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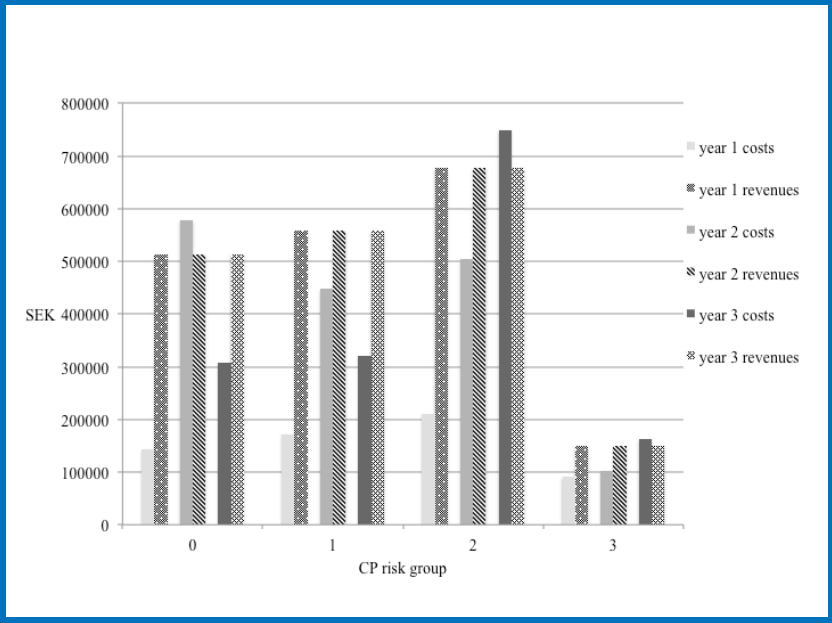

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Instructions to authors

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A new dental insurance scheme – effects on the treatment provided and costs

CHARLOTTE ANDRÉN ANDÅS[1], ANNA-LENA ÖSTBERG[1,2], PONTUS BERGGREN[2], MAGNUS HAKEBERG[1,2]

Abstract

◎ The aim of this study was to investigate whether the revenues cover the costs in a pilot capitation plan, a dental insurance scheme, and to compare this capitation plan (CP) with the original fee-for-service system (FFS), in terms of the amount and type of dental care provided.

Data was collected longitudinally over a period of three years from 1,650 CP patients in five risk groups at a test clinic, and from 1,609 (from the test clinic) and 3,434 (from a matched control clinic) FFS patients, in Göteborg, Sweden. The care investigated was the number of total treatments provided and the number of examinations by dentists and dental hygienists, together with preventive, restorative and emergency treatments.

The economic outcome was positive from the administrator's perspective, in all risk groups for the three-year period. The amount and type of care provided differed between the payment models, as CP patients received more preventive treatments, less restorative treatments, and more examinations by dental hygienists than the FFS patients. Emergency treatment was performed more often on CP patients, and the difference was due to a higher frequency of such treatments among women in the CP group. The difference between clinics concerning certain treatment measures was sometimes greater than the difference between payment models.

The results from this study indicate a net positive economic outcome for the pilot CP system over three years. The payment model and the clinic affiliation had impact on what type and amount of dental care the patients received. This might suggest that the risk of skewed selection and its consequences as well as the influence of clinic-specific practice need further investigation, to ensure economic sustainability in a longer perspective.

Key words

Dental insurance, capitation fee, prepaid dental care, fee-for-service reimbursement

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Kostnader och förmedlad vård i Frisktandvård, en ny betalningsmodell i svensk tandvård

CHARLOTTE ANDRÉN ANDÅS, ANNA-LENA ÖSTBERG, PONTUS BERGGREN, MAGNUS HAKEBERG

Sammanfattning

◎ År 2009 infördes i alla Sveriges landsting möjligheten för patienterna inom Folktandvården att betala för sin tandvård med ett fast belopp för en viss tidsperiod, ett betalningssätt som kan liknas vid en tandvårdsförsäkring.

Målet med denna studie var att undersöka om kostnaderna inom ett sådant kapitationsbetalningskoncept täckte utgifterna för försäkringsgivaren, samt att jämföra den behandling som utförts på kapitationsbetalande patienter med den som utförts på patienter som betalar på traditionellt vis, per utförd åtgärd.

Vid en testklinik i Göteborg med lång erfarenhet av kapitationsbetalad tandvård samlades data från 1650 kapitationsbetalande patienter in. Data innehöll patientkostnader, antal och typ av utförd vård uppdelad på undersökningar utförda av tandhygienister respektive tandläkare, förebyggande och reparativa åtgärder, akutåtgärder, samt alla registrerade behandlingsåtgärder sammanlagt, vid studiens start och efter 1, 2 och 3 år. Patienterna var fördelade på 5 olika riskgrupper. Motsvarande typ av data samlades också in från 1609 traditionellt per-åtgärdsbetalande patienter från samma testklinik, och från 3434 per-åtgärdsbetalande patienter vid en kontrollklinik belägen i ett område med jämförbar socioekonomi.

Studien visade att inkomsterna täckte utgifterna för försäkringsgivaren inom kapitationsbetalningssystemet, för alla riskgrupper sammanlagt under den totala studietiden. Dock översteg utgifterna intäkterna för försäkringsgivaren inom enskilda riskgrupper under enskilda år. Studien visade också på skillnader i såväl mängd som typ av vård, såväl mellan patienter inom de olika betalningsmodellerna, som mellan de olika klinikerna.

Kapitationspatienter undersöktes i högre grad av tandhygienister än per-åtgärdsbetalande patienter. Kapitationsbetalande patienter hade fler registrerade åtgärder av förebyggande typ, och färre registrerade åtgärder av restaurerande typ än per-åtgärdsbetalande. Dessutom erhöll kapitationsbetalande patienter fler akutbehandlingsåtgärder än per-åtgärdsbetalande patienter, och kvinnor stod för den största delen av skillnaden. Skillnaderna var större mellan de kapitationsbetalande patienterna och de per-åtgärdsbetalande som kom från kontrollkliniken än mellan de kapitationsbetalande och de per-åtgärdsbetalande från testkliniken.

Sammanfattningsvis visade studien att det fanns statistiskt signifikanta skillnader i mängd och typ av utförd behandling mellan de två betalningsmodellerna, men också mellan klinikerna. Detta indikerar att såväl betalningsmodellen som det klinikspecifika arbetssättet har inflytande på den vård patienterna erhåller. Försäkringsspecifika ekonomiska konsekvenser av s.k. skevt urval hör också till de faktorer som kan spela roll för betalningsmodellens ekonomiska stabilitet över tid.

Introduction

Dental care remuneration involves a minimum of two parties, the patient and the dentist/dental hygienist. However, in most cases a third party is involved as well. The character of this third actor varies between countries, depending on the organization of dental care financing (14). In Sweden, as in the other Nordic countries, public involvement is significant, compared with other parts of Europe (14). In Sweden, public involvement is associated with substantial subsidies to certain patients groups, and with little access to privately financed insurance alternatives (11). Subsidies are supplied by the National Dental Insurance, and are financed by taxes. Dental care in Sweden is provided by either the Public Dental Service (PDS), or by private practitioners.

Remuneration to the provider of dental care, regardless of whether the money comes from the patient or from the National Dental Insurance, can come from two principal sources, fee-for service (FFS) payment, per unit of work, or capitation (CP) payment, per registered patient. In Sweden, practitioners are remunerated for patients aged 0-19 according to the CP system, which is fully covered by the National Dental Insurance since 1974, whereas for patients aged 20 and older, payment has so far been according to the FFS system (13). The proportion of patients' out-of-pocket payments versus the National Dental Insurance payments has varied over time.

For comparison, in Swedish health care, reimbursement is according to a combination of methods, as is the case in for example Great Britain. In primary care reimbursement is by per capita and/or per time period, so called appropriation funding. Hospital care is financed through a combination of appropriation and a variation of FFS, where the unit of work reimbursed might be a so-called Diagnosis Related Group (DRG) (8). A comparison between Swedish county councils found that those county councils who had a higher proportion of performance-based remuneration had a gain in production, but to a higher cost (8). Internationally, Gosden (4) compared FFS –and CP systems in US Health care, and found more visits and measures in FFS. However, in the CP system, the author reported that patients experienced a lower quality of care and less accessibility to health care.

It has been shown that both types of remuneration for dental care are associated with economic incentives, and that these incentives may lead to differences in the amount and variety of dental treatment produced (6), (9). FFS remuneration, when the dentist/dental hygienist gets paid for whatever treatment he/she believes is appropriate, naturally includes no incentives to undertreat. On the other hand, FFS has been shown to allow so called supplier-induced demand (15), i.e. treatment beyond what is medically justified for a patient, with more treatment provided the fewer the number of patients per dentist/dental hygienist (5), resulting in increasing costs (i.e. public expense, in the case of public financing). In the same way, CP counteracts increasing costs from supplier-induced demand, as the dentist/dental hygienist receives the same pay per patient regardless of the amount of care provided. Instead, CP entails a risk for undertreatment (5). CP remuneration also includes an incentive to take on a larger number of patients, with the possible negative effect that healthy patients are singled out at the expense of those with greater treatment needs. Furthermore, the degree of influence from these incentives is significantly dependent on the share of the dentists'/dental hygienists' salary being fixed, versus directly derived from the CP or FFS payment schemes (6).

A review article by *Johansson et al* (9) found indications towards more preventive care, less restorations, and more decayed teeth in CP compared with FFS. *Grönqvist* found evidence of moral hazard (7) and adverse/advantageous (i.e. skewed) selection (7), caused by asymmetric information, which may pose a risk for the sustainability of a dental insurance scheme. Asymmetric information is referred to as the fact that the patient is better informed about his/her risk (i.e. need for dental care) than the insurer (i.e. dentist/dental hygienist). Moral hazard refers to the policyholders' desire to make use of their benefits, and thus demand additional care beyond the agreement once the fee has been paid, thereby increasing the costs for the administrator to maintain the scheme. Skewed or adverse selection, in turn, addresses the possibility that those with the lowest risk refrain from enrolling in the insurance scheme, as they expect to gain less in relation to what they have to pay. They thereby contribute to increasing the average risk of the policyholders, resulting, eventually, in increased costs for administering the plan. Most CP schemes that have been used as bases for published analyses differ from one another to some extent, which prevents a full comparison. However, both the above authors refer to the same scheme, from the county of Värmland, Sweden, which is similar to the one described in this paper, with regard to significant features (9), (7).

Since 1999, there has been an opening in the Swedish National Dental Insurance for capitation as a complement to fee-for-service reimbursement for adults over 20, under the label "dental care subscription". As we write 2013, a capitation scheme, a dental insurance system, has been implemented by the PDS commonly in all Swedish county councils since 2009. This addition of a second payment system for dental care, entailing the possibility of a choice for the individual patient, can thus be considered to imply a positive effect from a societal perspective. This system means that the adult patient (≥ 20 years) at his/her regular examination appointment, alternatively to pay on current account, is offered to sign a 3-year contract with the dentist/dental hygienist on receiving all basic dental care needed, in exchange for a fixed fee and the fulfilling of individual oral hygiene instructions. The fee is established after a risk group placement performed by the dentist/dental hygienist, preceding the patient´s decision whether or not to accept the contract offer. The contract will be subjected to renegotiation after 3 years, whereas the patient may decide either to renew it, possibly to a changed fee, if the risk group placement is altered, or to withdraw, and thereby re-enter the FFS. The principles of the dental insurance system have been further described by *Johansson* (10) and *Zickert et al* (16). There is a lack of long-term studies concerning the effects on cost coverage and type of treatment performed in CP model insurance schemes.

The first aim of this study was to investigate whether the revenues from the CP covers the actual costs of the care provided over time. A second aim was to compare the amount and type of dental care performed in a CP with that provided in a FFS system in a three-year perspective.

Material and methods

Subjects

Patients at a test PDS clinic in Göteborg, the Region Västra Götaland, Sweden, were informed about and offered the choice to enroll in a first version of a CP, or to pay traditionally according to the FFS system. Patients were consecutively selected to the study if they fulfilled all the inclusion criteria (seeking care at the model clinic and accepting the CP agreement, aged 20 or older at start), during a five-month period from December 1, 2004, to April 30, 2005. Subjects who did not remain in the CP payment plan for three years or longer, were excluded. Among those who did not accept the CP offer, a similarly sized group of FFS patients was matched by age and gender. A second FFS group was recruited from a control PDS clinic with a matching socioeconomic profile, without the possibility for patients to choose the capitation plan. This FFS group was in the same manner matched by age and gender. The clinics were both situated in the city of Göteborg, representing urban inner-city-areas with similar housing categories, levels of education, social welfare disbursement per citizen, and foreign-born share of the population. The number of patients included in the CP were n=1,650 and in the FFS totally n=5,043 (n=1,609 at the CP-clinic and n=3,434 at the control clinic). The patients were followed longitudinally for three years, as this was the length of the contract period. Data concerning demographics, dental care costs (SEK) and the type and amount of care received were collected on four occasions, at baseline and at year 1-3. The drop out rate over the period was for the CP and FFS test and control groups 1.8%, 2.6% and 10.7% respectively.

Dependent variables

The dependent variables were the two payment methods, the capitation plan (CP) and the fee-for-service (FFS) system.

• Capitation plan (CP)

After examination and risk assessment, the patients in the CP group were allocated to one out of five possible risk groups (0-4). Risk assessment was based on a 5 point scale, from very low to very high, using criteria in the categories *general and oral medical history / previously received dental care (technical risk) / Chewing-muscular –or joint dysfunctions / caries / periodontal disease / wisdom teeth / oral hygiene.* The sums of scores were weighted to an overall single score (1-5). Each risk group was linked to a certain fee. A contract of benefits and payment was then agreed upon and signed by both the patient and the dentist/dental hygienist. All basic dental care needs were included in the contract: however, specialist treatments and fixed prosthodontics care were excluded. Regular examinations were included, and were mandatory. The patient also had to commit to an individually designed self-care protocol, including advice concerning oral hygiene, diet and fluoride usage. The contract period started after the patient's treatment need had been settled. The contract was renewable for another three-year period, after an updated risk assessment. No patients were allocated to risk group 4. The distribution of patients in the other four risk groups in the CP is shown in Table 1.

Table 1. Distribution of individuals by gender and age, in CP and FFS, total and subgroups, at baseline.

	Sub/risk Group	N	Gender %		Age Years Mean (SD)		
			women	men	women		men
CP	0	829	51,1	48.9	33.2 (7.0)		32.7 (6.9)
	1	436	56.9	43.1	40.4 (7.8)		40.7 (7.6)
	2	339	59.0	41.0	51.0 (8.4)		50.3 (8.3)
	3	46	65.2	34.8	53.4 (7.9)		51.1 (11.4)
	total	1650	54.7	45.3	39.8 (10.6)	**	38.4 (10.2)
FFS	total	5043	54.7	45.3	38.9 (10.5)	**	37.6 (10.2)
	control	3434	54.5	45.5	38.5 (10.5)	**	37.2 (10.1)
	test	1609	54.9	45.1	39.7 (10.5)	*	38.6 (10.2)

* $p < 0.05$
** $p < 0.01$

• Fee-for-service (FFS) system
The patient paid a certain amount per item of performed care, regardless of the number of treatments needed, according to the current tariff applied in the Region Västra Götaland. The Swedish National Dental Insurance reimbursed part of the expense for the patient, varying with the type of treatment. The FFS group patients were not subjected to risk assessment as described above, however, they had a full dental examination and their treatment need was settled in the same manner as for those who chose the CP system. FFS (total) represents FFS (test clinic) and FFS (control clinic) together.

Independent variables
The independent variables were separated into two main groups, financial variables and type of dental treatment.
• Financial variables (CP)
o Costs
Costs in the CP were based on treatment time multiplied by a cost per hour of SEK 800 for dental hygienists and SEK 1600 for dentists, respectively, according to the PDS treatment fee tariff for 2007.
o Gains
The CP gains were calculated on the basis of patient fee revenues according to risk group (SEK 420, 1080, 1800, 3036 or 4788) per person per year, plus remuneration from the National Dental Insurance amounting to SEK 200 per person per year.
• Type of dental treatment.
The type of dental treatment was defined by options in the National Dental Insurance. The numbers of treatment measures performed were combined into groups to form variables:

o Total number of dental treatments
o Number of examinations by a dentist
o Number of examinations by a dental hygienist
o Number of preventive treatments
o Number of restorative treatments (fillings)
o Number of emergency treatments

Furthermore, the analyses included gender as an independent variable.

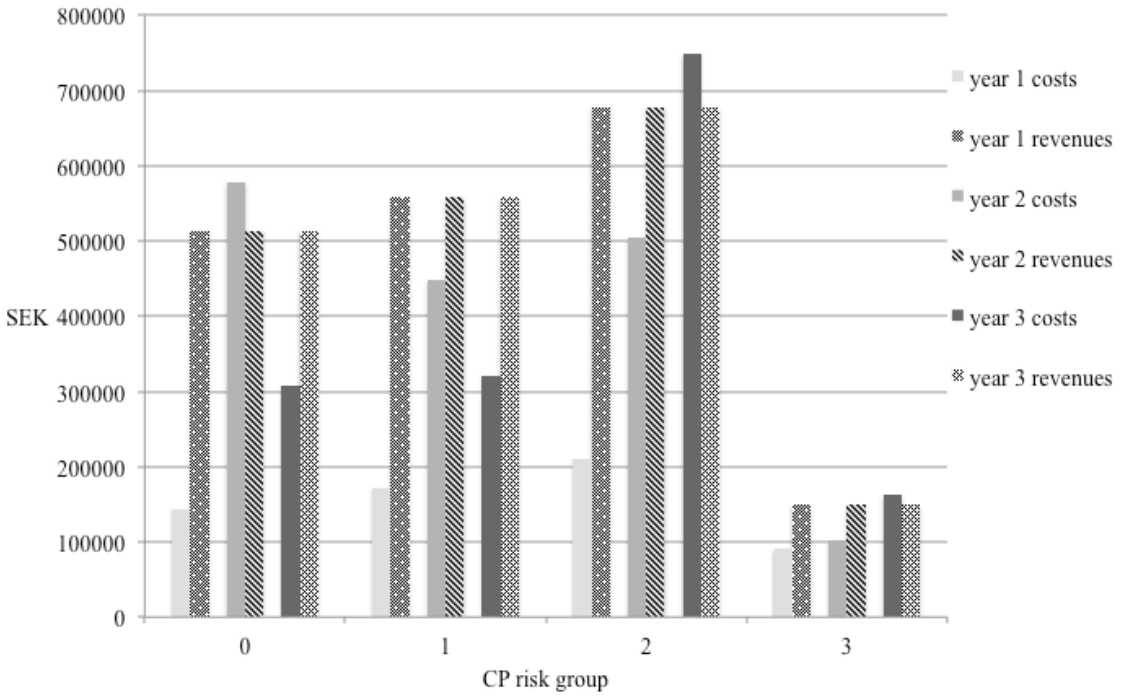
The study followed the ethical regulations of the Swedish Research Council and met the proposals of the Helsinki declaration.

Data management and statistical analysis
The data comprised recorded information from the PDS digital dental record system. The information was consecutively entered into the system by the dentists/dental hygienists at the time of examination, according to the legislation on dental records, and was specifically retrieved for this analysis. The statistical analyses were carried out using the SPSS software version 18.0. Descriptive statistics presenting percentages, means and standard deviations were followed by analyses using the Mann-Whitney and chi-square tests, to analyze the significance of differences between performed treatments, payment models, and gender.

Results

The distribution of gender and age in the CP and the FFS schemes were approximately similar (Table 1). However, when testing age differences in categories we found a significant difference showing proportionally more FFS patients than CP pa-

Figure 1. Cost coverage in CP for the administrator (Public Dental Service), per year and risk group.



tients in the youngest age group (Table 2). There was a statistically significant difference with regard to the proportion of gender within the CP group (χ^2 =3.8, p=0.022). Specifically, the significant difference was found between the risk groups 0 and 2 (p=0.017) (not in tables). Moreover, significant differences were revealed between the mean age of women and men in the CP total group, as well as the FFS total, test and control groups (Table 1). In the CP group, there were statistically significant differences between the risk groups with regard to mean age, except between groups 2 and 3 (not in tables). Dropout analysis showed no statistically significant difference between those who dropped out of the study and those who remained, regarding the distribution of sex, neither in the CP group (χ^2=0.05, p=0.855) nor in any of the two FFS groups (χ^2=0.03, p=0.868(control), χ^2=0.09, p=0.875(test)). Concerning age, there was a significant difference between those above and those below the age of 30, in the CP group (χ^2=12.8, p=0.001) as well as in the FFS control group (χ^2=35.5, p<0.001), but not in the FFS test group (χ^2=0.75, p=0.456), with the younger age group representing the higher drop out rate.

Costs and gains in CP

The total income from the CP minus the total cost, showed a positive net result for the administrator (i.e. the PDS) over the whole three-year period. The coverage was 168 %, 114 % and 119 % per year, respectively. However, as shown in Figure 1, all risk groups did not have 100 % coverage for all three

Table 2. Numbers (n) and proportion (%) in different age groups of CP and FFS patients.

	22-39		30-39		40-49		50-59		≥60	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
CP total *N*=1650	337	22,8	526	31,9	466	28,2	210	12,7	71	4,3
FFS total *N*=5043	1294	25,7	1634	32,4	1357	26,9	569	11,3	189	3,7

Table 3. Net economic balance from the patient perspective, at group level, per year and risk group, by gender (SEK).

CP Risk group		year 1	year 2	year 3	year 4
0	Women	-229	**+286**	-30	**+27**
	Men	-266	**+270**	-70	-66
1	Women	-662	-130	-313	-1104
	Men	-720	**+46**	-391	-1064
2	Women	-1197	-283	**+584**	-895
	Men	-1161	-353	**+161**	-1352
3	Women	-1058	-898	**+413**	-1544
	Men	-1044	-686	**+681**	-1050

Table 4. Number of treatments in CP and FFS. P-values for differences between each FFS group in relation to CP.

	CP		FFS test			FFS control			FFS total		
	mean	SD	mean	SD	*p*	mean	SD	*p*	mean	SD	*p*
Total number of treatments (range 0-32)	5.38	3.5	5.88	3.7	<0.001	4.36	3.2	<0.001	4.85	3.5	<0.001
Examinations by dentist (range 0-5)	0.72	0.7	1.08	0.8	<0.001	1.14	0.7	<0.001	1.13	0.7	<0.001
Examinations by hygienist (range 0-3)	1.07	0.8	0.59	0.8	<0.001	0.09	0.4	<0.001	0.25	0.6	<0.001
Preventive treatment (range 0-15)	2.04	1.2	2.15	1.4	0.012	1.14	1.2	<0.001	1.46	1.3	<0.001
Restorative treatment (range 0-22)	1.07	1.8	1.56	2.1	<0.001	1.45	2.0	<0.001	1.49	2.0	<0.001
Emergency treatment (range 0-7)	0.35	0.8	0.28	0.7	0.006	0.27	0.7	<0.001	0.28	0.7	0.039

years. The coverage was below 100 % for the lowest risk group in year 2 and for higher groups in year 3. Table 3 shows that women in risk group 0 received more care than they paid for, during the three-year period. In all other risk groups the net result for the patients was the opposite, for both men and women.

Total dental treatment

There was a statistically significant difference in the total number of treatments received by patients in the CP and the FFS total groups, with FFS patients receiving less treatment than CP patients (Table 4). However, when the FFS group was divided into subgroups by clinic, the results diverged. FFS patients from the test clinic received more treatment than CP patients, while FFS control patients had fewer treatments carried out. Moreover, the difference between the FFS subgroups was statistically significant ($p<0.001$). In addition, women received significantly more total dental treatment over the three-year period compared to men ($p=0.003$).

Examinations

Significantly fewer examinations were performed by dentists on the patients in the CP group but more by dental hygienists, compared with patients in the FFS

total group (Table 4). In contrast, the FFS test group received a statistically significantly larger number of dental hygienist examinations than the FFS control group ($p<0.001$). The FFS test group also had fewer dentist examinations ($p=0.003$).

Preventive and restorative treatments

FFS patients received significantly fewer preventive measures compared with patients in the CP group (Table 4). But again, when divided into clinic-based subgroups, FFS patients from the test clinic received more preventive measures than the CP group, whereas the FFS control patients had fewer preventive measures carried out (Table 4). The difference between the FFS subgroups was statistically significant, $p<0.001$. The number of restorative treatments showed a significant difference between the CP group and the FFS group, with FFS patients receiving more treatments than CP patients (Table 4). No significant differences could be seen between the FFS subgroups ($p=0.082$).

Emergency treatments

The CP group had a significantly larger number of emergency treatments compared with the FFS group (Table 4). This difference was influenced by gender, as female CP patients accounted for most of the disparity. There was no similar gender discrepancy to be found in any of the FFS groups.

Discussion

In this study, we aimed to compare the outcome of a CP plan to that of a FFS system, with regard to economy as well as treatment panorama. One of the main findings was that the net economic outcome of CP in this pilot capitation plan over three years, resulted in a positive coverage for the model CP-clinic. The study also showed a significant difference between the two payment systems in the amount and type of dental care provided. Furthermore, for certain variables, the difference between clinics was sometimes larger than the difference between payment models, indicating the importance of the clinic-specific practice.

A net positive outcome in this longitudinal study over three years provides some suggestions regarding the practical sustainability of the construction of this insurance scheme. This is an important indication, as increasing public costs (13) is one of several plausible reasons to alter or diversify the system for reimbursement in Swedish dental care. Threats to the sustainability of the system may theoretically emerge from the insurance system itself, as either skewed selection or moral hazard.

Grönqvist has shown evidence of the influence of moral hazard in the increased amount of care performed on CP patients in the county of Värmland study referred to above (7). In this present study moral hazard is a possible reason for the increased numbers of emergency treatments, in CP compared to the FFS, as mentioned by *Grönqvist* "The most direct evidence of moral hazard is the increased propensity to seek acute dental care, since the decision to initiate a contact is exclusively made by the agent." The female dominance in this increase is in accordance with other findings showing that women seek treatment more often than men (1). One possible explanatory approach may be to look for gender-based attitudes towards health and health care (2), or for gender differences in risk management (3). However, although significant, the absolute difference between men and women must be considered to be small, from a clinical perspective.

Grönqvist (7) has found evidence of both adverse selection, and its opposite, so-called advantageous selection, in dental insurance plans. It is not possible to distinguish, with certainty, skewed selection from other economic imbalances in this dental insurance plan. The net result was however positive in all risk groups, indicating no critical consequences due to skewed selection, during the three-year period. Regulations have been built into the present insurance scheme, for the purpose of counteracting effects from changes in behavior and consumption after enrolling in the insurance scheme: for example diversified fees, sharp definitions in contracts and mandatory self-care protocols. Reports on the economic outcome of dental insurance schemes, other than those already referred to, are sparse (12), (5).

The dental care content in the CP compared to that of the FFS plan was different concerning both quality and quantity. CP patients received more preventive care than FFS patients, which corresponds to findings by *Johansson et al.* (9). This could be seen as a response to the incentive for dentists/dental hygienists in the CP to keep the patient healthy and preferably away from restorative treatment, in order to improve the revenue/cost ratio. Furthermore, the amount of preventive care, the number of total dental treatments and the number of examinations by dental hygienists in the FFS test group, were larger than those in the FFS control group, thus showing greater similarity within clinic than within payment model. It is possible that the treatment philosophy

and the composition of the staff had as much influence as the payment method on the care provided. *Grönqvist* (7) demonstrated for instance a strong influence by the dentist or dental hygienist on the patient's decision to enroll in an insurance scheme or not.

Methodologically, this study has both strengths and weaknesses. The advantages are a relatively large sample size and a longitudinal study design. Among the disadvantages are the previously discussed small sample sizes in the high-risk groups, and the fact that the data from the CP patients were retrieved from one clinic only. To make conclusions about skewed selection, a longer time for follow-up, beyond an additional option to choose between the payment systems, would have been necessary. Moreover, using estimated treatment time might have introduced some classification problems. We believe, however, that such a possible error in the analysis should be seen as a random error that may be compensated for by the large sample size. Another possible methodological weakness may be the design of using a matching selection of samples within a clinic and between clinics, thereby introducing a clustering effect since the patients may be more similar within respective clinic. However, we believe that such an effect should be small, partly justified through the matching procedure taking socioeconomic profiles into consideration. Further, we consider the drop out rate to be small enough not to threaten the results. In this observational study the available measures are reported, however few, meaning that explicit multivariate statistical methods were not applicable. Thus, known or less obvious confounding factors were not taken into consideration. We further believe, that a quasi-experimental design of a study of a natural experiment is preferred to fairly and ethically reflect the individual patient's own choice of payment model, based on their perception of their own oral health and what they might gain from each system. This study design may lead to a selection bias. However, a matching procedure has been made in the present study, to compensate for effects from selection bias, and the result of the matching procedure has been described in detail. Moreover, we argue that the underlying characteristics of self-selection are findings of interest. This pilot study evaluated an early version of a CP model with 5 risk groups. Today, the Swedish CP system includes 10 risk groups. Furthermore, among the Public Dental Services in Swedish county councils there is a variation in fee for different risk groups, but since we evaluated one county council only, this is not of importance for the results of the present study.

In summary, the patients in the CP plan had, on average, more prevention and more examinations by a dental hygienist and less restorative treatment compared with patients in the FFS system. Concerning preventive treatments and total dental treatments, however, the differences between the clinics were larger than the differences between the payment models. This result indicates that both the payment model and the clinic affiliation were influential on the type and amount of dental care received by the patients. The net economic outcome for the administrator was positive, but the 3-year follow-up time in this study may be too short to evaluate insurance-specific economical consequences of skewed selection.

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References

1. Addis ME, Mahalik JR. Men, masculinity, and the contexts of help seeking. Am Psychol. 2003;58:5-14.
2. Byrnes JP, Miller DC, Schafer WD. Gender Differences in Risk Taking: A Meta-Analysis. Psychol Bull. 1999;125:367-83.
3. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. Social science & medicine. 2000;50:1385-401.
4. Gosden T, Forland F, Kristiansen I, Sutton M, Leese B, Giuffrida Amf, et al. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. Cochrane Database Syst Rev. 2000;3.
5. Grytten J. Models for financing dental services. A review. Community Dent Health. 2005;22:75-85.
6. Grytten J, Holst D, Skau I. Incentives and remuneration systems in dental services. Int J Health Care Finance Econ. 2009;9:259-78.
7. Grönqvist E. Selection and moral hazard in health insurance: taking contract theory to the data. Thesis. Stockholm: Economic Research Institute, Stockholm School of Economics, 2004.
8. Jacobsson F. Monetära ersättningsprinciper i hälso-och sjukvård. CMT Rapport 2007:2. Linköping: Linköping University Electronic Press, 2007.
9. Johansson V, Axtelius B, Soderfeldt B, Sampogna F, Lannerud M, Sondell K. Financial systems' impact on dental care; a review of fee-for-service and capitation systems. Community Dent Health. 2007;24:12-20.
10. Johansson V. Oral health-related quality of life and patient payment systems: a study of contract and fee-

for-service care in a county in Sweden. Thesis. Malmö: Malmö University, 2009.
11. Kravitz AS, Treasure ET. EU Manual of dental practice: version 4.1. Wales, United Kingdom: Dental Public Health Unit, Cardiff University, 2009.
12. Manning WG, Bailit HL, Benjamin B, Newhouse JP. The demand for dental care: evidence from a randomized trial in health insurance. J Am Dent Assoc. 1985;110:895-902.
13. SOU (Statens Offentliga Utredningar/Official Reports of the Swedish Government). Friskare tänder - till rimliga kostnader: slutbetänkande, SOU 2007:19. Stockholm: Norstedts Juridik AB, 2007.
14. Widstrom E, Eaton KA. Oral healthcare systems in the extended European union. Oral Health Prev Dent. 2004;2:155-94.
15. Woodward RS, Warren-Boulton F. Considering the effects of financial incentives and professional ethics on 'appropriate' medical care. J Health Econ. 1984;3:223-37.
16. Zickert I, Jonson A, Klock B, Krasse B. Disease activity and need for dental care in a capitation plan based on risk assessment. Br Dent J. 2000;189:480-6.

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Pain sensation and injection techniques in maxillary dento-alveolar surgery procedures in children – a comparison between conventional and computerized injection techniques (The Wand®)

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Abstract

◎ Local anesthesia, especially palatal injection, is often associated with fear and anxiety.

The aim was to compare the sensation of pain when using palatal block technique with computerized injection technique (CIT), to conventional infiltration technique with traditional syringe in surgical procedures involving the palate.

Patients referred for bilateral minor maxillary surgical treatments were randomized for traditional infiltration anesthesia on one side and palatal block anesthesia with CIT on the other side. AMSA and P-ASA approaches were used with CIT. The sensation of pain was scored by the VAS scale.

Twenty-eight patients were included in the study, whereof 17 (61%) were girls. The median age was 14.8 yrs. (12.6 – 17.8). Bilateral exposure of palatal impacted canines was the most common treatment. The injection pain was significantly lower, ($p = 0.009$), when using the CIT injection compared to conventional injection. However, with time-consuming surgery, additional CIT analgesic solution had to be injected in the buccal gingiva when suturing, in one fourth of the cases. Patients sedated with nitrous oxide seemed to benefit less from CIT.

Computerized injection techniques, including P-ASA and AMSA approaches, reduces the sensation of pain when carrying out less time-consuming palatal dental surgery, especially in non-sedated teenagers.

Key words

Computerized injection, pain control, maxillary surgery.

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Upplevelse av smärta vid injektion i samband med dento-aveolär kirurgi i överkäken på ungdomar – en jämförelse mellan konventionell och datoriserad bedövningsteknik (The Wand®)

Birgitta Jälevik, Gunilla Klingberg

Sammanfattning

◎ Smärta i samband med bedövning är en vanlig orsak till tandvårdsrädsla. En injektion i gommen upplevs som särskilt smärtsamt. Kirurgiska ingrepp i form av friläggningar av palatinalt retinerade hörntänder och extraktioner av premolarer på ortodontiska indikationer är vanliga ingrepp i tonåren och riskerar att bidra till framtida tandvårdsrädsla.

Syftet med denna studie var att mäta den upplevda smärtan vid palatinal ledningsblockad med datoriserad injektionsteknik och jämföra den med smärtan vid konventionell infiltrationsteknik utförd med vanlig injektionsspruta. Ledningsblockaderna var P-ASA (Palatal approach anterior superior alveolar) och AMSA (Anterior middle superior alveolar). För att utföra den datoriserade bedövningen användes Wand®. De båda bedövningsteknikerna testades på samma patient på varsin sida vid olika tillfällen. På detta sätt blir varje försöksperson sin egen kontroll. Smärtan mättes med VAS-skalan.

Patienter, som remitterades för bilaterala kirurgiska ingrepp i överkäken, erbjöds att delta i studien. Tjugoåtta patienter inkluderades, 17 (61 %) av dem var flickor. Medianåldern var 14.8 år (12.6 – 17.8). Den vanligaste behandlingen var friläggning av palatinalt retinerade hörntänder.

Den upplevda smärtan vid injektion var signifikant lägre med datoriserad injektionsteknik (p = 0.009) jämfört med konventionell injektionsteknik. Skillnaden var störst för de patienter som inte var sederade med lustgas. Bedövning av buccala slemhinnan kompletterades i samband med suturering i en fjärdedel av fallen vid datoriserad teknik.

Datoriserad bedövningsteknik innefattande P-ASA och AMSA nervblockader minskar smärtupplevelsen vid kirurgiska ingrepp i överkäken hos tonåringar, i synnerhet om ingreppen är kortvariga och patienterna inte är sederade med lustgas.

Introduction

Pain control, when treating children and adolescents, is of great importance in order to prevent future dental anxiety and treatment problems. Local anesthesia offers an almost painless dental treatment, but the injection itself is often associated with fear and anxiety. It has been shown that more than one fourth of the population expresses fear of dental injections due to expected pain (18). Fear of injections is one of the highest ranked dental fear items when assessing dental fear and anxiety, also in children and adolescents (3, 12, 26). The use of topical analgesic agents, slow injection techniques, room temperature solutions, and good psychological preparation of the child patient reduces pain and discomfort during injection. In spite of this, palatal injections with a conventional syringe have the potential to be painful (17). When restoring maxillary teeth, an infiltration injection in the buccal fold is often sufficient, but there are situations where the palatal mucosa has to be anesthetized, e.g., when extracting a tooth in the upper jaw or when treating newly erupted permanent maxillary molars. In these cases, a palatal injection is necessary. Furthermore, when exposing or extracting a palatal impacted tooth, a proportionately larger volume of solution has to be injected into the tissue and the oral mucosa is often penetrated several times.

The Wand® (Milestone Scientific, U.S.A.), a computerized delivery system for local anesthesia, has been developed to enable painless injections (5). This computerized injection technique (CIT) delivers an analgesic solution at a constant pressure and controlled volume regardless of the resistance in the tissues. Slow injections can be regulated more precisely by this computerized system than by the traditional syringe. Precise regulation is important as pressure and volume are thought to be directly related to pain (5, 20). By using computerized delivery systems, two new palatal block procedures, P-ASA (palatal approach anterior superior alveolar) and AMSA (anterior middle superior alveolar) have become possible. The palatal approach anterior superior alveolar (P-ASA) nerve block provides bilateral analgesia for the incisors and partially for the canine teeth with a single needle penetration. The palatal muco-periosteum and gingiva associated with the anterior third of the palate also are anesthetized. Clear access to the incisive papilla is required for this injection. The objective is to gain entrance into the naso-palatine canal and maintain contact with the inner bony wall. The final target depth is approximately 6 to 10 mm or approximately the length of a 30-gauge extra short needle (5). Anterior middle superior alveolar (AMSA) nerve block is a single site injection anesthetizing the palatal tissues extending from the mid-palate to the free gingiva. Teeth from the central incisor to the first molar are also anesthetized. The injection site is located at a point that bisects the maxillary first and second premolars and is midway between the crest of the free gingival margin and the mid-palatine suture (6). These single-site palatal block procedures achieve anesthesia of the teeth and associated gingival tissues, while at the same time eliminating collateral anesthesia to the face, lips, and facial expression muscles. P-ASA and AMSA injection techniques are described in detail by the manufacturer (http://www.milestonescientific.com/sta_techniques.html). However, the AMSA injections, using computer-assisted injection techniques, have been shown to have a slow onset as well as a short duration for pulpal anesthesia (16).

A number of studies on computer-assisted injection systems have dealt with the pain of injection and have compared injections using a conventional syringe (1, 2, 7, 9, 14, 15, 19, 21-25, 27, 28). The majority of these studies have found the two injection methods to be comparable (2, 14, 15, 19, 21, 23-25). The remaining studies have shown statistically significantly fewer problems with CIT when comparing pain ratings and/or pain behavior between the two injection methods (1, 7, 9, 22, 27, 28). All but one (28) of the latter studies compared conventional injections in the maxilla to palatal block techniques with CIT. Hochman et al. (9) and Yenisey (27) used split mouth design in adults. In the remaining studies, the study subjects were preschool children aged 2-5 (1, 22) or school children aged 5-13 (7). The subjects in those studies were randomly assigned to either CIT or conventional injection technique prior to having dental restorations in the maxilla. As there is no knowledge about the perceptions of the different injection techniques in surgical procedures involving the palate in young patients, the aim of the present study was to compare the sensation of pain during the injection procedure when using palatal block technique with CIT, to conventional infiltration technique with traditional syringe using a split mouth design. It was hypothesized that CIT was as painful as the traditional technique when carrying out minor maxillary surgical treatments in children.

Materials and Methods

During an 18 months period, all consecutive patients aged 12 to 18 years (11 boys, 18 girls), referred to the

Specialist Clinic of Paediatric Dentistry in Mölndal, Sweden, for minor bilateral maxillary surgical treatments (i.e. extractions and exposures of impacted teeth), were invited to participate in the study. The participants derived from a low caries population and had no or very limited experiences of dental injections and oral surgery. A split mouth design was used where conventional injection technique with buccal fold and palatal infiltration was used on the one side and palatal block anesthesia with CIT (computerized injection technique using The Wand®) on the other side. The treatment measures were always identical on both sides and consisted of uncomplicated surgical exposure of palatal impacted canines and/or extractions for orthodontic reasons. The injection method, conventional or computerized technique, was randomized by flipping a coin before the first treatment session. Heads meant starting with CIT, tails starting with the conventional injection. The other injection technique was then used for the second treatment. Sixteen of the patients started with CIT.

Prior to all injections, topical anesthetics (5% lidocain ointment) were applied for two minutes at the place of injection. All injections were carried out using room temperature solutions of Xylocain® Dental Adrenalin (2% lidocain + 1:80,000 epinephrine) and 30-gauge needles. During injection, the patients were visually shielded from the syringe and injection, and thereby not able to see which of the techniques were used. This procedure was used for all treatments. All conventional injections were carried out slowly, ensuring the injection speed did not exceed 1.8 cc per 2 minutes. In order to prepare the patients for the injections, all participants received information and a short introduction prior to each treatment. When the patients were in need of sedation, nitrous oxide-oxygen sedation (N_2O) was used at both treatment sessions and the sedation was used throughout the sessions. This enabled comparisons of two identical treatments where only the method for administering local anesthesia differed and the inclusion of patients needing N_2O sedation was decided after consulting statistical expertise. The existing local guideline for using N_2O sedation was used when deciding about sedation. According to this, all patients verbally expressing anxiety about surgical treatment should be offered treatment under sedation. Complying with this routine was a requirement for carrying out the study.

After agreeing to participate and prior to the first treatment session, all patients answered a questionnaire with the Children's Fear Survey Schedule – Dental Subscale (CFSS-DS) to measure dental fear and anxiety (4). This psychometric scale consists of 15 items, where each item can give a score from 1 (not afraid) to 5 (very afraid). Thus, possible total scores range from 15 to 75. At the treatment sessions, a 100 mm Visual Analogue Scale (VAS) (10) was used to assess perceived pain. The children answered this immediately after each of the injections, and also after the surgical procedures were finished, i.e., at the end of each treatment session as a global pain assessment.

Statistics

Statistica software, StatSoft® was used for performing descriptive and analytic statistics. Wilcoxon's matched pair test was used for comparisons of pain assessment (VAS) between the two types of injections and between injection pain and total pain assessment (within groups). Mann-Whitney's U test was used for comparisons of VAS values between the non-sedated and sedated groups. Spearman Rank Order Correlations were used to analyze the correlations between CFSS-DS and VAS measurement while t-tests were used for comparisons of CFSS-DS scores. Furthermore, ANOVA repeated measures were used to analyze the impact of gender, dental fear, sedation, starting technique, palatal procedure (P-ASA and/or AMSA) and type of surgical treatment (extractions and/or exposures) on VAS. P-values < 0.05 were regarded as statistically significant.

Ethical approval

The study and study design were approved by the Regional Ethical Review Board at the University of Gothenburg (Ö404-2). Written information about the study, including information on full confidentiality and the right to discontinue participation at any time, was posted to the patients and their parents. A written informed consent form was obtained from both patients and parents.

Results

A total of 31 patients referred from the orthodontic department were eligible for the study. Two patients (one boy and one girl) abstained participation and one girl did not return the questionnaire. Thus, 28 patients (17 girls (61%)) were included in the study with a mean age of 15 yrs. (± 1.5) and median age of 14.8 yrs. (ranging from 12.6 to 17.8). Twenty-one patients were referred for bilateral surgical exposures of maxillary canines and application of an eyelet,

Table 1. Reported pain (measured by 100 mm VAS) during injection with conventional injection technique and computerized injection technique. VAS scores of the total sample and subgroups (Wilcoxon Matched Pair Test).

		Conventional injection		Computerized injection		
	N	Mean (±)	Median (min-max)	Mean (±)	Median (min-max)	Significance
Total	28	41.50 (22.60)	38.5 (0-81)	**31.43 (21.11)**	**30.5** (0-85)	p = 0.009
Boys	11	40.0 (21.59)	34 (17-78)	26.0 (20.98)	30 (5-75)	p = 0.008
Girls	17	42.47 (23.84)	45 (0-81)	**34.94 (21.07)**	31 (0-85)	p = 0.171
Not fearful¤	24	39.83 (22.29)	35 (0-81)	30.75 (20.07)	30.5 **(0-85)**	p = 0.036
Fearful§	4	51.5 (25.16)	55 (18-78)	35.5 (29.96)	**31 (5-75)**	p = 0.069
No sedation	14	43.93 (18.32)	38.5 (18-81)	27.07 (12.59)	**31.5 (5-47)**	p = 0.003
Sedation	14	39.07 (26.70)	37.5 (0-78)	35.79 (26.96)	**30 (0-78)**	p = 0.600

¤ Not fearful defined as CFSS-DS scores < 32
§ Fearful defined as CFSS-DS scores ≥32

and in two cases, in combination with bilateral extractions of maxillary premolars. AMSA as well as P-ASA approaches were used with CIT for these treatments. The remaining seven patients were referred for bilateral orthodontic extractions in the premolar region of the upper jaw. In these cases, the AMSA approach was used.

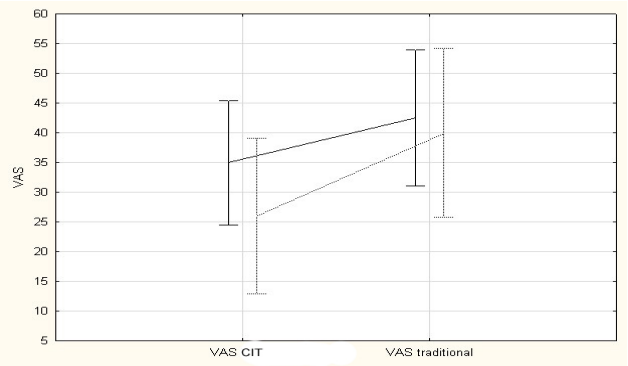
The volume of injected analgesic solution differed substantially. In mean, 2.4 cc was administered with CIT and 3.6 cc with conventional injection technique (p=0.00001). When using CIT, seven patients showed signs of pain from the buccal gingiva before suturing and additional analgesic solution had to be administered buccally. This was also done using CIT.

The reported pain during injection, as measured by the 100 mm VAS, was statistically significantly lower when using CIT compared with conventional injection (p = 0.009) (Table 1). This was found in the total group and for the boys, while there were no differences in pain reports between the two methods in girls (Fig 1a). There were no differences in the global pain report for the total treatment procedure (VAS mean 31.04±21.33 vs. 27.36 ±21.13 for traditional and CIT injection, respectively; p=0.404 (Wilcoxon matched pair test)). ANOVA repeated measures showed that the sequence of the injection methods did not influence the VAS scores in a statistically significant way, p=0.714. Furthermore, ANOVA repeated measures showed there were no differences between the two types of CIT (P-ASA and/or AMSA), nor did the type of surgical treatment (exposure of palatal impacted canines and/or extractions) impact the VAS scores in a statistically significant way, p= 0.370 and p=0.340 respectively. The pain assessments for all injections (any type) were fairly high (VAS mean 36.46±22.26), compared with the global pain report for the total treatment procedures (VAS mean 29.20±20.12, p=0.002) (Wilcoxon matched pair test).

The mean CFSS-DS score was 24.33 (± 8.0). Fear of injection was the highest ranked dental fear item. There were no statistically significant correlations between CFSS-DS scores and any of the VAS-scores (r=0.42 and r=0.27 for VAS conventional and VAS CIT, respectively (Spearman Rank Order Correlations)). Three girls and one boy were defined as having dental anxiety when using CFSS-DS scores greater than or equal to 32 as cut off (background population mean score plus one standard deviation (12)). The fearful patients reported higher VAS

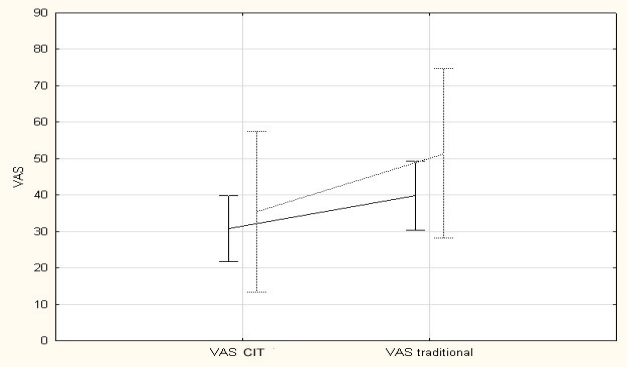
Figure 1. The graphs illustrate the impact of gender, dental fear and anxiety, and nitrous oxide-oxygen sedation on the VAS scores for computerized injection technique (CIT) and conventional injection techniques (Repeated measure ANOVA). Vertical bars denote 0.95 confidence intervals. Fig.1a shows VAS scores for boys and girls separately (current effect p=0.394). Fig. 1b shows VAS scores for fearful (CFSS-DS ≥ 32) and non-fearful patients separately (current effect p=0.394). Fig. 1c shows VAS scores for sedated and non-sedated separately (using nitrous oxide-oxygen (current effect p=0.06).

Fig. 1a



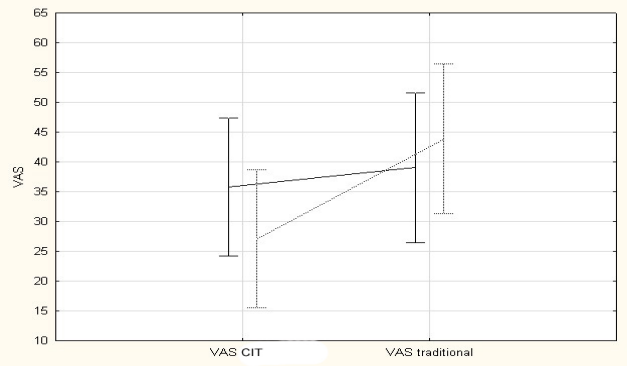
____ Girls
……. Boys

Fig. 1b



____ Not fearful CFSS-DS <32
……. Fearful CFSS-DS ≥32

Fig. 1c



____ Nitrous oxide sedation
……. No sedation

scores for conventional injections (however not statistically significant) and almost the same scores for CIT injections as compared to non-fearful. (Table 1, Fig. 1b). While non-fearful patients reported more pain for injections with the conventional technique than with CIT, there were no differences in dentally anxious patients (Table 1).

Nitrous oxide-oxygen sedation was needed in 14 patients (9 girls, 5 boys). These patients had statistically significantly higher mean CFSS-DS scores than the others (27.11 vs. 21.33, p = 0.048, t-test). The VAS-scores for CIT and the conventional injection technique differed less for sedated patients compared to non-sedated. However, the impact of sedation was not statistically significant (p=0.06 ANOVA repeated measures). (Table 1, Fig. 1c).

Discussion

The present study has shown that injections using single-site palatal blocks (P-ASA and AMSA) with computerized injection techniques (CIT) were perceived as less painful compared with conventional injection techniques in the palate when carrying out minor maxillary surgery, such as extractions and uncomplicated exposure of palatal impacted canines in children aged 12 to 18 years. Thus, the hypothesis that CIT injections would not differ from traditional injection techniques regarding perceived pain during injection was rejected.

The two different types of CIT, the P-ASA and AMSA procedures, were equal in terms of pain ratings. Furthermore, the type of surgical treatment, exposure and/or extraction, did not impact on the pain ratings. Non-sedated children were more relieved by CIT while highly anxious children benefited just slightly from CIT. The anesthetic effect of two palatal block procedures, P-ASA and AMSA, when using CIT, seemed to be sufficient as the global pain scores were significantly lower than the pain scores from conventional injections. However, the duration of the CIT was short in the buccal mucosa and additional anesthesia had to be administered in one fourth of the cases before suturing, which is in concordance with the study of Lee et al. (16). This is a shortcoming of the CIT technique but it should be noted that the administering of extra anaesthesia did not affect the pain ratings.

Split mouth designs have been used in two previous studies in adults for comparing the pain experiences of maxillary infiltration injections with a conventional syringe to palatal block anesthesia with the Wand® technique (9, 27). When 50 dentists were given contralateral palatal injections, one side with the Wand® and the other side with a conventional syringe, 48 of them rated the Wand® as more comfortable (9). *Yenisey* (27) had 16 adult patients undergoing fixed prosthodontic treatment on both the right and left side of the maxillary arch and reported that pain levels were statistically significantly lower with the Wand® technique for needle insertion and injection, but that the pain levels for the two methods were comparable to that for the tooth preparation. Surgical exposures of canines or extractions for orthodontic reasons have the potential of being extremely stressful for children and adolescents because of fear of injection and unfamiliarity with invasive treatments. Therefore, it was natural to compare CIT with conventional injections in those treatments in the present study. According to the knowledge of the authors, this study is the first using maxillary split mouth design in children, and also the only study comparing surgical treatments in a clinical setting.

The high VAS scores during injections (mean for all injections 37.16±22.5) show that children and adolescents perceive dental injections as painful despite the use of topical anesthetics and information given prior to the injections. In clinical pain management, VAS scores above 40 are generally regarded as high and additional pain management is advocated. At the Karolinska University Hospital in Sweden, pain alleviation is offered at VAS exceeding 30 (11). The painful feature of injection is underlined by the fact that the global pain reports for the total treatment procedure including injection were significantly lower.

The mean CFSS-DS score was slightly higher compared with previous reports from populations of the same age in Scandinavia, reporting mean scores around 22 (8, 12, 26). However, the study group was rather small compared with larger population-based studies, with the patients being referred for surgical treatment, which may have affected their answers on the CFSS-DS instrument. The study was not designed to ensure inclusion of dentally anxious patients or to evaluate different injection techniques in relation to dental anxiety, and caution should be taken when drawing conclusions. Still, four out of 29 patients were classified as fearful using a rather low cut-off on the CFSS-DS. As a comparison, there are reports of dental anxiety in approximately 9 % of all children and adolescents (13).

A shortcoming of the present study is that half of the patients needed nitrous oxide-oxygen sedation

and this group had higher scores on the CFSS-DS. There was a standardized routine at the clinic regulating how sedation should be offered for anxious patients undergoing surgical treatments, and this study was obligated to follow this routine for its patients. Another thing to observe in this context is the fact that the nitrous oxide-oxygen sedation, apart from its anxiolytic properties, also has an analgesic effect on the oral mucosa. However, the split mouth design makes it possible to compare pain perception between the two injection techniques, as patients needing nitrous oxide-oxygen sedation received this at both treatment sessions. It would have been desirable to have included more patients. Even though all patients in need of identical bilateral treatment in the maxilla were invited, only 28 patients could be included. The study was ended after 18 months; a time frame decided beforehand.

The pain response of the sedated patients only differed slightly between the two techniques with the advantage to CIT (Fig.1c). An interesting finding is that the sedated patients had higher VAS scores with CIT but lower with conventional injection compared to the non-sedated patients. Still, those differences were not statistically significant. The higher VAS scores with CIT could possibly be explained by higher levels of dental fear as measured by CFSS-DS in the children needing sedation. *Veersloot et al.* 2005 (24) found that highly anxious children did not seem to benefit from the use of the Wand®. However, the authors could not replicate this finding in a later study (25). The reduced differences in pain sensations between conventional and CIT injections by the sedated children could also partly be explained by the analgesic effect of the nitrous oxide-oxygen sedation and plausibly also by its sedative effect. It is reasonable to assume that the alleviation of pain when using CIT would be even greater if the use of sedation had been less frequent. The VAS-scores for CIT and conventional injection technique differed less for sedated patients compared to non-sedated. As the majority of clinics performing oral surgery have no access to oxide-oxygen sedation, CIT could be considered as a way to reduce pain in patients needing minor and uncomplicated palatal surgery.

This study used minor and uncomplicated surgery treatments as a model for evaluating pain during injection. The study shows that patients reported lower pain when using single-sited palatal blocks by CIT as compared with traditional injections. Treatment needing palatal injections was chosen because palatal injections are known to be painful in particular. Surgical treatment was chosen as it was assumed it would be easier to repeat the same treatment procedures in the same patient. If filling therapy had been used, the variation between the two treatments was expected to be have been greater and thereby possibly affecting the outcome of the study. However, it is important to interpret the results as pain ratings of different injection techniques in child patients. The study results do not give any guidance to surgical procedures or how they should be carried out.

To conclude, the computerized injection techniques, including AMSA and P-ASA approaches, were found to reduce the sensation of pain when carrying out minor and uncomplicated palatal dental surgery in non-sedated teenagers.

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References

1. Allen KD, Kotil D, Larzelere RE, Hutfless S, Beiraghi S. Comparison of a computerized anesthesia device with a traditional syringe in preschool children. Pediatr Dent. 2002; 24:315-20
2. Asarch T, Allen K, Peterson B, Beiraghi Efficacy of a computerized local anesthesia device in pediatric dentistry. Pediatr Dent 1999; 21:421-4
3. ten Berge M, Veerkamp JSJ, Hoogstraten J, Prins PJM. Childhood dental fear in the Netherlands: prevalence and normative data. Community Dent Oral Epidemiol 2002; 30:101-7
4. Cuthbert MI, Melamed BG. A screening device: children at risk for dental fears and mangement problems. J Dent Child 1982; 49: 432-6
5. Friedman M, Hochman MN. The AMSA injection: A new concept for local anesthesia of maxillary teeth using a computer-controlled injection system. Quintessence Int 1998; 29:297-303
6. Friedman MJ, Hochman MN. P-ASA block injection: a new palatal technique to anesthetize maxillary anterior teeth. J Esthet Dent 1999; 11:63-71
7. Gibson RS, Allen K, Hutfless S, Beiraghi S. The Wand vs. traditional injection: a comparison of pain related behaviours Pediatr Dent 2000; 22:458-62
8. Gustafsson A, Arnrup K, Broberg AG, Bodin L, Berggren U. Child dental fear as measured with the Dental Subscale of the Children's Fear Survey Schedule: the impact of referral status and type of informant (child versus parent). Community Dent Oral Epidemiol 2010; 38:256–66
9. Hochman M, Chiarello D, Hochman CB, Lopatkin R, Pergola S. Computerized local anasthetic delivery vs. syringe technique. Subjective pain response. NY State Dent J 1997; 63:24-9
10. Huskisson EC. Visual analogue scale. In: Melzack R, ed.

Pain measurement and assessment. New York: Raven Press, 1983, pp 33-7
11. Karolinska Universitetssjukhuset. Riktlinjer vid smärta. Solna, Sweden: ANOPIVA-kliniken Solna, 2009
12. Klingberg G, Berggren U, Norén JG. Dental fear in an urban Swedish child population: prevalence and concomitant factors. Community Dent Health 1994; 11:208-14
13. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents – a review of prevalence and concomitant psychological factors. Int J Paediatr Dent 2007; 17:391-406
14. Koyuturk AE, Avsar A, Sumer M. Efficacy of dental practitioners in injection techniques: computerized device and traditional syringe. Quintessence Int. 2009; 40:73-7
15. Kuscu OO, Akyuz S. Is it the injection device or the anxiety experienced that causes pain during dental local anaesthesia? Int J Paediatr Dent. 2008; 18:139-45
16. Lee S, Reader A, Nusstein J, Beck M, Weaver J. Anesthetic efficacy of the anterior middle superior alveolar injection. Anesth Prog 2004; 51:80-9
17. Meechan JG. Pain control in local analgesia. Eur Arch Paediatr Dent 2009; 10:71-6
18. Milgrom P, Coldwell SE, Getrz T, Weinstein P Ramsay DS. Four dimensions of fear of dental injections. J Am Dent Assoc 1997; 128:756-66
19. Nusstein J, Lee S, Reader A, Beck M, Weaver J. Injection and postinjection pain of the anterior middle superior alveolar injection administered with the Wand or conventional syringe. Oral Surg Med Oral Pathol Oral Radiol Endod 2004; 98:124-31
20. Primosch RE, Brooks R. Influence of anesthetic flow rate delivered by the Wand Local Anesthetic System on pain response to palatal injections. Am J Dent. 2002; 15:15-20
21. Ram, D, Peretz B. The assessment of pain sensation during local anesthesia using a computerized local anesthesia and a conventional syringe. J Dent Child 2003; 70:130-3
22. Ram D, Kassirer J. Assessment of a palatal approach-anterior superior alveolar (P-ASA) nerve block in paediatric dental patients. Int J Paediatr Dent 2006; 16:348-51
23. Tahmassebi JF, Nikolaou M, Duggal MS. A comparison of pain and anxiety associated with the administration of maxillary local analgesia with Wand and conventional technique. Eur Arch Paediatr Dent 2009; 10:77-82.
24. Versloot J, Veerkamp JSJ, Hoogstraaten J. Computerized aneshesia delivery system vs. traditional syringe: comparing pain and pain-related behavior in children. Eur J Oral Sci 2005; 113:488-93
25. Versloot J, Veerkamp JSJ, Hoogstraten J. Pain behaviour and distress in children during two sequential dental visits: comparing a computerised anaesthesia delivery system and a traditional syringe. Br Dent J 2008; 205:351-2
26. Wogelius P, Poulsen S, Toft Sørensen. Prevalence of dental anxiety and behaviour management problems among six to eight years old Danish children. Acta Odontol Scand 2003; 61:178-83
27. Yenisey M, Comparison of the pain levels of computer-controlled and conventional anesthesia techniques in prosthodontic treatment. J Appl Oral Sci 2009; 17:414-20
28. Yesilyurt C, Bulut G, Tasdemir T. Pain perception during inferior injection administered with the Wand or conventional syringe. Br Dent J 2008;205:258-9

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Patients´ experiences of dental implant placement for treatment of partial edentulism in a student clinic setting

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Abstract

◉ The aim of this study was to evaluate patients' experiences of oral implant surgery when performed in a student clinic setting and the potential impact on patients' daily life.

Patient selection was carried out during a round, to which undergraduate students in semester 9 and 10 could bring patients that they considered eligible for one or two implants. Partial edentulous patients that fulfilled the inclusion criteria for implant installation at the student's clinic were consequently enrolled to implant surgery with either Astra Tech or 3i implants. The same surgeon accomplished all implant installations and the students were involved in the treatment, initially by assisting during the surgery and subsequently by performing the prosthetic restoration. After the surgery, a study-specific questionnaire was sent to patients for evaluation of discomfort, pain during the surgical procedure and postoperative symptoms.

Thirty-six patients were included in the study, 30 patients answered the questionnaire (response rate 83%). When retrospectively assessed, more than half of the patients (60%) perceived discomfort in the course of the implant surgery and 29% reported pain during the surgical procedure. Impact on daily living and postoperative symptoms were rarely reported (most common were pain, swelling and difficulties with chewing) and had a short duration when they occurred.

Based on the results of this study conducted at a student's clinic, the impact of implant surgery on daily living appears to be small. However, it is noteworthy that the perception of discomfort and pain during the surgical procedure was frequently reported. Continued research is recommended to expose the patient's experiences of implant surgery in an educational context as well as in general dental practice.

Key words

Oral implant surgery, patient-reported outcomes, student's clinic, undergraduate students, patient's perception

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Patienters erfarenheter av implantatkirurgi på studentklinik för behandling av partiell tandlöshet

JOTTA SEFERLI, MATTIAS MICHELIN, BJÖRN KLINGE, LENA WETTERGREN

Sammanfattning

◎ Syftet med denna studie var att utvärdera patienters erfarenheter av implantatkirurgi som utfördes på en studentklinik och hur ingreppet påverkade deras vardagsliv.

Studenter i termin 9 och 10 på Odontologiska Institutionen, Karolinska Institutet var delaktiga i implantatoperationer och utförde senare själva den protetiska behandlingen på partiellt tandlösa patienter som krävde protetisk rehabilitering med 1-2 implantat. Urvalet av patienter beslutades vid en rond, dit studenterna presenterade potentiella fall. Utifrån hälsoanamnes, röntgenbilder och studiemodeller bedömdes lämpligheten för implantatbehandling, i vilken studenterna skulle kunna vara delaktiga i genomförandet. Patienter som uppfyllde inklusionskriterierna fick följaktligen antingen Astra Tech- eller 3i-implantat installerade. Samma kirurg opererade alla patienter. En tid efter implantatkirurgin skickades ett studiespecifikt frågeformulär till patienterna för utvärdering av information om ingreppet, genomförande av operation och ingreppets påverkan på dagligt liv.

36 patienter inkluderades i studien, varav 30 patienter besvarade frågeformuläret (svarsfrekvens 83%). Mer än hälften av patienterna (60%) upplevde implantatkirurgin som obehaglig och 29% rapporterade att de kände smärta under operationen. Postoperativa symtom var sällsynta (vanligast var smärta, svullnad och nedsatt tuggförmåga) och beskrevs som kortvariga då de förekom.

Resultaten från denna studie påvisar att implantkirurgi har liten inverkan på vardagslivet. Det ska dock uppmärksammas att obehag och smärta under ingreppet rapporterades som vanligt förekommande. Forsatt forskning inom området rekommenderas för att belysa patienters erfarenheter och uppfattningar av implantatkirurgi i utbildningssammanhang såväl som i allmäntandvård.

Introduction

For many years oral implants have been used to rehabilitate partial and total edentulism and are an acknowledged clinical procedure (17). In the literature an overall survival rate of 82–94% in oral implants with an observation period of 10 years has been reported (16). A frequently used term in implant dentistry is success rates and the criteria for success are based on defined thresholds of objective clinical parameters where patient-reported outcomes are seldom included and yet, may represent major aspects of the implant success for the patient (22). The research in the field of implant dentistry taking patient-reported outcomes into account has until today mainly focused on the final implant treatment with the prosthetic restoration. The existing studies that investigate patients' satisfaction and experience with dental implants are referring to the final treatment outcome in totally edentulous patients (8,11,23,28,30) and prosthetic restorations such as single crowns, fixed and removable partial dentures or further treatment concepts are not well represented (27). The few trials that are published concerning these types of restorations (7,21-22,25), show a high level of patient satisfaction, but these studies are far too few.

There are merely a small number of publications concerning patients' experiences of implant surgery and those that exist focus on pain and anxiety following placement of dental implants (9,15,20). Eli et al (9) found that implant surgery provoked high level of anxiety and emphasized that it is important that oral surgeons who perform procedures such as implant surgery are aware of the possible effect of anxiety on the patient's perception of pain. Results from another study that assessed pain, anxiety and other potential problems following implant placement reported that most patients experienced mild postoperative symptoms that had some interference with daily activities and lasted mainly the first days after the surgery (15). *Muller et al* (20) found that the occurrence of pain in implantology was minimal and suggested that the onset of pain could be associated with the amount of trauma produced during the surgical procedures. The need to take patients' experiences into account has been recognized by the fact that many large-scale government-supported clinical trials include health-related quality of life (HRQL) as an outcome in clinical trials (31).

Dental implant treatment is nowadays an indispensable part of dental education and undergraduate students are to a varying extent, depending on the curriculum of each Dental School, participating in implant therapy. Therefore research is needed to fully understand patients' experiences of undergoing surgery in such an environment.

The purpose of this study was to evaluate patients' experiences of implant surgery in a student clinic setting and the potential impact on patients' daily living.

Material and Methods

Sample, inclusion criteria and surgical procedure

Between August 2009 and February 2010, a round was created, to which, last year students could bring patients with partial edentulous jaws (in need of a minor oral rehabilitation with one or two implants), that they considered eligible for implant treatment. All patients were already receiving dental care at the students' clinic, Department of Dental Medicine, Karolinska Institutet. According to the curriculum, the students would be involved in the therapy, initially by assisting during the surgery and subsequently by performing the prosthetic restoration and therefore complicated cases were undesirable. The inclusion criteria for implant treatment at the students' clinic were: (1) Over 20 years of age (full-grown jaws), (2) Partial edentulous (3) Good general health, lack of systemic contradiction for oral surgery and (4) Presence of adequate bone width and height precluding the need for bone augmentation procedures. Exclusion criteria: (1) Local jaw pathology and (2) Untreated periodontal disease. All patients who were considered to meet the inclusion criteria were consecutively enrolled for further examination clinically, by a periodontist. They also underwent a radiographic examination, including an intraoral radiography, panoramic examination and a tomography (if required). Bone quality, jaw relations, periodontal status including oral hygiene, was registered. Based on the clinical/radiographic examination and the diagnostic study models, patients that fulfilled the criteria had Astra Tech implants (Mölndal, Sweden) or 3i Innovations implants (West Palm Beach, FL, USA) installed. The surgery was performed at the student's clinic, meaning that students in semester 9 and 10 were engaged in the treatment to a great extent, e.g. responsible for providing the patients with standardized pre- and postoperative information about the surgical procedure both verbally and written, for anaesthetizing the patients (with 2% Xylocaine Dental with epinephrine 1:100 000, mostly by local infiltration and in a few cases by nerve block), preparing the

operating theatre and assisting the surgeon. Sedation was discussed with the patients but all denied the offer. Before the initiation of the procedure the surgeon ensured that the patients felt properly anesthetized. It was the same surgeon, an experienced periodontist, who accomplished the implant installation in all patients using the non-submerged surgical technique, though with respect to the guidelines and the protocol given by the manufacturers of each system. At the time of implant insertion data regarding following parameters was recorded: duration of the surgery, implant positions, primary stability of the implants, bone fenestrations and complications. Postoperative care was as identical as possible for all patients using a written protocol.

The implant surgeries took place between September 2009 and February 2010, in 36 patients (19 women and 17 men) with mean age of 53 (range 29-76 years) who had an operation with one or two dental implants. In one case, a patient received three implants, two at the first surgery and one at the second. Another four patients underwent two implant surgeries where one implant was installed in each surgery.

Study-specific questionnaire

A self-administrated questionnaire including 33 items was developed for the study. The short version of Oral Health Impact Profile, OHIP-14 (2, 26) was used as a template for designing the questionnaire. The first four items covered oral and written pre-/postoperative information. The following 26 items examined if the patient had perceived discomfort in the course of the implant surgery, had experienced pain during and after the surgery, illness, swelling, difficulties to open the mouth, inability to go to work/school, difficulties conducting daily routines, difficulties talking, impact on taste, difficulties chewing, trouble sleeping and impact on social life due to the implant surgery. Two items referred to the healing abutment and if it was annoying to the patient by causing food impaction. The last two items concerned the oral hygiene routines. All items had four to six-graded verbal response options ranging from "very good" to "very bad" or from "very much difficulties" to "not at all", depending on the item. For the items that evaluated how long the postoperative symptoms lasted, the response options ranged from "some days after the surgery" to "still, to date problems". To test face validity, the questionnaire was given to colleagues for peer-reviewing and to previous patients that had undergone implant surgery. Minor modifications of the items were made based on the comments given.

Procedure

In March 2010 a letter was sent to those patients who had fulfilled the inclusion criteria and had implants installed at the student's clinic. The letter included information about the study and contained the study-specific questionnaire. The letter stressed that participation was voluntary and that non-participation would not affect care or treatment. Patients who subsequently agreed to participate were asked to complete the questionnaire and return it in an enclosed postage-paid envelope. Patients that underwent two surgeries on different occasions received two questionnaires to fill out, one for each surgery. A reminder was sent to non-respondents with a three week interval and after another week the patients that still had not answered were contacted by telephone. Three of the patients answered the questionnaire over the phone. The study was approved by the Head of the Department and conducted in accordance with principles of the Declaration of Helsinki (6).

Data analysis

The verbal responses were dichotomized in order to facilitate analysis and interpretation of the results. The items including six response alternatives were dichotomized in the middle for example information into *good* (very good/good/quite good) and *bad* (very bad/bad/quite bad). The items that included four response alternatives "very/quite/little" or "not at all" to describe a condition/symptom was dichotomized into *symptom* or *not symptom* e.g. *discomfort* (much discomfort/quite discomfort /little discomfort) vs. *no discomfort at all*. The items regarding how long time after surgery the patient experienced a specific symptom were dichotomized into two answer alternatives *some days up to one week after the operation* and *some weeks up to still to date*. The last item exploring how often the patients performed oral hygiene procedures was dichotomized into *often* (more than twice per day/twice a day/once a day) vs. *rarely* (a few times a week/once a week/a few times per month/never).

Feasibility of the study-specific questionnaire was investigated by recording the amount of missing data which could be due to difficulties in understanding the procedure and by analyzing participants' written comments regarding the instrument.

The statistical analyses were performed using

PASW statistical software for windows (PASW statistics 18.0, SPSS Inc., Chicago, IL, USA). The possible influence of the duration of surgery on the perceptions of pain and discomfort in relation to surgery were analyzed with Pearson's correlation coefficient. The four graded verbal responses concerning three selected items (discomfort, pain during surgery, postoperative pain) were correlated to duration of surgery, were 1 was referring to *no pain at all/no discomfort at all* and 4 was when pain and discomfort was stated as highest/*much discomfort*. Correlation coefficients of <.29, .30-49 and >.49 are interpreted as small, moderate and large, respectively (5).

Results

Totally 36 patients were included in the study and the total number of questionnaires that were sent out to patients was 41, since five patients had undergone the implant surgery on two different occasions. The questionnaire was answered by 30 patients, (response rate 83%) including all of the patients that had undergone two surgeries, so the total number of the questionnaires included in the analysis was 35. Of the 30 patients that answered 14 were men and 16 were women, their age ranged between 32-76 years with a mean of 55 years. A total of 46 implants were placed; 26 Astra Tech implants and 20 3i implants. Of the six patients that did not answer three had Astra Tech implants installed and three had 3i implants installed, three were women and three were men. Their age ranged from 29 to 52 years, with a mean age of 42.

Perceptions of the implant surgery and pain

When thinking back on the time of surgery, more than half of the patients remembered perceiving discomfort during the implant surgery and described the days following surgery as painful (Table 1). Illness after the surgery (open-end item) was expressed as dizziness (1 patient), fever (1 patient), pain (1 patient), nausea (1 patient), "strange feeling" (1 patient), fatigue (2 patients).

Table 1. Patients reporting negative experience and postoperative symptoms during and after the implant surgery.

Experience of implant surgery and postoperative symptoms	N=35	(%)
Discomfort during surgery	21	(60)
Pain during surgery	10	(29)
Pain the days after surgery	20	(57)
Retained pain	6	(17)
Illness after surgery	7	(20)

Limitations of activities and postoperative symptoms

The extent to which the outcomes of surgery interfered with patient's well-being and daily life is shown in Table 2. In the cases that patients stated that they had some postoperative symptoms or difficulties, the problems lasted only a few days and up to one week. None of the patients reported postoperative symptoms that lasted more than one week.

Table 2. Patient's self- reported difficulties the days after the implant surgery.

	N=35	(%)
Swelling	18	(51)
Trismus	8	(23)
Impact on work/school	6	(17)
Difficulties performing daily activities	4	(11)
Problems talking/having a conversation	3	(9)
Impact on taste	1	(3)
Difficulties chewing certain food	15	(43)
Had to interrupt meals	6	(17)
Impact on social life	3	(9)

The healing abutment and the oral hygiene

Regarding experiences of having the healing abutment in their mouth, only 14% of the patients answered that they were disturbed by the presence of the healing abutment. Forty percent of the patients had food impaction in the healing abutment and 11% of the patients claimed that they felt it was difficult to carry out oral hygiene in the implant region. The patients in this study showed awareness of oral hygiene as 97 % of them brushed their teeth more than once a day. It was only one patient that answered that he never brushed his teeth.

Duration of surgery

The mean time for performance of the implant surgery was 91 minutes (SD= 17.5). The correlation coefficient between duration of the surgical procedure and perception of discomfort during surgery was 0.34, between duration and pain during surgery 0.24 and between duration and pain the days after the surgery 0.31. All coefficients were positive, indicating that the longer the duration of the surgical procedure the more discomfort and pain during and after surgery was perceived. Two of the correlation coefficients were of moderate size and the coefficient between pain during surgery and duration was small.

Information

Overall the patients perceived the information as good. The oral information before surgery was rated as good by 94% of the patients and the written was perceived as good by 74%. The oral postoperative information was regarded as good by all patients (100%) and the written was stated as good by 91%.

Feasibility

The response rate was 83%. All questions were answered and done so in a correct way, there were no missing items or ineligible responses.

Discussion

The purpose of the present study was to evaluate patients' experiences of the implant surgery in a student clinic setting and to assess the potential impact of the surgery on daily living.

When asked to think back, more than half of the patients (60%) reported discomfort during the surgical procedure. Surgical procedures in the oral cavity and implant placement have been reported in the literature as stressful and anxiety-provoking procedures in dentistry (9,12,31-32). All the patients in this study were offered sedation even though it was not strongly recommended. For some patients sedation can be considered as an option to help them handle fear and anxiety. The positive association between duration of the surgery and experience of implant surgery reflects that the patients that underwent an operation that lasted longer also were more likely to report more discomfort and postoperative pain. A similar correlation between duration of surgery and both duration of pain and average pain level has previously been described in a study (31) carried out at a private practice. Since this study was conducted at a student's clinic many parts of the surgical procedure were expanded for educational purposes in order for students to be able to participate in the treatment. We do not know if the educational context had an impact on the patient's perception of the procedure and if the student's inexperience in anesthetizing the patients was significant for the results. To give more local anaesthesia might have been helpful to the patients that felt pain during the surgery which accounted for 29%, though it has been stated in literature (19) that factors such as fear are clearly capable of influencing patient response to local anaesthetic. Therefore managing fear should probably be of primary interest. Pain and discomfort is a complex sensory and emotional experience, closely associated with factors such as stress and anxiety (9,29). Recently, two publications (12,31) exhibited a positive correlation between high preoperative anxiety levels and pain perception as well as with a prolonged recovery process following implant surgery. Based on the results it is recommended that the therapist and his/her team develop a way to manage the anxiety of the patients before and during surgery by paying extra attention and providing support (psychological and/or pharmaceutical) when needed. Such an approach needs to include the students that are involved in the procedure and the issue should be emphasized in the education. The high percentage of patients retrospectively reporting that they perceived discomfort and pain during surgery merits concern.

Besides swelling that occurred in 51% of the patients, most of the remaining conditions, such as trouble to open the mouth, interference with the ability to perform activities (work/school/daily activity), difficulties to perform daily routines (personal hygiene/ food shopping/ recreational activities), problems to talk/have a conversation, worsened sense of taste, trouble to sleep due to the implant surgery and difficulties with social life were not frequently reported as problematic and went to normal within the following days. Chewing ability was stated as troublesome by almost half of the patients (43%) though the difficulties lasted only up to a week. As described in literature, it is expected that minor problems can occur when surgery is performed in the mouth (18).

The majority of the patients considered the verbal information to be good both before and after the surgery. Satisfaction with the written information was rated as high, before surgery (74%) and even higher after the surgery (91%). Two of the patients explored that they could not recall any information being given to them. Since a person's cognitive ability to process information is significantly affected by stress (10), and dental implant surgery can be a very stressful situation, attention has to be paid to improve the information routines so that the information reaches every patient in a satisfying way. A solution could be that the information is repeated on different occasions and to introduce a checklist to assure that sufficient information has been given.

The results of the present study were mostly in line with previously published articles regarding occurrence and duration of postoperative pain and symptoms examined. Results from one study (14) showed that mild pain and moderate inflammation occurred after implant placement. Al-Khabbaz et al.

(1) who prospectively (during surgery, 24 hours and 1,6,12 weeks after surgery) assessed pain connected to the surgical placement of dental implants, reported that pain intensity was mild for the majority of the patients and it was significantly associated with female gender, operator experience and surgical difficulties. The surgeries in that study were performed either by an experienced surgeon or by postdoctoral residents and the total amount of patients that reported pain at surgery was 16%. This is almost half as many patients compared to the findings in the present study in which the patients that experienced pain reached 29%. In the latter the measures was retrospective, which must be taken into consideration when explaining the difference in figures. How to interpret and understand retrospective ratings is under debate. Bauer et al. (3) showed in their research that subjects are able to accurately recall and rate the severity of pain or discomfort for a period of 3 months. On the other hand, while patient-reported outcomes have been considered as valid and reliable measures of outcome, it's becoming clearer that the cognitive processes involved in completing them are complex and response shift is described in literature (24) as a phenomenon that must be taken into consideration. This means that persons may change over time in how they perceive health aspects, not only because their health or quality of life (QoL) has changed, but also because they might have changed their internal standards or conceptualisation of health and quality of life (24). *Weisensee et al* (31) studied the experienced pain level on the day of implant surgery as well as how pain was remembered to be that day, retrospectively 7 days later. A significant decrease in retrospective pain evaluation versus the day of surgery was observed. Based on these findings we recommend that the patients who will be included in studies investigating the perception of dental implant surgery, should be under a longitudinal follow-up with the possibility to observe changes during the first weeks and to include assessment of the procedure when thinking back (so called then-test). With such a procedure it is possible to further investigate how persons undergoing implant surgery experience pain and other patient-reported outcomes.

In addition to the cross sectional design, there are some limitations in this study that should be mentioned. Firstly, the small sample size limits the possibility to perform multivariate analysis including several independent variables such as gender, age, position of implant (maxilla/mandible) and complications during surgery. It would have been helpful if the questionnaire had comprised items that investigated in what way the patient's perceived discomfort and the level of dental anxiety prior to surgery. Moreover, three of the patients included in the study answered the questionnaire over the telephone. It has been shown that adults provide significantly more favorable responses via telephone interviews than with self-administrated questionnaires (4). However, the answers of these three patients were in line with the rest of the sample and we found no indication that mode of administration had an impact on the results. A previously validated and published instrument could not be used in this context because there was none existing that covered all aspects of the research question.

All questionnaires that were sent back to the authors were without missing items with an acceptable response rate (83%) and no patients commented on the statements in any way. This is regarded as an indication that the content was understood and manageable to fill out i.e. feasibility of the questionnaire. Another strength of the present study was that the data collection as well as the data analysis was entirely accomplished by a master student who was not involved in the treatment and care of the patients.

Most of the outcomes reported in this study were mild; still a significant proportion remembered the surgical procedure as painful several weeks later. This is of great clinical importance (discomfort, pain during surgery) and it is recommended that patients' experience of implant surgery is to be further investigated with a larger sample size and a longitudinal study design in which associations between patient-reported outcomes, clinical parameters and cost-effectiveness are analysed. The involvement of undergraduate students in implant treatment and if their presence has an impact on the way patients experience implant surgery is a topic that has not previously been evaluated and needs additional exploration. Moreover the importance of patients' perception of the treatment should be emphasized in the curriculum, so that students at an early stage understand the importance of dealing with the patient's anxiety and fear in order to prevent negative notion that might serve as major barrier, making the patient reluctant to seek for dental implant treatment in the future.

Conclusion

Based on the results of this study conducted at a student's clinic the impact of implant surgery on daily

living appears to be small. However, it is noteworthy that 60% of the patients, when retrospectively assessed, perceived discomfort during the surgical procedure, furthermore; pain during surgery was reported by almost one third of the patients. Swelling, pain and decreased chewing ability some days after the implant surgery were the most common postoperative outcomes. Continued research that elucidates the patient's experience and perceptions of oral implant surgery is warranted in an educational context as well as in general dental practice in order to deliver the best care possible.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

1. Al-Khabbaz AK, Griffin TJ, Al-Shammari KF. Assessment of pain associated with the surgical placement of dental implants. J Periodontol 2007;78:239-46.
2. Allen F, Locker D. A modified short version of the oral health impact profile for assessing health-related quality of life in edentulous adults. Int J Prosthodont 2002;15:446–50.
3. Brauer C, Thomsen JF, Loft IP, Mikkelsen S. Can We Rely on Retrospective Pain Assessments? Am J Epidemiol 2003;157:552-7
4. Cheung Y.B., Goh C., Thumboo J., Khoo KS, Wee J. Quality of life scores differed according to mode of administration in a review of three major oncology questionnaires. J Clin Epidemiol 2006;59:185-91.
5. Cohen J. Differences between correlation coefficients. In: Cohen J. Statistical power analysis for the behavioral sciences, 2nd ed. New Jersey: Lawrence Erlbaum; 1988. p. 109-43.
6. Declaration of Helsinki: Seoul: World Medical Association (WMA) 2008. General Assembly from http://www.wma.net/en/30publications/10policies/b3/index.html
7. den Hartog L, Slater JJ, Vissink A, Meijer HJ, Raghoebar GM. Treatment outcome of immediate, early and conventional single-tooth implants in the aesthetic zone: a systematic review to survival, bone level, soft-tissue, aesthetics and patient satisfaction. J Clin Periodontol 2008;35:1073-86.
8. Dierens M, Collaert B, Deschepper E, Browaeys H, Klinge B, De Bruyn H. Patient-centered outcome of immediately loaded implants in the rehabilitation of fully edentulous jaws. Clin Oral Implants Res 2009;20:1070-7.
9. Eli I, Schwartz-Arad D, Baht R, Ben-Tuvim H. Effect of anxiety on the experience of pain in implant insertion. Clin Oral Implants Res 2003;14:115-8.
10. Eli I., Schwartz-Arad D. Anxiety and ability to recognize clinical information in dentistry. J Dent Res 2008;87:65-8.
11. Emami E, Heydecke G, Rompré PH, de Grandmont P, Feine JS. Impact of implant support for mandibular dentures on satisfaction, oral and general health-related quality of life: a meta-analysis of randomized-controlled trials. Clin Oral Implants Res 2009;20:533-44.
12. Fardal Ø, McCulloch C. Impact of Anxiety on Pain Perception Associated With Periodontal and Implant Surgery in a Private Practice. J Periodontol 2012;83:1079-85
13. Feine SJ, Dufresne E, Boudrias P, Lund JP. Outcomes of implant-supported prostheses. J Prosthet Dent 1998;79:575-9.
14. González-Santana H, Peñarrocha-Diago M, Guarinos-Carbó J, Balaguer-Martínez J. Pain and inflammation in 41 patients following the placement of 131 dental implants. Med Oral Patol Oral Cir Bucal 2005;10:258-63.
15. Hashem AA, Claffey NM, O'Connell B. Pain and anxiety following the placement of dental implants. Int J Oral Maxillofac Implants 2006;21:943-50.
16. Holm-Pedersen P, Lang NP, Muller F. What are the longevities of teeth and oral implants? Clin Oral Implants Res 2007;18:15–9.
17. Lekholm U, Gröndahl K, Jemt T. Outcome of Oral Implant Treatment in Partially Edentulous Jaws Followed 20 Years in Clinical Function. Clin Implant Dent Relat Res 2006;8:178-86.
18. McGrath C, Comfort MB, Lo EC, Luo Y. Patient-centred outcome measures in oral surgery: validity and sensitivity. Br J Oral Maxillofac Surg 2003;41:43-7.
19. Milgrom P, WeinsteinP, Kleinknecht R, Getz T. Treating fearful dental patients. Virginia: Reston Publishing Company, 1985
20. Muller E, Rios Calvo MP. Pain and dental implantology: sensory qualification and affective aspects. Part I: At the private dental office. Implant Dent 2001; 10:14-22.
21. Palmer RM, Farkondeh N, Palmer PJ, Wilson RF. Astra Tech single-tooth implants: an audit of patient satisfaction and soft tissue form. J Clin Periodontol 2007; 34:633-8.
22. Pjetursson BE, Karoussis I, Bürgin W, Brägger U, Lang NP. Patients' satisfaction following implant therapy. A 10-year prospective cohort study. Clin Oral Implants Res 2005;16:185-93.
23. Quirynen M, Alsaadi G, Pauwels M, Haffajee A, van Steenberghe D, Naert I. Microbiological and clinical outcomes and patient satisfaction for two treatment options in the edentulous lower jaw after 10 years of function. Clin Oral Implants Res 2005;16:277-87.
24. Ring L, Höfer S, Heuston F, Harris D, O'Boyle CA. Response shift masks the treatment impact on patient reported outcomes (PROs): the example of individual quality of life in edentulous patients. Health Qual Life Outcomes 2005;3:55.
25. Schropp L, Isidor F, Kostopoulos L, Wenzel A. Patient experience of, and satisfaction with, delayed-immediate vs. delayed single-tooth implant placement. Clin Oral Implants Res 2004;15:498-503.
26. Slade GD. Derivation and validation of a short-form oral

health Impact profile. Community Dent Oral Epidemiol 1997;25:284–90.
27. Strassburger C, Kerschbaum T, Heydecke G. Influence of implant and conventional prostheses on satisfaction and quality of life: A literature review. Part 2: Qualitative analysis and evaluation of the studies. Int J Prosthodont 2006;19:339-48.
28. Turkyilmaz I, Company AM, McGlumphy EA. Should edentulous patients be constrained to removable complete dentures? The use of dental implants to improve the quality of life for edentulous patients. Gerodontology 2010;27:3-10.
29. Vassend O. Anxiety, pain and discomfort associated with dental treatment. Behav Res Ther. 1993;31:659-66.
30. Walton JN, Glick N, Macentee MI. A randomized clinical trial comparing patient satisfaction and prosthetic outcomes with mandibular overdentures retained by one or two implants. Int J Prosthodont 2009;22:331-9.
31. Weisensee W, Scheer M, Müller L, Rothamel D, Kistler F et al. Impact of Anxiety Parameters on Prospective and Experienced Pain Intensity in Implant Surgery. Implant Dent 2012;21:502-6
32. Wong M, Lytle WR. A comparison of anxiety levels associated with root canal therapy and oral surgery treatment. J Endod 1991;17:461-5.

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Effects of oil-based and oil-free enamel prophylactic agents on bracket failure – a prospective randomized clinical trial

MAGDALENA MAGNIUS[1], FARHAN BAZARGANI[2]

Abstract

◉ This study evaluates and compares the effects of enamel prophylaxis using either oil-free pumice or oil-containing prophylaxis paste on the incidence of bracket failure in orthodontic patients.

Forty-six orthodontic patients participated in this prospective clinical trial. A cross-mouth method was used in each patient, in which two diagonal quadrants (i.e. upper right and lower left or vice versa) were randomly assigned to the pumice group and the contralateral diagonal quadrants to the Prophy Paste® group. A total of 836 teeth were bonded using Transbond XT (3M Unitek) and monitored for an average of 23 months for bond failure. Chi-square analysis was used to compare the number of bracket failures between the groups.

Overall, 26 bond failures occurred by the end of the trial. Fifteen bracket failures were observed in the Prophy Paste group (3.6%) and 11 in the pumice group (2.6%). The failure rates were fairly evenly distributed between the upper and lower jaws. There were no statistically significant differences between the groups (P = 0.43).

This study showed that enamel prophylaxis using either pumice or Prophy Paste before orthodontic bonding works equally well in a clinical setting.

Key words

Orthodontic brackets, enamel bond, dental polishing, randomized clinical trial

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Effekt av olje-baserat och olje-fritt emaljpolerings-medel på incidensen av lossnade ortodontiska brackets – En prospektiv randomiserad klinisk studie

Magdalena Magnius, Farhan Bazargani

Sammanfattning

◎ Syftet med studien var att undersöka och jämföra effekterna av emaljprofylax med antingen oljefri pimpsten eller oljebaserad profylaxpasta för evaluering av incidensen av lossnade ortodontiska brackets.

I denna prospektiva randomiserade studie deltog 46 ortodontipatienter. På varje patient användes en Cross-month-metod som innebär att två diagonala kvadranter (dvs. höger överkäke och vänster underkäke eller vice versa) slumpvis behandlades med pimpsten (pimpstensgruppen), medan den kontralaterala diagonalen behandlades med Prophy paste® polerpasta (Prophy paste-gruppen). Totalt 836 tänder bondades med Transbond XT (3M Unitek) och följdes sedan upp under i genomsnitt 23 månader för kontroll av hållbarheten. Chitvå-test användes för att jämföra antalet lossnade brackets mellan grupperna.

Totalt sett hade 26 brackets lossnat vid studiens slut. I gruppen som fått Prophy paste® lossnade 15 fästen (3,6 %), medan 11 fästen (2,6 %) lossnade i pimpstens-gruppen. De lossnade fästena fördelade sig jämnt mellan över- och underkäke. Skillnaden mellan grupperna är inte statistiskt säkerställd (p = 0,43).

Pimpsten och Prophy paste® är likvärdiga som emaljpoleringsmedel inför ortodontisk bondning, när alla andra faktorer är konstanta.

Introduction

Bonding of brackets to enamel surfaces is the most crucial part of orthodontic treatment because adequate and stable bonding between the brackets and enamel is decisive for treatment success. Bracket failure means longer treatment time for the patient and has economic consequences for the orthodontist because it requires increased resources.

To obtain clinically adequate bond strength, it is often recommended that the enamel surface be cleaned by removing the organic pellicle using either pumice or prophylaxis paste applied with a rubber cup or brush. Although some studies indicate that cleaning the enamel surface before orthodontic bonding might be unnecessary (2) other studies contradict this finding (3).

Many studies have investigated the effects of various factors and parameters on the in vitro bond strength (5,7); this approach has its limitations and cannot fully replace clinical trials.

Oil-based, fluoride-containing prophylaxis pastes are not generally recommended because of fears that they might hinder the etching and bonding process. However, Aboush et al. (1) conclude that prophylaxis pastes containing fluoride or oil might be used to clean the enamel before acid etching. Many clinicians polish the enamel surface with prophylaxis paste to ensure adequate bonding strength, while others strictly advocate the use of oil-free pumice in orthodontic bonding. The literature contains little evidence regarding the effectiveness of either pumice or prophylactic paste polishing versus traditional etching not using self-etching primers (SEPs).

This prospective randomized controlled trial evaluates and compares the effects of enamel cleaning using either oil-free pumice or prophylaxis paste on incidence of bracket failure in orthodontic patients. The null hypothesis was that there would be no difference between the use of pumice and prophylactic paste in terms of bracket failure rate.

Material and methods

The Regional Ethical Review Board in Uppsala, Sweden, which follows the Helsinki Declaration guidelines, approved the study protocol.

Fifty consecutive patients, mean age 14.1±1.4 years (±SD), participated in this study, all of whom were to receive conventional bimaxillary fixed appliance therapy at the Postgraduate Dental Centre, Department of Orthodontics, Orebro County Council, Sweden. An equal number of teeth on each side of the dental arch, with a minimum of four teeth per quadrant, was required. Patients with labial restorations and/or hypomineralization on their teeth were excluded from the study. First and second molars were not included in the statistics due to the risk of occlusion interferences.

A cross-mouth design was used. In each patient, two diagonal quadrants (i.e. upper right and lower left or vice versa) were randomly assigned to the pumice group and the contralateral diagonal quadrants to the Prophy Paste® group. The randomization process was as follows: A computer-created block-randomization list was acquired using SPSS version 15.0 (SPSS, Chicago, IL). Each time a patient gave consent, the randomization list was checked to see which diagonal quadrants were to be cleaned using pumice (Orthodontic Prophy Pumice, 1st & Final®, Reliance Orthodontic Products, Itasca, IL) and which using Prophy Paste® CCS RDA 170 (CCS Healthcare, Borlänge, Sweden). The Prophy Paste contains, among other ingredients, glycerine, pumice, sodium fluoride, and hydrogenated castor oil.

After professional cleaning using either pumice or Prophy Paste and adequate moisture control using dental cotton rolls in the anterior segment, parotis dental rolls in the lateral segments, and a saliva ejector, the labial surfaces were etched with Ultra-Etch 35% phosphoric acid gel (Ultradent Products, South Jordan, UT) for 30 s and then thoroughly rinsed. The labial surfaces were then air dried and a very thin layer of Transbond XT primer (3M Unitek, Monrovia, CA) was applied to the enamel surface and rubbed in for 5 s, blown into the etched prisms using a 3-in-1 syringe, and light-cured for 20 s using a Demetron 2000 curing unit (Demetron, Danbury, CT) of quartz tungsten halogen type. Metal brackets having either a .018" or .022" slot (Victory Series®, 3M Unitek) were then bonded using Transbond Plus (3M Unitek) and light-cured for 20 s. A check for occlusal interference was conducted. The same standardized bonding procedure was applied in all patients.

The same operator (MM) bonded all the brackets on all patients to limit variability. The patients were then followed for an average of 23 months, 22.8 ± 6.7 months (mean ± SD), until the fixed appliances were removed, and the incidences of bracket failure and debonding, noted in patient records during the 2009–2012 observation period, were compiled by the other co-author (FB), and thus were blinded to the operator. Debonded brackets were rebonded and then removed from future counts.

Chi-square analysis and Risk Ratio (RR) was used

to compare the number of bracket failures between groups. For the analysis, $P < 0.05$ was considered statistically significant. Statistical software, SPSS version 17.0, was used for the analysis.

Results

Of a total of 50 patients, two received treatment only in the upper jaw, although they were initially to have had bimaxillary treatment, and two were bonded in one jaw by an assistant and not the operator and therefore were excluded from the study. A total of 46 patients, 29 girls and 17 boys, completed the trial, of whom 22 were treated without any extractions, 18 with 4 premolar extractions, and 6 with 2 premolar extractions. In all, 836 teeth were bonded, of which 418 were polished with pumice and 418 with Prophy Paste before etching and bonding the fixed appliances. Overall, 26 bond failures occurred by the end of the trial. Fifteen bracket failures were noted in the Prophy Paste group (3.6%) and 11 in the pumice group (2.6%). The failures were almost equally distributed between the upper and lower jaws and between extraction and non-extraction patients. There were no statistically significant differences between the groups ($P = 0.43$; see Table 1). Table 2 shows the number of patients who experienced at least one bracket failure with each method. The risk ratio (1.38, 95% confidence interval 0.61–3.10) indicates a 38% increased bracket failure rate in the Prophy Paste group, though the difference between the diagonal quadrants was not statistically significant.

Table 1. Total number of brackets failure compared between groups

	Brackets failure	No failure	Total
Pumice	11	407	418
Prophy paste	15	403	418
Total	26	810	836

Chi-square = 0.43; NS

Table 2. Total number of patients with brackets failure

	Brackets failure	No failure	Total
Pumice diagonals	8	38	46
Prophy paste diagonals	11	35	46
Total	19	73	92

Chi-square = 0.86; NS

Discussion

In this study, we evaluated the rate of bracket failure in orthodontic patients whose enamel surfaces were polished with either pumice or oil-containing prophylactic paste (Prophy Paste®). We found no statistically significant differences between the groups after 23 months of treatment.

Bonding is a critical part of orthodontic treatment. To obtain optimum results and for the bracket to last throughout the treatment, the tooth surface must be properly cleaned and carefully etched and dried; resin is then applied and light cured and the bracket is attached with composite. Like previous studies (1) this study finds that failure of orthodontic brackets is probably due to failure in bonding technique rather than to failure in prophylactic paste or pumice pretreatment. One critical consideration is that the tooth must be dry during the bonding process. Contamination with moisture, such as saliva, blood, or water, during the bonding process will eventually lead to bracket failure. Bonding technique is highly exacting and dentists and orthodontic assistants should devote particular attention and effort to this part of the treatment.

Several studies indicate that enamel polishing with prophylatic pastes containing oil or fluoride is not recommended (4,8,9). However, these studies evaluate the effect of pastes in association with SEPs. The importance of the pumice prophylaxis step in ensuring the clinical success of SEP bonding might be due, in part, to the inherently lower bond strength of SEPs and to technique sensitivity (6). Other studies suggest that pumicing is particularly important in SEP bonding because the chalky appearance of enamel that results from traditional etching is not clinically visible when using SEP (8). This indicates that, compared with SEP, traditional etching is less sensitive to the selection of polishing agents.

The risk ratios calculated here indicate a 38% increased risk of bracket failure when using Prophy Paste, though the difference between groups was not statistically significant and could be due to chance.

Conclusions

The null hypothesis could not be rejected. Accordingly, this randomized controlled cross-mouth study concluded that enamel cleaning using either oil-free pumice or oil-containing Prophy Paste before orthodontic bonding works equally well in a clinical setting.

References

1. Aboush YE, Tareen A, Elderton RJ. Resin-to-enamel bonds: effect of cleaning the enamel surface with prophylaxis pastes containing fluoride or oil. Br Dent J 1991; 171:207–9.

2. Barry GR. A clinical investigation of the effects of omission of pumice prophylaxis on band and bond failure. Br J Orthod 1995; 22(3):245–8.
3. Burgess AM, Sherriff M, Ireland AJ. Self-etching primers: is prophylactic pumicing necessary? A randomized clinical trial. Angle Orthod 2006; 76:114–8.
4. Grover S, Sidhu MS, Prabhakar M, Jena S, Soni S. Evaluation of fluoride varnish and its comparison with pumice prophylaxis using self-etching primer in orthodontic bonding--an in vivo study. Eur J Orthod 2012; 34:198–201.
5. Leodido Gda R, Fernandes HO, Tonetto MR, Presoto CD, Bandeca MC, Firoozmand LM. Effect of fluoride solutions on the shear bond strength of orthodontic brackets. Braz Dent J 2012; 23:698–702.
6. Lill DJ, Lindauer SJ, Tufekci E, Shroff B. Importance of pumice prophylaxis for bonding with self-etch primer. Am J Orthod Dentofacial Orthop 2008; 133:423–6.
7. Nirupama C, Kavitha S, Jacob J, et al. Comparison of shear bond strength of hydrophilic bonding materials: an in vitro study. J Contemp Dent Pract 2012; 13:637–43.
8. Pandis N, Eliades T. A comparative in vivo assessment of the long-term failure rate of 2 self-etching primers. Am J Orthod Dentofacial Orthop 2005; 128:96–8.
9. Talic NF. Effect of fluoridated paste on the failure rate of precoated brackets bonded with self-etching primer: a prospective split-mouth study. Am J Orthod Dentofacial Orthop 2011; 140:527–30.

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Parental attitudes and experiences of dental care in children and adolescents with ADHD – a questionnaire study

MARIE STABERG[1], JÖRGEN G NORÉN[1], MATS JOHNSON[2,3], SVENNY KOPP[2,3], AGNETA ROBERTSON[1]

Abstract

◎ Attention deficit hyperactivity disorder (ADHD) is a common psychiatric condition characterized by age-inappropriate levels of inattention, hyperactivity-impulsiveness or a combination of these.

The aim of this study was to analyze parental attitudes to and experience of dental care, oral hygiene and dietary habits in children/adolescents with ADHD. Twenty- six parents of 31 subjects, 20 boys and 11 girls, aged 5-19 years with ADHD registered at the Gothenburg Child Neuropsychiatric Clinic, were invited. The parents answered a questionnaire regarding different oral problems when visiting the Clinic of Pediatric Dentistry, Gothenburg, for an oral examination of their child.

The parents felt the dental care at the Public Dental Service was good, but noted a lack of knowledge regarding child neuropsychiatry among the dental staff which may influence the dental treatment.

Fifteen parents reported their children had experienced mouth pain and 15 reported their child had suffered from both discomfort and pain from local anesthesia. Thirteen of the children had a dental trauma and 12 parents reported pain in connection to the dental treatment. Pain related to filling therapy was stated by 11 parents. According to the parents, five children suffered from dental fear but 15 reported the child had a general fear. Pursuant to the parents, the beverage for dinner was mainly milk or water, while sweet drinks were more frequent when thirsty. Seventeen parents reported their children had poor oral hygiene or could not manage to brush their teeth and 14 of the 31 children only brushed once a day or less.

The results show that the parents experience a lack of child neuropsychiatric knowledge, care and patience from the dental staff, which may influence the treatment. Oral hygiene/tooth brushing is neglected and the frequent consumption of sugar is difficult for the parents to handle.

Key words

ADHD, dental care, dental treatment, oral hygiene, questionnaire

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Föräldrars uppfattning och erfarenheter av tandvård för barn och ungdomar med ADHD

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Sammanfattning

◎ Barn och ungdomar med ADHD (Attention Deficit Hyperactivity Disorder) har stora svårigheter att anpassa sin aktivitetsnivå till den situation de befinner sig i och bromsa sin benägenhet att direkt reagera på de impulser de får.
Syftet med denna studie var att analysera föräldrarnas uppfattning och erfarenhet av tandvård, munhygien och kostvanor hos barn/ungdomar med ett neuropsykiatriskt funktionshinder.

Tjugosex föräldrar till 20 pojkar och 11 flickor i åldern 5-19 år med ADHD och normal IQ som remitterats till Barnneuropsykiatriska kliniken (BNK) vid Drottning Silvias barn- och ungdomssjukhus i Göteborg tillfrågades om deltagande i studien. Föräldrarna fick svara på ett frågeformulär på Specialistkliniken för Pedodonti, Göteborg, Folktandvården Västra Götaland.

Resultaten visar att majoriteten av föräldrarna var nöjda med den behandling barnen/ungdomarna fått på Folktandvården. Trots detta upplevde de att det fanns bristande neuropsykiatriska kunskaper hos tandvårdspersonalen, vilket skulle kunna inverka på själva tandbehandlingen.

Femton föräldrar uppgav att deras barn upplevt smärta i munnen och 15 att deras barn upplevt obehag och smärta i samband med att de fått lokalanestesi. Tolv föräldrar uppgav att barnet upplevt smärta i samband med behandling av tandtrauma och 12 föräldrar svarade att deras barn upplevt smärta relaterat till fyllningsterapi. Av de 31 barnen hade 13 haft ett tandtrauma.

Enligt föräldrarna var det 5 barn som var tandvårdsrädda men 15 föräldrar svarade att deras barn hade någon form av allmän rädsla.

Den vanligaste måltidsdrycken var vatten eller mjölk, medan söta drycker var mer vanligt förekommande vid törst. Att barnet hade dålig munhygien eller inte klarade av sin egen munhygien ansågs av 17 föräldrar. Enligt föräldrarna borstade 14 av de 31 barnen tänderna bara en gång om dagen eller mindre ofta.

Resultaten pekar på att föräldrar till barn med ADHD upplever att tandvårdspersonalen saknar kunskaper om barn med neuropsykiatriska tillstånd och att de önskar ett bättre bemötande och större tålamod från tandvårdens sida. Munhygien/tandborstning fungerar dåligt och liksom det ofta frekventa intaget av sötsaker är svårt att hantera för föräldrarna.

Introduction

In childhood, attention deficit hyperactivity disorder (ADHD) is a psychiatric condition characterized by age-inappropriate levels of inattention, hyperactivity-impulsiveness or a combination of these problems (1).

ADHD is one of the most common childhood psychiatric disorders, present in 3-7% of school-aged children. Boys are more prone to ADHD than girls (7), with a gender ratio of 3-6:1 and a peak between 6 and 9 years of age for boys, however, girls have a higher prevalence during adolescence (16). Boys and girls have the same type of core problems and the same degree of functional impairments (8), but girls with ADHD are often under-diagnosed since they have less acting-out behavior (11). The symptoms of ADHD often lead to functional impairment in multiple domains and a lower quality of life (6). In approximately 50%, ADHD is a persisting disorder into adulthood. Of the diagnosed children with ADHD, most will go on to have significant difficulties in adulthood, which may include continued ADHD, personality disorders, emotional and social difficulties (14).

Dental treatment is a stress situation with a variety of unpleasant stimuli. Children in particular show their distress in behavior which sometimes leads to management problems. In a dental setting, the behavior management of children with ADHD may be challenging. Children with ADHD exhibit more problems interacting with a dentist and have more difficulties staying focused on the examination, thus causing the situation to easily become vague and confusing for the child (3).

Few articles have been written on ADHD from a dental and parental point of view. Therefore, deeper knowledge of the parent's dental experience for their children/adolescents with ADHD is of interest.

The aim of this study was to analyze parental attitudes and experiences of dental care and oral hygiene and dietary habits in their children/adolescents with ADHD.

Material and methods

Subjects

The inclusion criteria to participate in the study were full DSM-IV (1), diagnostic criteria for ADHD, and a normal IQ. Parents of 93 subjects with ADHD, visiting their physicians at the Gothenburg Child Neuropsychiatric Clinic, were invited. Parents of 31 subjects contacted the Clinic of Pediatric Dentistry and agreed to participate in the study. Three of the individuals in the group had one sibling and one had two siblings participating. The final study group thus consisted of 26 mothers to 20 boys and 11 girls, aged 5-19 years, diagnosed with ADHD.

Questionnaire

A questionnaire containing 76 multiple choice questions and two open questions was sent home to the parents before the dental visit. The parents completed the questionnaire concerning informant, parent's place of birth, social relations (living with biological parents or own apartment), siblings, medical anamnesis (diagnosis and medication), pain experience, dental experience and feelings regarding it, dental fear/medical fear/general fear, and dental fear in the family.

The parents were also asked to evaluate their child's oral health including dietary habits, oral hygiene routines, fluoride exposure, and earlier dental care. In the questionnaire, the parents were able to give their reflections.

Open questions

The open questions at the end of the questionnaire were "*Is there anything else you would like to tell us about dentistry for children/adolescents with ADHD*" and "*Is there anything you think dentists could do better/different concerning dentistry for children/adolescents with ADHD?*"

The answers are first presented as annotations from parents grouped under *sweets*. Then grouped into four sections: *Preparation* before the dental visit and knowledge in advance regarding the dental treatment, enough *time*, *care* regarding the child and *patience* from the dental staff. There were also annotations regarding *knowledge of neuropsychiatry* and *the parents' reflections* of their child during dental visits.

Ethical considerations

This study was approved by the Regional Ethical Review Board of the University of Gothenburg, Sweden, (2003-03-28) number SO16-03. Children, adolescents and parents were given written and verbal information regarding the study and asked to give written consent to participate.

Results

Subjects

All 31 children, 20 boys and 11 girls, were born in Sweden to a Swedish mother, except one mother who was from Finland. All fathers were from Sweden

except two; one came from former Yugoslavia and one from Italy. The children lived with their biological parents, except two having their own apartment.

Medical anamnesis and medication

Of the 31 subjects, 26 also had other psychiatric diagnoses. Medication with Ritalin®, Concerta® or Strattera® was prescribed for 28 of the 31 subjects (Table 1). The medical anamnesis was verified by the child's physician.

Dental care

All of the subjects had received dental care at the Public Dental Service (PDS) and had previous experience of dental treatment within the PDS. Two of the children had received specialist dental care and two had general anesthesia for dental care.

Table 1. Frequencies of co-morbid conditions and medication among the 31 subjects. (ADHD=Attention Deficit Hyperactivity Disorder; DCD=Developmental Coordination Disorder; ODD=Oppositional Defiant Disorder; OCD=Obsessive-Compulsive Disorder.)

Disorder		Number
ADHD		31
Multiple diagnoses		26
	DCD	13
	Reading and writing disorders	13
	Autistic traits	4
	ODD	3
	Depression	3
	Tics	3
	OCD	1
	Tourette's syndrome	1
	Panic disorder	1
Medication		28
	Ritalin	14
	Concerta	10
	Strattera	4
Other medications		
	Zoloft	1
	Cipramil	2
	Risperdal	1
	Fontex	1

Previous dental experience and treatment

According to the parents, their children had experienced taking X-ray images, local anesthesia, filling therapy and tooth extractions. A majority of the parents also expressed their children had experienced pain and discomfort during different treatments. Thirteen parents reported their child had experienced a dental trauma (Table 2).

Fifteen parents reported their children had experienced both discomfort and pain from local anesthesia, 12 reported pain from treatment of a dental trauma and 11 parents reported pain in connection with filling therapy (Table 2). The answers indicated no influence of siblings.

A majority of the parents thought their child had received necessary dental treatment, good dental information and considered the dental staff had been kind to their child while seventeen believed the staff's knowledge regarding neuropsychiatry was not sufficient (Table 3).

Fear

According to the parents, five children suffered from dental fear but 17 parents thought their child did not manage dental care in a suitable way. Four children had problems going to the physician because they were afraid of injections, three children with dental fear were also afraid of going to the physician.

General fear of snakes, spiders, insects, darkness and thunderstorms was reported from 15 parents. Only one individual with dental fear also had a fear of medical care, general fear and had a sibling with dental fear. According to the answered questionnaires, 13 mothers, 5 fathers and 11 siblings had dental fear. However, only one mother with dental fear reported having a child with dental fear.

Dietary habits

The beverage for dinner was mainly milk or water while syrup, soft drinks and juice were more frequent when thirsty (Table 4, Table 5).

Table 2. Results of the questionnaire from the 26 parents (representing 31 subjects) during previous dental experiences.

Report of previous dental experiences	Yes	No	No answer	Pain	Discomfort
X-ray	29	2	0	11	14
Local anesthesia	19	12	0	15	15
Filling therapy	18	12	1	11	13
Polishing of teeth	18	12	1	4	6
Tooth extraction	16	14	1	8	11
Dental trauma	13	18	0	12	11

Table 3. Evaluation of treatment at the Public Dental Service according to the questionnaire filled out by the 26 parents of the 31 children with ADHD.

Evaluation	Good	Less good/ doubtful	No answer
Received with kindness	23	7	1
Dental information	23	7	1
Necessary dental treatment	21	10	0
Patience	18	12	1
Care	18	13	0
Knowledge	12	17	2

Table 4. Results of the questionnaire from the 26 parents (representing 31 subjects) regarding beverage intake for dinner and when thirsty. (Several alternatives were possible).

	Milk	Water	Syrup	Soft drinks	Juice	Other
Drink at dinner	23	21	9	5	5	0
Drink when thirsty	8	22	12	9	6	8

Table 5. Results of the questionnaire from the 26 parents (representing 31 subjects) regarding frequency of sweet beverages and the consumption of sweets, biscuits, sweet cereals and spreads.

	Never	Seldom	Once a week	Several times a week	Daily	No answer
Sweets	0	2	13	13	2	1
Syrup/soft drinks	0	4	11	11	4	1
Juice	1	12	8	7	2	1
Cookies, biscuits	0	8	15	6	1	1
Sweet cereals	14	8	4	1	3	1
Bread with marmalade jam/Nutella	12	10	7	1	0	1

Oral health

Oral health being very important or important was claimed by 25 of the parents answering the questionnaire. Nineteen parents stated their child's dental health was very good or good, while seven parents thought it was bad and five did not know. Three children with dental fear were also evaluated by their mothers to have poor oral health and they were not siblings.

Parent's report of oral hygiene routines and fluoride exposure

Seventeen parents reported their child/children had poor oral hygiene or did not manage at all to brush their teeth. Sixteen of the parents reported it had been difficult or not possible to help their child brush his/her teeth during childhood (<8 year). According to the questionnaire, all children in the age-group 8-19 years (no=29) brushed their teeth themselves, while children aged 5-8 years received help from an adult (no=2). Fourteen of the children brushed once a day or less and all children used fluoride toothpaste. Extra fluoride supplementation was used by 15 individuals according to the questionnaires. An ordinary toothbrush was used by 17 children, 3 used an electric toothbrush and 11 children used both an electric and an ordinary brush.

Open questions

Twenty parents made comments in the questionnaire to the two open questions; "*Is there anything else you would like to tell us about dentistry for children/adolescents with ADHD*", and "*Is there anything you think dentists could do better/different concerning dentistry for children/adolescents with ADHD?*" The comments are listed in Appendix (page 100). The most frequent comments were for time, care and patience regarding personnel in the dental clinic (30 comments) followed by the parent's general reflections (16 comments).

Discussion

This study shows that parents with children/adolescents with ADHD are generally satisfied with the Public Dental Service (PDS). However, the questionnaire indicates parents experience a lack of neuropsychiatric knowledge, care and patience from the dental staff more than dental fear in their children when visiting the PDS.

This study was designed to give a picture of dental treatments and everyday oral care for a group of children and adolescents with the neuropsychiatric diagnosis ADHD. The number of individuals included in the study was relatively small, but with a wide age range and all of the children had dental experience. To double-check the influence of siblings, it was found that the parents had given individual answers for each child, both for previous dental experiences and feelings regarding dental care. This confirms a person is not his diagnosis but an individual with a diagnosis.

The answers to the questionnaire showed the parents were satisfied with the dental treatment at the PDS, however, the open questions indicated the parents experienced the dental team lacking knowledge regarding patients with ADHD and other disabilities. Therefore, more information and knowledge in this area would be beneficial for the patients and also for the dental team.

This lack of knowledge may influence the dental treatment in many ways. According to the parents, this group of children needs preparation in advance, more time, frequent visits and better care and structure at the PDS.

Few of the parents reported their child suffered from dental fear, even if dental fear was common in the family (mothers, fathers and siblings). General fear was also common among the studied subjects. It has been shown that highly anxious children reported more pain than less anxious children (17). Other studies have found that children with ADHD did not exhibit a higher degree of dental anxiety except if they had several symptoms of hyperactivity or impulsivity (4, 5). In general, parents tend to estimate dental fear in their children slightly higher than their children do (9, 12). This indicates that the parents do not recognize dental fear as being the main problem for this group of children when visiting the dental clinic.

When looking at the answers to the open questions, given by the parents, some core categories were found. Time, care and patience are regarded as being essential for a good dental treatment experience. Preparation and knowledge in advance is also important for this group of individuals which is shown in the parents´ reflections on previous dental visits. Dental care for individuals with special needs requires specialized knowledge acquired by additional training, as well as increased awareness and attention, adaptation, and accommodative measures beyond what is considered routine. The need for increased dental appointment time should be documented so the office staff is prepared to accommodate the patient's unique circumstances at each subsequent visit (2).

The answers to the open questions indicate the parents are well aware of their child's passion for sweets. According to The National Food Administration in Sweden, approximately 15-25 percent of a child's daily energy comes from sweets, soft drinks, snacks, ice cream, desserts and pastry, with 20% of Swedish children consuming sweets every day (13).

The risk factors for caries should be attended to in the anamnesis and a reduction of the consumption of sweets, soft drinks, snacks and pastry should be emphasized to the parents promoting non-cariogenic alternatives. Therefore, notations regarding sweets are an important reminder that a caries-risk assessment should be performed to assess changes in an individual's risk status at each visit.

Poor oral hygiene, where only half of the subjects brushed their teeth every day, and the poor oral hygiene reported by the parents is not in agreement with the majority of Swedish children's oral habits, where more than 90 percent of all individuals brush their teeth twice or at least once a day (10).

Another dimension of oral health is also the child-parent relationship and the conflict priority the parent can manage. Children and adolescents with ADHD can elicit high levels of parental stress, more conflicts in the parent-child relationship and maladaptive parenting (15), which may influence the child's oral hygiene, dietary habits and in the long run, the oral health.

The picture of dental treatments and everyday oral care for children and adolescents with ADHD seems to be multi-factorial. The diagnosis in itself, with impulsivity and attention deficit, influences many areas such as the parent-child relationship, coordination, memory, dietary habits, oral hygiene habits and how dental care at the PDS has worked out. A dental setting may be challenging both for the dental team, the child and the parents. Thus, it is important to listen to the parents, obtain a more profound medical history, interview parents regard-

ing oral hygiene/tooth brushing/dietary habits and provide fluoride when needed. These findings stress the importance of early recognition of this disorder for prevention and early intervention strategies.

Conclusion

The results show that parents of children/adolescents with ADHD experience a lack of neuropsychiatric knowledge, care and patience from the dental staff, more than dental fear in their children. This lack of knowledge influences dental treatment in many ways. It is of importance that the dentist use individually tailored strategies for each patient to minimize all presumptive pain reactions. Oral hygiene/tooth brushing is often neglected and the frequent consumption of sugar is difficult for the parents to handle. The dental teams need to work together with the parents, acquire a more profound anamnesis and interview parents regarding oral hygiene/tooth brushing/dietary habits.

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References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision. Arlington,VA: American Psychiatric Association. 2000.
2. American Academy of Pediatric Dentistry. Council on Clinical A. Guideline on management of dental patients with special health care needs. Pediatr Dent. 2012;5:160-5.
3. Blomqvist M, Augustsson M, Bertlin C, Holmberg K, Fernell E, Dahllof G, Ek U. How do children with attention deficit hyperactivity disorder interact in a clinical dental examination? A video analysis. Eur J Oral Sci. 2005;3:203-9.
4. Blomqvist M, Holmberg K, Fernell E, Ek U, Dahllof G. Oral health, dental anxiety, and behavior management problems in children with attention deficit hyperactivity disorder. Eur J Oral Sci. 2006;5:385-90.
5. Blomqvist M, Holmberg K, Lindblad F, Fernell E, Ek U, Dahllof G. Salivary cortisol levels and dental anxiety in children with attention deficit hyperactivity disorder. Eur J Oral Sci. 2007;1:1-6.
6. Coghill D, Danckaerts M, Sonuga-Barke E, Sergeant J. Practitioner review: Quality of life in child mental health--conceptual challenges and practical choices. J Child Psychol Psychiatry. 2009;5:544-61.
7. Cormier E. Attention deficit/hyperactivity disorder: a review and update. Journal of pediatric nursing. 2008;5:345-57.
8. Gaub M, Carlson CL. Gender differences in ADHD: a meta-analysis and critical review. J Am Acad Child Adolesc Psychiatry. 1997;8:1036-45.
9. Gustafsson A, Arnrup K, Broberg AG, Bodin L, Berggren U. Child dental fear as measured with the Dental Subscale of the Children's Fear Survey Schedule: the impact of referral status and type of informant (child versus parent). Community dentistry and oral epidemiology. 2010.
10. Hugoson A, Koch G, Gothberg C, Helkimo AN, Lundin SA, Norderyd O, Sjödin B, Sondell K. Oral health of individuals aged 3-80 years in Jonkoping, Sweden during 30 years (1973-2003). I. Review of findings on dental care habits and knowledge of oral health. Swed Dent J. 2005;4:125-38.
11. Kopp S, Gillberg C. Swedish child and adolescent psychiatric out-patients--a five-year cohort. Eur Child Adolesc Psychiatry. 2003;1:30-5.
12. Krikken JB, van Wijk AJ, ten Cate JM, Veerkamp JS. Measuring dental fear using the CFSS-DS. Do children and parents agree? Int J Paediatr Dent. 2013;2:94-100.
13. National Food Agency. Barn och ungdomar. 2013 [2013 01 18]; Available from: http://www.slv.se/sv/grupp1/Mat-och-naring/Matvanor---undersokningar/Barn-och-ungdomar/
14. National Institute for Health and Clinical Excellence. Attention deficit hyperactivity disorder: the NICE guideline on diagnosis and management of ADHD in children, young people and adults. Leicester, UK The British Psychological Society and The Royal College of Psychiatrists. 2009.
15. Pelham WE, Jr., Lang AR. Can your children drive you to drink? Stress and parenting in adults interacting with children with ADHD. Alcohol Res Health. 1999;4:292-8.
16. Szatmari P, Offord DR, Boyle MH. Ontario Child Health Study: prevalence of attention deficit disorder with hyperactivity. J Child Psychol Psychiatry. 1989;2:219-30.
17. Versloot J, Veerkamp JS, Hoogstraten J. Computerized anesthesia delivery system vs. traditional syringe: comparing pain and pain-related behavior in children. Eur J Oral Sci. 2005;6:488-93.

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Appendix

ANNOTATION FROM PARENTS REGARDING SWEETS (9 COMMENTS)

"My child has an enormous need of sugar."
"Sugar and salt, both are good."
"We try to have sweets once a week but he buys himself if he finds money."
"He is crazy for sugar."
"My son eats a lot of sweets, to increase the blood sugar level and with that keep up the activity level because of his ADHD."
"We have to lock the pantry."
"He gets money back on return bottles and gets sweets from friends."
"The more he eats, the nicer he gets."
"We understand his need for sweet things but try to offer fruits instead."

PREPARATION/KNOWLEDGE IN ADVANCE (9 COMMENTS)

"We (the parents) try to prepare at home."
"The dentist/nurse must also prepare."
"Tell more before the day's treatment."
"My son is very suspicious, he asks about everything."
"She has to prepare one week in advance."
"He wants to know what will happen."
"Explain more, there are many rumors about the drill and mistakes."
"Inform the child what will happen next time."
"The Public Dental Service doesn't understand this."

TIME, CARE AND PATIENCE (30 COMMENTS)

"More time."
"More pause."
"Listen to the child."
"If he says it hurts, then it hurts."
"My daughter refused to go to the dentist after a few visits."
"My child wants to go straight in to the dentist."
"Let the parents stay in the room."
"Time limits made the dentist angry."
"My child needs to go more often to the dentist and learn more."
"Better information and more advice."
"Take her pain and fear seriously."
"Be nice and happy."
"Show understanding if the child is afraid."
"We need more regular follow-up and oral hygiene information."
"The dentist is nice but rough."
"Waiting is difficult."
"Don't scrape the teeth when it's not necessary."
"My daughter goes home if she needs to wait."
"Act instead of talking."
"Treat the child on the basis of his age, not as a preschool child."
"Behave, Martin!" "Endure!"
"Be nice and have patience."
"The dentist was angry and irritated because of time limits."
"You need to be more concrete about everything."
"Give better information so the child will understand."
"More follow-up information and cooperation."
"My child easily becomes angry and gets into conflicts."
"The encounter was bad."
"Rewards are good."
"The dental hygienist was very boring, rough and unpleasant. Now she is retired."

KNOWLEDGE OF NEUROPSYCHIATRY (3 COMMENTS)

"There was lack of knowledge about the child's behavior problems."
"You need educating so you can take better care of children with ADHD, dental fear and other disabilities."
"The dentist did not know anything about the diagnosis."

PARENT'S REFLECTIONS (16 COMMENTS)

"The Public Dental Service has good quality and provides warranty."
"My child has an impaired mood."
"She has a lot of anxiety and phobias but can't always communicate it."
"It is very difficult to relax and to calm down, he has always been hyperactive."
"My child is difficult to handle and the dentist accused me of his caries problems."
"Mornings are difficult; it takes time to wake up and function."
"She is always tired in the mornings because she can't go to sleep in the evening". "She has a different 24 hour rhythm."
"According to his school, there are no problems at all, but at home nothing works out."
"He is afraid of injections."
"Organization and planning is difficult."
"My child is always messy; it easily becomes chaos around her."
"My child doesn't trust dentists or doctors."
"I think I have ADHD too (mother)."
"The local anesthesia did not work."
"The medication makes him calm."
"My child has an eating disorder and is suffering from depression."

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