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Decision Making Among Swedish General Dental Practitioners Concerning Prosthodontic Treatment Planning In a Shortened Dental Arch

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Abstract - *The purposes of this study were to describe how dentists evaluated the importance of various patient-related items when planning for a treatment in a shortened dental arch, to analyse common dimensions of the decision-making in comparison to other decision situations, and to identify explanatory factors behind these dimensions. A questionnaire containing different statements regarding the shortened dental arch concept was sent to a random sample of Swedish general dentists (n=189), with a response rate of 54%. The dentists were asked to evaluate items to be considered when planning for a prosthetic treatment in a shortened dental arch. Differences between individuals were great as well as between groups of dentists. Especially delivery system but also place of dental education and attitudinal factors were related to the shortened dental arch decision making process.*

KEY WORDS: Shortened dental arch, decision making, partially edentulous.

INTRODUCTION

Clinical decision making in dentistry is complex, which is true especially for prosthodontics. Similar oral conditions can be treated in different ways as there are many prosthodontic treatment options available for the clinician. A diagnosis may not necessarily lead to a specific treatment. The traditional model of clinical work, "the rational model" for decision making[1] has been criticized, since other factors than the clinical status of the patient and scientifically based knowledge have been shown to influence the clinical decision making [2-7]. Still, the clinical decision making process is not well understood, especially as to what factors influence decisions and how these decisions are made.

Many studies have shown great variations in treatment decisions among dentists[5, 8-13]. The multitude of treatment options in prosthodontics makes the decision making process difficult to manage. For example, the patient´s financial situation and involvement have a great impact on the process. Good oral health has been shown to enhance quality of life which is essentially a subjective assessment [14-16]. A controversy in prosthodontic treatment-planning is the number of teeth necessary for maintaining sufficient oral function and comfort[17-21].

Shortened-dental-arches (SDA) is defined as a dentition where most posterior teeth are missing. A dentition with reduced number of posterior teeth is common especially among older individuals, since molars often have been lost due to caries and periodontal diseases[22]. The SDA-concept was mainly proposed as a treatment option based on individual preferences. It was suggested that sometimes a reduced number of posterior teeth or a reduced occlusal table would provide sufficient oral function in the rehabilitation of the partially edentulous patient. However, a successful treatment using the SDA-concept would depend on a combination of predictable and less predictable local and systemic factors, such as the condition of the remaining dentition, the vertical and horizontal relationship between maxillary and mandibular teeth, age, occlusal condition, chewing pattern and adaptive capacity [23, 24]. The SDA treatment planning protocol aimed primarily at the functional requirements of the patient and at a "problem-oriented approach", preventing overtreatment and making it possible to develop a treatment plan in a clear and systematic way[25].

The primary aim of this study was to describe how dentists evaluated the importance of various patient-related items when planning a treatment in a SDA, and then to analyse common dimensions of the decision-making in comparison to other decision situations [2-4] and finally to find some explanatory factors behind these dimensions.

MATERIAL AND METHODS

In 2003, questionnaires were sent to a random sample of 200 Swedish General Practitioners (GP). About 50% of the dentists in Sweden are employed in the Public Dental Health System (PDHS), while the remaining are working as Private Practitioners (PPs). The sample was taken from the membership register of the Swedish Dental Association comprising almost all dentists in Sweden. No specialists were to be included in the study but it was not possible to identify dentists with a speciality in the sample frame. Eleven dentists were later excluded from the study, since they did not belong to the study population. Nine dentists had a certificate in a speciality issued by the Swedish

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National Board of Health and Welfare. One dentist was working abroad and one was not working as a dentist any longer. Data on employment, private or public, were also obtained through the membership register of the Swedish Dental Association. Those who had not responded within 3 weeks were sent a mailed reminder. After that, no further attempts were made to contact the dentists. The response rate was 54% (102 dentists of 189).

The questionnaire contained 64 questions and details are published elsewhere[26]. It was divided into four main sections:

- Questions about factors to be considered when planning for a prosthodontic treatment in a "shortened-dental-arch".
- Attitudes related to possible risks and benefits in a "shortened-dental-arch".
- Attitudes related to various statements concerning "the-shortened-dental-arch-concept".
- Questions about gender, age, approximate working time as a dentist and place of dental education.

The results of the dentists´ attitudes to the SDA in section 2 and 3 have been reported in a previous paper [26].

The dentists were asked to indicate their opinion about factors to be considered when planning a prosthodontic treatment in a "shortened-dental-arch". The format was similar to that used by Kronström et al[2-4] and was presented as follows: "How do you assess the following items when planning for a prosthodontic treatment in a "shortened-dental arch"? The statements are presented in Table I. Dentists were asked to mark their opinions on a Visual Analogue Scale (VAS) ranging from "unimportant" to "decisively important". The VAS was later coded in 10 equidistant sections and coded from 0 ("Unimportant") to 10 ("Decisively Important").

Variables about socio-demographic attributes were constructed from items including gender (male or female), the age (in 9 categories:<25, 25-29, 30-34, 35-39, 40, 44, 45-49, 50-54, 55-60 and 60 years and above); years in profession (any figure could be given) and dental school (the four Swedish dental schools in Umeå, Stockholm, Göteborg and Malmö or abroad).

In the questionnaire, there were questions about perception of possible risks and advantages of SDA[26]. The variables "risks" and "advantages" were defined in a previously published paper[26]. The questions were subjected to a principal component analysis, yielding a two factors solution as intended with a total variance explanation of 32 % for the first factor, interpreted as "advantages", and 21% for the second factor, interpreted as perception of "risks". The constituent variables were summarized into indices, indicating perception of "risks" and "advantages" and used as independent variables.

STATISTICAL METHODS

The data were first analysed in frequency tables where means and standard deviations were calculated for the entire sample. Differences in means were tested with the Student´s *t* test for delivery system and gender. The treatment planning statements were subjected to principal

Table 1. *Frequency distribution of important factors to be considered when planning a prosthetic treatment in "shortened-dental-arch". Responses were on visual analogue scale ranging from "Unimportant"=0 to "Decisively important"=10. PP=private practice; PDHS=Public Dental Health Service*†

	Item	*Total population (mean)*	*SD*	*Men (mean)*	*Women (mean)*	*PP (mean)*	*PDHS (mean)*
8	Periodontal condition of remaining teeth	8.2	1.3	8.1	8.4	8.4	8.0
16	Prognosis for delivered treatment	8.1	1.2	8.0	8.2	8.0	8.1
1	Patient´s wish	7.8	1.3	7.7	7.8	7.6	7.9
7	Patient´s experience of bad chewing ability	7.8	1.4	7.4	8.0*	7.6	7.7
6	Patient´s adaptive capacity	7.6	1.4	7.4	8.0*	7.2	8.1***
5	Expected patient comfort	7.7	1.4	7.5	7.9	7.3	8.1**
19	My own clinical experience	7.4	1.9	7.4	7.4	7.4	7.5
12	Localisation of remaining teeth	7.1	1.5	7.1	7.2	7.2	6.9
10	Good oral hygiene	7.0	1.6	6.9	7.1	7.0	7.0
3	Patient´s economy	6.9	2.3	6.8	7.1	6.6	7.3
9	Cariological status of remaining teeth	6.8	2.0	6.6	7.1	6.4	7.2*
4	Patient´s general health	6.7	1.8	6.5	7.0	6.8	6.6
14	Previous temporomandibular joint problems	6.7	1.7	6.2	7.4***	6.7	6.6
13	Occlusion	6.5	1.8	6.2	7.0*	6.9	6.1*
18	Esthetic outcome	6.5	1.8	6.5	6.4	6.4	6.6
15	Cost for patient	6.2	2.2	5.8	6.8*	5.9	6.6
11	Abrasion level of remaining teeth	5.6	1.8	5.3	6.1*	5.7	5.5
2	Patient´s age	4.7	2.8	4.4	5.1	4.4	5.0
17	Relatives wish	3.0	2.2	2.7	3.5(*)	3.0	3.0
20	Treatment time required	3.0	2.1	2.9	3.1	2.9	3.1

(*) = $P \leq .10$ * = $P \leq .05$ ** = $P \leq .01$ *** = $P \leq .001$

†*99 ≤n≤102 sample size*

component analysis (PCA), where a 3-factor solution was obtained[27]. The number of factors was determined through the Kaiser criterion and inspection of scree plots. Two statements were excluded because of low communalities (no 14 and no 18).

The 3 factors were set as dependent variables in multiple regression models [28] using "social and demographic attributes", and the other factors as independent variables. The models were run with inspection of residual plots for determination of heteroscedasticity (unequal distribution of residuals along the regression line). Statistical significance was set at α=0.05. All data analysis was done in SPSS.

RESULTS

The results showed a large variation for several questions as indicated by the standard deviations (Table I). The statements given the highest importance were "periodontal condition of remaining teeth" (mean=8.2) and "prognosis for delivered treatment" (mean=8.1) also showing the lowest standard deviations, while the statement "patient´s age" (SD=2.8) showed the largest standard deviation. The statements given the lowest importance were "relatives´ wish" (mean=3.0) and "treatment time required" (mean=3.0). There were significant differences between groups. The largest mean difference between genders was seen for the statement "previous temporomandibular problems" where female dentists evaluated this variable as more important than men did. PDHS dentists reported a significantly higher importance for the statements "patient's adaptive capacity" and "expected patient comfort" than PPs did.

When analysing the items using PCA, a 3–factor model with a total variance explanation of 46 % was obtained (Table II). The 3 factors were interpreted to capture the dimensions "technical" (questions 8,11,10,13,9,12,7), "comfort" (questions 6,15,16,1,5,3,19,4) and "time" (items 20,2,17) (Table II).

Multiple regression analyses were run for these factors as dependent variables (Table III). The results showed that PPs compared to PDHS dentists expressed a significantly greater importance of the "technical" factor ($P \leq .01$) and less of the "comfort" factor ($P \leq .10$). Dentists educated in Stockholm gave greater importance to the "technical" factor compared to dentists educated abroad ($P \leq .01$) and the opposite was seen for dentists educated in Umeå ($P \leq .05$). The "time" factor was important for dentists educated in Stockholm and Malmö.

The "technical" factor showed significant associations with the variables "comfort", "time" and the attitudinal variable "risks" with an SDA. The "comfort" factor gave great importance to the "technical" variable and the attitudinal variable "advantage" with an SDA. The "time" factor was significantly associated with the"technical"variable. All 3 models showed adjusted R^2 values (0.23, 0.24 and 0.07 respectively) indicating relatively good precision except for the third model, indicating lacking model specification in that case. The third model was also non-significant.

DISCUSSION

The main results of the present study were (1) there was great individual variation among the dentists in their evaluation of the importance of various patient-related factors when planning for treatment in a SDA, (2) there were significant differences between groups of dentists, (3) the decision-related questions could be reduced into three underlying dimensions, and (4) delivery system, place of education and attitudes were all related to the SDA decision making process. Swedish GP regarded "periodontal condition of remaining teeth", "prognosis for delivered treatment", "patients´wish" and "patient´s experience of poor chewing ability" as the most important items. An interesting finding was that periodontal conditions were regarded as more important than cariological conditions. Both periodontitis and caries are highly prevalent diseases and caries is the primary cause for tooth loss among older individuals[29]. In the past, loss of periodontal support for remaining teeth was thought to be related to dental arches with poor occlusal stability. In a study by Witter and coworkers they concluded that the combination of an existing severe periodontal involvement and SDA were considered an unfavourable combination[17].

The present results resemble the findings in another study concerning decision making among Swedish GPs[2-4]. In the studies by Kronström et al[2-4] the items "prognosis for delivered treatment" and "patients wish" were given the highest VAS values while the lowest value was found for "treatment time required" which is the same pattern as could be observed in present study. In an American study on clinical decision making, dentists ranked "technical factors" such as an extent of tooth damage and periodontal status as the most important when deciding about FPD therapy[13]. However, in that study factors such as "patient preference" and "oral condition" were rated as less important but since it was performed almost 20 years ago, and it is likely that factors related to the patient´s influence have changed in the US and elsewhere and that the conditions now may be comparable with findings in the present study.

In the present study, the item "patient´s experience of bad chewing ability" was also given one of the highest mean scores in the frequency table. This could reflect the opinion that loss of posterior teeth is associated with reduced masticatory performance[18]. Especially in extremely shortened dental arches, comprising 0-2 occluding premolars, the chewing ability is severely impaired[19]. However, the subjective chewing ability seems to be sufficient or at least acceptable, when 20 well distributed teeth are present[20, 21]. There was a large individual variation in responses. The statement "patients´age" showed the largest standard deviation which could mirror the fact that Swedish GPs are not overall convinced that the SDA-concept is applicable mainly for older people[19]. There were also some differences between groups of dentists. The largest mean gender difference was for the item "previous temporomandibular joint problems". The reason for this could be that female dentists pay more attention to this problem since women more often than men are reporting pain from temporomandibular joints[30]. A limitation of the present study was the relatively small amount of material but the relatively high R^2 values provide strong support to the findings.

The results in Table II can be compared to studies by Kronström et al[3, 4] where Swedish dentists were asked to evaluate clinical and patient related factors when choosing between fixed and removable partial dentures in a given situation[3] and between fixed partial dentures and single

Table 2. *Varimax Rotated Principal Components Analysis of items relevant for decision-making in SDA*

Item	*Factor 1 (technical)*	*Factor 2 (comfort)*	*Factor 3 (time)*	*Communality (h^2)*
8 Periodontal condition of remaining teeth	0.73			0.46
11 Abrasion level of remaining teeth	0.72			0.60
10 Good oral hygiene	0.68			0.35
13 Occlusion	0.66			0.52
9 Cariological status of remaining teeth	0.55			0.49
12 Localisation of remaining teeth	0.54			0.49
7 Patient´s experience of bad chewing ability	0.49			0.40
6 Patient´s adaptive capacity		0.72		0.31
15 Cost for patient		0.63		0.45
16 Prognosis for delivered treatment		0.60		0.61
1 Patient´s wish		0.59		0.42
5 Expected patient comfort		0.57		0.55
3 Patient´s economy		0.54		0.34
19 My own clinical experience		0.52		0.33
4 Patient´s general health		0.46		0.52
20 Treatment time required			0.78	0.37
2 Patient´s age			0.64	0.60
17 Relatives´wish			0.59	0.40
Variance explanation (%)	17.1	16.7	11.9	

Loadings ≥ 0.30 , n= 92

Table 3. *Multiple Regression Model Regarding Assessments of Importance for the Variables Influencing Dentists´ Choice of Treatment in a SDA*

	Regression coefficient		
Independent variable (range or ref cat)	*Technical factor (32-66)*	*Comfort factor (29-77)*	*Time factor (0-26)*
Social and demographic attributes			
Gender (female, men ref.cat)	1.96	2.30	0.64
Delivery system (PDHS, PP ref cat)	-3.91**	3.08 (*)	1.19
Years in profession (2-42)	-0.02	0.07	0.04
Dental education (dummy variable)			
Umeå	-6.85 *	0.83	3.54
Stockholm	-7.58 **	1.28	4.90 *
Göteborg	-4.32	4.14	1.59
Malmö	-3.66	-0.36	3.61 (*)
Abroad (ref.cat)			
Risk (20-75)	0.15 *	0.06	0.07
Advantage (0-70)	0.03	0.10 (*)	0.04
Comfort (29-77)	0.29 **		0.08
Technical (32-66)		0.34 **	0.20 **
Time (0-26)	0.35 **	0.16	
Adjusted R square	0.23	0.24	0.07
Model significance	0.001	0.001	0.119

(*) =$P \leq .10$ *=$P \leq .05$ **=$P \leq .01$
***=$P \leq .001$

implant[4]. A 3-factor model was obtained and the 3 factors were interpreted to capture the dimensions "time", "health" and "comfort" which resembles the results in present study where a reduction of the decision items to 3 similar factors ("technical", "comfort" and "time") was done. The similar results suggest it might be possible to capture common dimensions of decision-making in prosthodontics.

The finding that PDHS dentists regarded the "technical" factor as less important and the "comfort" factor as more important compared to the PPs might be explained by the fact that PHDS dentists on average are less experienced with prosthodontic treatment as indicated by lower production scores[7]. Further the PDHS dentists might regard economic aspects to be a less important than PPs do since they generally have a fixed income, while PPs have a production based salary. Another explanation could be that PDHS dentists in general have a different population of patients compared with private practitioners. Most of the children and often older patients with a reduced financial capacity are seen by dentists in the PDHS[7]. The attitudinal variables "risks" and "advantage" with an SDA showed significant association with the factors "technical" and "comfort" respectively. This indicates that attitudes have an influence on the decision-making process.

CONCLUSION

The present study showed that there were great individual differences for most questions. It was possible to make a data reduction of the decision-making items into 3 factors; "technical", "comfort" and "time" which resembles the findings in other studies[2-4], which indicates that it is possible to capture common dimensions of the decision-making in prosthodontics in comparison to other decision situations. Delivery system and also place of dental education and attitudinal factors were related to the decision making process in SDA.

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