor effect' may be a problem mainly within non-patient samples and possibly should not affect patient samples seeking care for specific problems to the same level.

When analysing all OHIP-14 items separately (Table 3), greater impact for all items were found in IMP patients. Another interesting finding is the correspondence among frequently reported items for the four patient groups. According to *Locker* [22] the OHIP-49 captures seven dimensions of oral health but in a study validating the OHIP-14 and the GOHAI *Locker et al* [11] used only four dimensions. These four dimensions were: 'psychological impact', 'pain and discomfort', 'behavioural impact' and 'functional limitation'. Using these parameters five of the most commonly reported items of the present study were 'psychological impact' items

(items 5, 9, 10, 13) and the last one (item 5) was a 'pain and discomfort' item. Thus, no 'behavioural impact' or 'functional limitation' items were found among the most common problems. One might expect the functional limitation items to have a greater impact on OHIP-14 score due to the relation found between OHRQL and missing teeth and dentures. However, the functional limitation items of the OHIP-14 do not consider 'chewing' and 'biting' but 'trouble pronouncing words' and 'sense of taste worse', which may not be a main problem for patients with few teeth or/and dentures. Yet, the psychological impact in this sample and especially among IMP patients is interesting, as it shows the importance of using OHRQL-instruments. Thus, in the present study OHIP-14 manage to capture other aspects of oral health than objective measures are able to.

Previous studies have found strong impact on quality of life in TMD groups and especially for pain items [2,23]. In the present study as in the original study [6] jaws was not included in the wording of the OHIP-14, which may be the reason for the overall lack of impact in the TMD group. In a study by *Larsson et al* [2] where the Swedish version of the OHIP-49 was validated, the authors modified the index so that the masticatory system was part of the wording. Thus, a strong association was found between TMD and OHIP-scores when assessment included teeth, mouth and dentures but also jaws.

In agreement with the Hebrew version of the OHIP-14 [15] patients in the present study referred for periodontal treatment did not score differently from the general dental care patients. However, in a study by *Reisine et al* [23], where other QoL measurements were used, the periodontal patients reported poorer QoL than the general dental care patients. Still, in that study the impacts were much more severe for the TMD patients followed by the denture patients. An explanation to the lower impact on OHRQL among periodontal patients may be that many of these patients are informed about their condition before severe symptoms occur.

Some limitations of the study have to be considered. Firstly, since the sample consisted of patients selected consecutively, the data should not be assumed to be representative of a wider population. However, the aims of the present study were to assess the psychometric properties of the OHIP-14 and to assess OHRQL in different patients groups, which do not necessitate a representative sample. Secondly, due to the small number of patients in the TMD group, the results from this group should be interpreted with caution. Thirdly, all data are self-reported and no clinical examination has been performed. However, self-reported data on remaining teeth and use of removable dentures have been found valid, while data on tooth mobility were less reliable [24,25]. Fourthly, in the present study a three-month recall period was considered to report impacts compared to longer periods in other studies [15,16,26]. A recall period of three months was decided on to minimise response bias since memory is expected to be more accurate over shorter periods. Nevertheless, John et al [27] have shown that the recall period did not have a significant effect on the internal consistency of the German version of the OHIP-49.

In conclusion, the Swedish version of OHIP-14 demonstrated good reliability and validity in this sample of general and specialist dental care patients.

The significantly poorer OHRQL observed for the patients referred for implant therapy reflects the strong association found between OHIP score and dentures and missing teeth, while OHIP-14 did not show similar sensitivity to other oral problems.

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Patient satisfaction with dental care in one Swedish age cohort

Part 1 – descriptions and dimensions

KATRI STÅHLNACKE¹, BJÖRN SÖDERFELDT², LENNART UNELL¹, ARNE HALLING³, BJÖRN AXTELIUS²

Abstract

© The aim of this study were to investigate the dimensionality of satisfaction with dental care, to control the reproducibility of the analysis over time, to investigate changes between the two studied years and to relate satisfaction with elapsed time since the most recent visit to dental care.

All persons born in 1942 in two counties in Sweden, Örebro and Östergötland, were surveyed by post in 1992 at the age of 50 and resurveyed at the age of 55. There were 5363 persons responding at both times, constituting the study group. In this study, opinions are analysed about general satisfaction with dental care and about the most recent dental visit. Factor analysis, one-way ANOVA and contingency tables were used.

Overall satisfaction was high both as to general satisfaction and as to the most recent dental care visit. Those with their most recent dental visit more than a year ago felt more pain, anxiety and unpleasantness and were also more generally dissatisfied. Of those having experiences of pain, anxiety and unpleasantness at most recent visit, there was an overrepresentation of non regular attenders. Factor analysis showed that the questions used revealed a stable pattern.

In conclusion, the overall satisfaction with dental care was high. Differences between the two studied years were small. Persons not visiting dental care within the last year were more dissatisfied both generally and with the most recent visit. A greater number of regular attenders had no feelings of anxiety, pain or unpleasantness at all.

Key words

Satisfaction with dental care, longitudinal survey, factor analysis, questionnaire design.

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Tillfredsställelse med tandvård i en svensk kohort

Del 1

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Sammanfattning

☉ Syftet med föreliggande arbete var att skapa en analysmodell för att studera tillfredsställelse med tandvård i en svensk kohort, personer födda 1942 som vid undersökningstillfället var folkbokförda i Örebro eller Östergötlands län. Denna kohort har studerats med hjälp av enkätundersökningar vart 5:e år; 1992, 1997, 2002 och 2007. De två första studieåren, 1992 och 1997, har i detta arbete studerats och kommer att utgöra plattform inför fortsatta analyser. Kohorten omfattade 5363 personer som svarat vid båda undersökningstillfällena.

Tillfredsställelsen med tandvård beskrivs, både övergripande och med hänsyftning på det senaste tandvårdsbesöket, samt avseende förändringar mellan de två studietillfällena. Reproducerbarheten över tid kontrolleras.

Kohorten visade en samlad bild av hög tillfredsställelse med erhållen tandvård, såväl i allmänna termer som med det senaste besöket. Personer som hade sitt senaste tandvårdsbesök för mer än 1 år sedan uppgav sig ha upplevt smärta, oro och obehag i större utsträckning än övriga, i ökande omfattning ju längre tid som passerat. Regelbundna besökare var mer nöjda än icke regelbundna, både rent allmänt sett och med det senaste besöket. Faktoranalyser visade att använda variabler uppvisade ett stabilt mönster och att de var nästan identiska vid de två studietillfällena. Förändringar mellan de två studieåren var små.

Introduction

Studies of satisfaction with care are important because it can be regarded as a quality indicator of health care. Patients' perspectives are central in evaluations of care. Satisfaction can also be regarded as a determinant of compliance (1, 16). It is said that "Put simply, care cannot be high quality unless the patient is satisfied" (27). However, there are also criticisms that conclusions about high quality in care are drawn too easily from studies with high ratings of satisfaction (5, 18, 26).

There are many dimensions of the concept of satisfaction. It has been studied from different points of views, in sociology, in psychology, in marketing and in health care. Most work has probably been done in the area of consumer satisfaction; knowledge that has been transformed to the care sector. However, consumer and patient satisfaction cannot be regarded as identical (5, 26).

Satisfaction research in dentistry mostly deals with five issues: technical competence, interpersonal factors, convenience, cost and facilities. This research has been criticized for disregarding other aspects of satisfaction used in the world of psychology and marketing (15). One example is the theory about consumers comparing the perception of a service with their prevailing expectations. There are, however, some studies from dentistry taking into account aspects such as expectations. They reveal a gap between the service patients expect and what they get. Mostly, failure is found in the area of communication and information (11, 12, 17).

There is no generally accepted theoretical definition of the concept patient satisfaction (3, 14, 19, 20). Hence, there are difficulties in measurement. Critical voices have been raised that the instruments generally used are too insensitive to variations in quality provided, i.e. too low discriminatory power, as a rate of 85–90 per cent satisfaction is of no use for analysis (5, 20). It is said that a positive response in a satisfaction survey cannot be interpreted as care may be considered good, only because no disaster occurred. For satisfaction measurements to be applicable and useful, sources of dissatisfaction must be identified as well as the specific kind of dissatisfaction in its specific situation (19).

Today several survey instruments are available in research on satisfaction with dental care; common are the DVSS – Dental Visit Satisfaction Scale including ten items (6, 9) and the DSQ – Dental Satisfaction Questionnaire including 19 items (16, 21). These are well-tested instruments as to validity and reliability

but they are not uncontested. Some prefer the use of these instruments while others think that they are too blunt and believe that specific questionnaires with detailed questions should be designed for a particular occasion (3, 19).

There are, thus, difficulties in measuring satisfaction with care (5, 18, 19). Depending on how the question is put, it can be difficult to separate general opinions about dental care either from a recent occasion or from some extraordinary experience in the past. Opinions about satisfaction often have an intrapersonal variation, as well as interpersonal, over time which constitutes an argument for those doubting the possibility of creating a unitary concept of satisfaction (5). Another possible factor affecting opinions about dental care is the time elapsed between the most recent visit and when the study of satisfaction is carried out (4, 25). Few studies have investigated changes in satisfaction over time. There is, in sum, a need for additional studies of satisfaction with dental care, especially with a longitudinal perspective.

Two large comprehensive oral health studies have been carried out on the same population in Sweden, the first in 1992 and the second one five years later in 1997. The studies were in part devoted to satisfaction with care. In previous studies on this cohort, changes in the perceived oral health and in the utilization of dental care between 1992 and 1997 have been analyzed with respect to social and demographic factors (22, 23, 24). This paper, part I, and the part II paper will study this cohort as to their satisfaction with dental care in general terms and with the most recent visit. There are several aims with this first part of the study:

1. to investigate the dimensionality of satisfaction with dental care
2. to control the reproducibility of the analysis over time, i.e. the stability and reliability
3. to describe changes between the two studied years
4. to relate satisfaction to elapsed time since the most recent visit to dental care.

Material and methods

Population

All persons born in 1942 and at the time of the study with residence in two Swedish counties, Örebro and Östergötland, received a mail questionnaire in 1992 and in 1997. A cohort comprising the same respondents from both 1992 and 1997 was established. During this period, 319 persons had moved

into the counties and 443 persons had moved out of the counties or were deceased. They were excluded from the cohort. The net population with a possibility to respond at both times was 8445 persons. The response rates were 72.0 % in 1992 and 74.9 % in 1997, all calculated on the net populations. Of those, 5363 persons (63.5 %) responded on both occasions and thus constituted the cohort with 51.3 % women and 48.7 % men. The non-response was not random. Among those not participating in the cohort, there was a small overrepresentation of men, of people with low education and of those with fewer teeth. This implies that, as always, caution is advisable in interpreting point estimates. However, in analysis of associations and differentials, data can be used with greater confidence as long as it cannot be deemed probable that the differentials or covariations are very deviant in the non-response group. As to satisfaction, the object of this paper, there was also a considerable internal non-response on some questions. Controlling this, there were no significant differences in crosstabulations of responses on questions with low vs. high internal non-response, which thus can be considered random. Further details of both the data collection and the non-response analysis are described in two recent papers (22, 23). The questionnaire consisted mainly of questions about self perceived oral health and opinions about dental care. Names and addresses were obtained from public population records (Statistics Sweden).

Questionnaire

The questionnaire was constructed in 1991 using other population studies as example. Detailed information about construction and administration is found in (22, 24). The questionnaire was designed in different sections, containing questions about socio-economic conditions, general health, oral conditions, attitudes, experiences and use of dental care and about the most recent visit to dental care. All questions were the same in 1992 and 1997. In this paper, the variables gender, regularity of visits and private/public care provider were used.

The variables in the questionnaire at focus in this analysis were:

Satisfaction with dental care

Questions of general satisfaction with dental care were:

- Are you in general satisfied with the care you have received earlier? Response alternatives: very satisfied, quite satisfied, rather dissatisfied, very dissatisfied
- Have you generally been able to visit the dentist

you want to? Response alternatives: yes always, yes mostly, just sometimes, no seldom, no never

- Have you any time during the last five years changed or wanted to change dentist because you have been dissatisfied? Response alternatives: yes several times, yes occasionally, no, do not remember.

There were four questions concerning most recent dental visit, with a common introduction: "We want to know how you experienced your most recent visit to dental care in various respects. Put an X on each line between two opposites, so that it shows what you felt at your visit". The alternatives were:

- painless – unbearable pain
- no discomfort – very unpleasant
- complete calm – great anxiety
- good reception – bad reception

For these variables, the response alternatives were differently constructed in the two study years. In 1992, there were Visual Analog Scales (VAS) scales with a middle point marked, in 1997 there were five check boxes. At both times, the endpoints of the scales were the same. To handle this difference, a trichotomy was done for both study years, with one category to the left and one to the right of the middle point (or box), which was retained as a middle category. This would render the responses approximately comparable.

Statistical analysis

The data were analyzed with descriptive statistics, cross-tabulations with χ^2 analysis and one-way ANOVA. For dimensionality analysis, Principal Components Analysis (PCA) was used (10). The number of factors was determined by the Kaiser criterion and after inspection of scree plots. Also Principal Axes Factor (PAF) analysis was performed, allowing communalities to be interpreted as variance explanations. Data analysis was processed by the SPSS (Statistical Package for the Social Sciences, version 11.0).

Results

The items aimed at measuring satisfaction were subjected to a PCA. The results were clear-cut and two factors emerged for both the 1992 and the 1997 study. The factor solutions are stated in Table 1. For interpretation, the PCA was supplemented with a PAF (Table 2). Basically, the same factor pattern emerged. The communalities were very high with one exception, the item concerning how a person was received at their most recent dental visit. Cronbach's

© **Table 1.** Factor analysis, Principal Component Analysis

Items	1992			1997		
	F1	F2	h ²	F1	F2	h ²
Was your most recent visit unpleasant or not	0.91	-	0.82	0.92	-	0.86
Was your most recent visit painless or not	0.86	-	0.74	0.85	-	0.73
Did you feel calm or great anxiety at your most recent visit or not	0.83	-	0.70	0.82	-	0.68
Were you taken good care of or not at your most recent visit	0.64	-	0.45	0.49	0.43	0.43
Are you in general pleased with the care you have received earlier or not	-	0.78	0.63	-	0.75	0.58
Have you generally been able to visit the dentist you want to or not	-	0.73	0.54	-	0.69	0.48
Have you during the last 5 years wanted to change your dentist or not		0.67	0.45	-	0.69	0.47
Eigenvalues	2.84	1.47		2.82	1.41	
Variance explanation	40.6%	21.0%		40.3%	20.1%	

© **Table 2.** Factor analysis, Principal Axis Factoring

Items	1992			1997		
	F1	F2	h ²	F1	F2	h ²
Was your most recent visit unpleasant or not	0.93	-	0.86	0.98	-	0.98
Was your most recent visit painless or not	0.79	-	0.63	0.74	-	0.57
Did you feel calm or great anxiety at your most recent visit or not	0.74	-	0.56	0.69	-	0.50
Were you taken good care of or not at your most recent visit	0.50	-	0.29	0.38	0.38	0.29
Are you in general pleased with the care you have received earlier or not	-	0.70	0.50	-	0.65	0.44
Have you generally been able to visit the dentist you want to or not	-	0.53	0.30	-	0.50	0.26
Have you during the last 5 years wanted to change your dentist or not		0.43	0.19	-	0.47	0.22
Eigenvalues	2.84	1.47		2.82	1.41	
Variance explanation	40.6%	21.0%		40.3%	20.1%	

alpha was 0.84 and 0.81 for the first factor the two study years and 0.55 and 0.54 for the second factor, respectively.

Overall general satisfaction with dental care was high in both 1992 and 1997. Most respondents felt that they could visit the dentist they wanted to, and rather few stated that they had wanted to change – or actually had changed – dentist during the last five years. There were small changes in general satisfaction with care between the two studied years (Table 3). An analysis was made concerning time elapsed between the most recent visit and the time of the questionnaire study. If the most recent visit to dental care was more than a year ago, general satisfaction with dental care was not as good as if the visit had

been within the last year. In 1992, 20 % of those with their most recent visit more than three years ago were generally dissatisfied, compared with 5 % for those who had their most recent visit in the last year. The corresponding figures for 1997 were 18 % and 4 % (Table 4).

Results concerning the most recent dental visit also showed a generally high satisfaction in both 1992 and 1997. Overall, there was a slight tendency to be more pleased with the most recent visit in 1997 than in 1992, with fewer respondents feeling anxiety, unpleasantness and pain (Table 5). For those expressing feelings of anxiety, unpleasantness and pain, analysis of gender differences, of being a regular attender to the same dentist or not and for care

© **Table 3.** Percentage distributions of questions for general satisfaction with dental care. 5.227≤n≤5.308

General satisfaction	1992 %					1997 %				
	1	2	3	4	5	1	2	3	4	5
Are you in general satisfied with the care you have received earlier*	51	44	3	2	-	47	48	3	2	-
Have you generally been able to visit the dentist you want to**	73	22	2	1	1	75	22	1	1	1
Have you any time during the last 5 years changed or wanted to change your dentist because you have been dissatisfied***	2	9	89	1	-	1	10	88	1	-

* 1= very satisfied, 2=quite satisfied, 3=rather dissatisfied, 4=very dissatisfied, 5=not applicable

** 1=yes always, 2=yes mostly, 3=just sometimes, 4=no seldom, 5=no never

*** 1=yes several times, 2=yes occasionally, 3=no, 4=do not remember, 5= not applicable

© **Table 4.** Experiences from the most recent dental visit and general satisfaction with dental care, in comparison with time elapsed since the most recent dental visit, in 1992 and in 1997. Percentage distribution.

	1992 %			1997 %		
	Most recent dental visit			Most recent dental visit		
	<1 year ago	1-3 years ago	>3 years ago	<1 year ago	1-3 years ago	>3 years ago
Quite a lot/too unbearable pain	3	5	21	2	2	14
Painless or a little pain	97	95	79	98	98	86
n	4522	396	111	4078	329	110
Quite a lot to great anxiety	6	11	34	4	9	22
Complete calm or a little anxiety	94	89	66	96	91	78
n	4586	405	127	4092	353	122
Quite unpleasant to very unpleasant	6	8	35	4	6	20
No discomfort to a little discomfort	94	92	65	96	94	80
n	4602	402	126	4232	367	120
Generally dissatisfied with earlier dental care	5	5	20	4	7	18
Generally satisfied with earlier dental care	95	95	80	96	93	82
n	4697	418	139	4705	419	159

organization was done by χ^2 and ANOVA (Table 6). Pain experiences were almost the same for men and woman, while feelings of anxiety ($P<0.0001$ in 1992, $P<0.0001$ in 1997) were higher for woman as well as unpleasantness which also was higher for woman, but only in 1992 ($P<0.028$ in 1992, $P<0.697$ in 1997). Experiences of pain, anxiety and unpleasantness were significantly higher among nonregular attenders ($p<0.001$ for all three and at both years). Almost no differences were seen between care organization, private or public, either for having had experienced pain, anxiety or unpleasantness.

In the analysis of the time elapsed between the most recent visit and the time of the questionnaire study, it appeared that if the most recent dental visit

was more than a year ago, feelings of pain, anxiety and unpleasantness were reported as worse. In 1992, 20% felt pain among those with their most recent visit more than three years ago, compared to 3% among those who had their most recent visit less than a year ago. The same pattern appeared for anxiety and unpleasantness (Table 4). There were also differences between irregular and regular visitors. Cross-tabulation showed that in 1992, 15% of irregular visitors to the same dentist were generally dissatisfied with dental care, while 5% of regular visitors were dissatisfied. Corresponding figures for 1997 were 19% of irregular visitors and 4% of regular visitors being dissatisfied.

© **Table 5.** Percentage distribution of questions for most recent dental satisfaction. 4521≤n≤5171

Most recent visit satisfaction	1992 %			1997 %		
	1	2	3	1	2	3
*Good reception – bad reception	96	3	1	98	1	1
**Complete calm – great anxiety	84	9	7	88	7	5
***No discomfort – very unpleasant	83	11	6	87	8	5
****Painless – unbearable pain	86	11	3	89	9	2
* 1=good – quite good reception,	2=in between,	3=not so good – bad reception				
** 1=complete calm – a little anxiety,	2=in between,	3=quite a lot – great anxiety				
*** 1=no discomfort – a little discomfort,	2=in between,	3=quite unpleasant – very unpleasant				
****1=painless – a little pain,	2= in between,	3=quite a lot – unbearable pain				

© **Table 6.** Analysis of those having had feeling of pain, unpleasantness and anxiety at most recent dental visit in relation to gender, being a regular attender to dental care or not and to care organization.

	Feelings of pain		Feelings of unpleasantness		Feeling of anxiety	
	1992 %	1997 %	1992 %	1997 %	1992 %	1997 %
Woman	63.3	39.1	64.6	38.0	61.9	33.4
Man	61.0	41.6	61.6	38.5	53.5	23.3
ANOVA F/P	2.796/<0.095	2.860/<0.091	4.920/<0.027	0.168/0.682	38.025/<0.000	57.296/<0.000
n	5030	4521	5131	4723	5119	4571
Regular attender	61.4	39.8	62.3	37.5	56.7	27.4
Nonregular attender	71.2	50.4	70.8	50.2	69.2	42.2
ANOVA F/P	14.036/<0.000	11.654/<0.001	11.003/<0.001	18.286/<0.000	23.196/<0.000	28.868/<0.000
n	4990	4486	5092	4686	5080	4536
Private care organization	61.9	37.5	63.0	38.9	57.3	28.6
Public care organization	61.6	40.0	62.0	35.3	57.5	26.2
ANOVA F/P	0.034/0.854	4.926/<0.026	0.454/<0.501	5.129/<0.024	0.013/<0.911	1.777/0.183
n	4903	4405	4993	4591	4980	4448

Discussion

The overall result of this study, as in many others, was that satisfaction with dental care was high. In 1992, 96% were pleased with the way they were taken care of, as were 98% in 1997. One criticism, among others, of satisfaction surveys is that they are too blunt, not focusing on what needs to be improved. One explanation for the high overall satisfaction ratings is pointed out in the so-called “Attribution Theory”, which deals with duty and culpability. Is the dentist to blame if something goes wrong? If a person has been a regular attender to a dentist for a long time with mostly good experiences, one slip-up or one bad occasion will not always be ground for dissatisfaction. The good impression holds, at least for a while. Most studies conclude that regular attenders are more satisfied than non regular ones (2, 8, 13). In this study regular visitors were more generally satisfied.

Another criticism in satisfaction studies is that questions often are phrased in too general terms, leading to poor discriminatory ability (15). In this study, an attempt was made to increase discrimination. That was attained by adding, to the analysis, questions about feelings of pain, anxiety and unpleasantness at the most recent visit. Separate analyses of these components showed that not being a regular attender to the present dentist was strongly related to experiences of pain as well as feelings of anxiety and unpleasantness. Gender differences showed that more women felt anxiety at the most recent visit. Skaret et al (20) have also shown that more women felt anxiety compared to men, although that study concerned younger women than studied here.

The time elapsed between the most recent dental visit and the time of the questionnaire study affected the expressed experience of that visit. Also the general opinion about dental care was affected by

the time-factor. More persons were generally dissatisfied of those who had had their most recent dental care visit more than three years ago, which is in accordance with other studies (13, 2). Of those having their most recent visit to dental care more than a year ago, a greater number of persons had felt pain, anxiety and unpleasantness than among those with their most recent visit less than a year ago. The longer the time passed, the greater the number of negative experiences. Maybe people having experiences of pain, anxiety and unpleasantness postpone their dental visits.

The purpose of doing factor analysis was not primarily, as most common (10), to establish a data reduction but rather to check the stability of the dimensional interpretations of the questions. The results showed that the questions used split in the expected pattern, which also was stable over time. Another reason for using factor analysis was to check whether the questions could be included in a composite index, somewhat improving the discrimination and approximation of interval scales. Two different methods of factor analysis were used, PCA and PAF. Here, PAF could be used since there was a clear theoretical model behind the analysis. Essentially, the two methods confirmed each other. PAF is interpretable as a variant of regression, where communalities are interpretable as multiple correlation coefficients, and they were remarkably high in some instances.

There are methodological problems in measuring satisfaction. In this study, the questions of satisfaction were one part in a questionnaire-survey concerning many other aspects of dental health and care, the same as many other survey studies. A possible weakness of this study follows from the longitudinal design. Establishing a cohort requires that similar questions are put at all study occasions. This means that the first study binds the following ones. If, for example, new multi-item instruments are developed during the study time, they cannot be used without disrupting longitudinality. There is one problem here on this point.

In 1992, a VAS scale was used with a middle point marked, in 1997 there were five check boxes. In 1992, data input was handled manually while the questionnaire forms were scanned in 1997. The scanner could not deal with a VAS scale. The endpoints of the scales were the same at both study times and both alternatives were computed in five steps. This change in design makes interpretations more uncertain, especially for the extreme answers. To miti-

gate this problem, in all analyses of these questions the response alternatives were trichotomized. This change cannot, however, solve the problem entirely. Any judgment of change between study years becomes uncertain – what can be ascribed to the scale change and what to a real change. This problem thus impairs the possibility of studying changes between the two study years (18). However, differences within the study years are not affected by this problem since then only gradients are interesting and not levels. Indeed, as can be seen in Table 5, the picture is clear of great stability with very little worry, pain or discomfort and very good reception, 83-98 % for both years. In crosstabulations, the two differently constructed variables gave identical results in 85-95 % of all persons.

There are strengths in this study, primarily the longitudinal design, the large material and the general stability of the results between the two study years. Changes in satisfaction with dental care between the two study years were small. One explanation is that a period of five years can be a relatively short time in this respect (further results will be presented in a forthcoming paper since this cohort is continually followed up).

In conclusion, the overall satisfaction with dental care was high both in general terms and with the most recent visit. Differences between the two study years were small in almost all aspects. The stability of results between the two studied years was high. Factor analysis showed that the questions used revealed a stable pattern. There was a relation between time passed since the most recent dental visit and the time of the study, with an increasing number feeling pain, anxiety and unpleasantness as well as being generally dissatisfied with dental care the longer the time had passed. Of those having experienced pain, anxiety and unpleasantness at most recent visit, there was an overrepresentation of those not being a regular attender to the present dentist.

The present study has dealt with the subject “descriptions and dimensions of satisfaction” as part one of the analysis of satisfaction with dental care in this Swedish cohort. In the “part II-paper” the issue of what affects satisfaction will be investigated.

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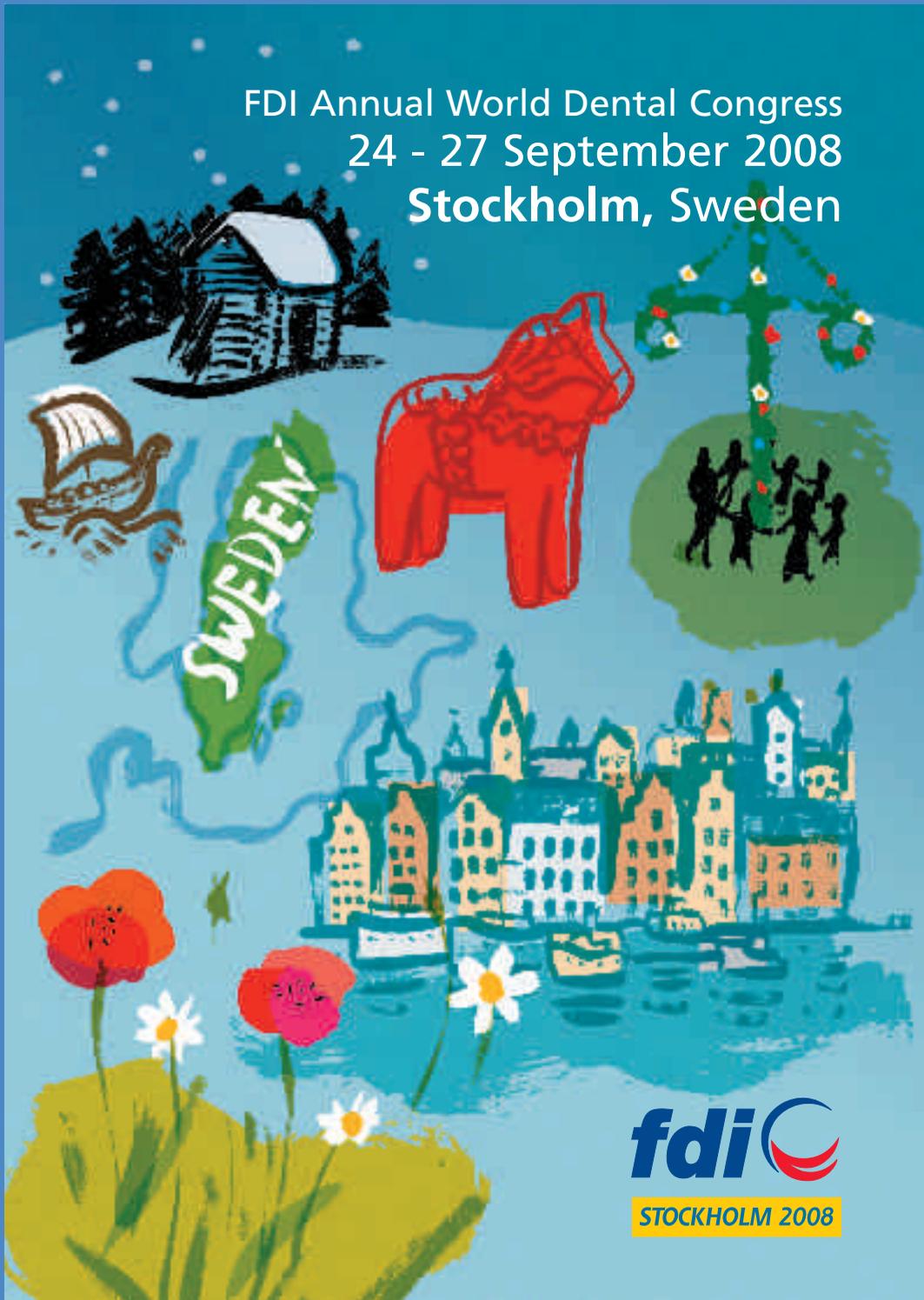
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