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Longitudinal comparison of factors influencing choice of dental treatment by private general practitioners

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Abstract

Background: Service rate variations and appropriateness of care issues have focused attention on factors that influence treatment decisions. The aims of this study were to examine what factors dentists consider in choosing alternative treatments, the stability of these factors over time and whether stability of treatment choice was related to age of dentist.

Methods: Baseline data were collected by mailed self-complete questionnaires from a random sample of Australian dentists (response rate=60.3 per cent, n=345 private general practitioners provided service data from a typical day) in 1997–1998 and follow-up data were collected in 2004 (response rate=76.8 per cent, n=177 matched longitudinal cases).

Results: The most frequent factors considered important across six alternative treatment pair choice scenarios were caries rate for 'exam v. x-ray', age of patient for 'preventive v. restorative intervention', cost of treatment for 'crown v. build-up', 'root canal v. extraction' and 'bridge v. denture', and calculus for 'prophylaxis v. scaling'. The only differences over time were (t-test, $P<0.05$): higher proportions of responses in the mouth status group at follow-up for 'exam v. x-ray'; higher proportions of responses in the visit history group at follow-up for 'preventive v. restorative intervention'; a lower proportion of responses in the caries group at follow-up for 'crown v. build-up'; and a higher proportion of responses in the treatment constraints group at follow-up for 'prophylaxis v. scaling'.

Conclusions: While a wide range of responses were offered as factors influencing the choice of alternative treatments, cost of treatment was a major consideration in situations where significantly cheaper alternatives existed, while patient preference was commonly included as a secondary consideration across a wide range of treatment choice scenarios. The treatment choice responses showed a high degree of stability over time across all age groups of dentists, suggesting that if routines are developed these are established before or soon after graduation as a dentist.

Key words: Treatment choice, general dental practice.

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INTRODUCTION

Variation in service provision has attracted interest as a public health problem due to the implications it has for appropriateness of care.[1,2] Investigations of factors influencing the clinical decision-making process have identified and compared the roles of technical (e.g., oral health factors) and patient factors.[3,4] These studies have indicated that technical factors dominated over patient concerns in the choice of substitutable treatments, such as extraction v. root canal treatment and crown v. build-up, but indicated the need to repeat the analysis on different populations of dentists in order to confirm the findings. An Australian study found that clinical decision making in dentistry is a complex process with a wide range of responses to the factors considered by dentists to be important in choosing one treatment over another, such as a visual exam v. an x-ray.[5] However, within each substitutable treatment pair scenario there were some factors that dominated treatment choice.

The dominance of key factors in choosing treatment may reflect the adoption of routines.[6] Such routines based on clinical experience may provide a means whereby practitioners can deal with the uncertainty involved in making treatment decisions. Dental students have been shown to rank a larger number of factors as important when choosing treatment compared with dentists which may indicate that students have yet to develop routines for decision making.[4]

In order to understand the development of treatment choice factors in terms of whether they change over time, and if so, at what age, it is necessary to collect longitudinal information from the same dentists at two points in time. The aims of this study were to examine what factors dentists consider in choosing alternative treatments, assess the stability of these factors over time and determine whether the stability of treatment choice was related to age of dentist.

MATERIALS AND METHODS

Sampling and data collection

Dentists were sampled at random from the dental registers of each Australian State/Territory based on a

sampling rate of 13.5 per cent, resulting in a total sample of 1202 dentists. Further details of baseline sampling have been published previously.[5] In 2004, a total of 292 dentists who had provided baseline data on treatment choice were identified from the dental registers for inclusion in the follow-up study.

Data on factors influencing choice of alternative treatments were collected by mailed self-complete questionnaires.[7] A primary approach letter was sent to introduce the study, followed by the questionnaire a week later and up to four follow-up mailings were sent to non-respondents.

Data items

Choice of substitutable alternative treatments were based on published reports,[3,4] which included 'crown v. build-up', 'root canal v. extraction', 'bridge v. denture' and 'prophylaxis v. scaling', with the addition of two further alternative treatment pairs. These were 'visual examination v. x-ray', and 'preventive intervention v. restoration'.* Dentists were instructed using an open-ended question to list up to five factors that they considered important in choosing the first alternative treatment of each pair presented. Although examples were given, dentists were instructed that these were not necessarily a complete list, and they should provide their own responses based on clinical experience and judgement, and if necessary repeat the same factors for different pairs of treatment, or leave blank if they felt less than five factors were needed.

Data analysis

To assess the potential impact of non-response and loss to follow-up the baseline characteristics of dentists who provided longitudinal data were compared to dentists that had responded at baseline only. Data analysis of treatment choice factors was based on longitudinal data for dentists that had linked data from both baseline and follow-up. To describe the most important factors that dentists consider when making treatment choices the highest-ranked responses were examined as percentages for each treatment choice scenario. To further refine the analysis the responses to the factors influencing choice of treatment within each substitutable treatment pair scenario were grouped into conceptual categories by one researcher (DSB) through an iterative sorting process and expressed as percentages. The conceptual grouping of responses was checked by the other researcher (AJS) and presented to a small group of researchers to verify their accuracy but no formal measurement of agreement was made. Since

the number of responses may have varied between baseline and follow-up the number of responses in each conceptual category were then counted and divided by the total number of responses to derive the proportion of responses per conceptual category. Mean proportions of responses were then analysed between baseline and follow-up by paired t-tests,[8] and this was then repeated for each baseline age strata of dentist. No adjustment was made for multiple comparisons as all tests, both non-significant and significant, are presented.[9]

Ethical review

The research project was reviewed and approved by the Human Research Ethics Committee of The University of Adelaide.

RESULTS

Response

A total of 676 dentists responded to the baseline survey in 1997–1998, resulting in a response rate of 60.3 per cent. Of the 676, a total of 552 were entered for analysis, with the remainder excluded for reasons such as ill health or retirement. Of the 552 entered responses, 451 were in general practice, with 418 in the private sector and 407 currently treating patients. Of the 407 private general practitioners currently treating patients, a total of 345 private general practitioners provided service provision data in a log of a typical clinical day. There were no significant differences between these dentists who supplied service data and responding dentists in the sample who did not provide service data by: gender of dentist, age of dentist, practice type, geographic location, years since graduation, per cent of time worked and number of other dentists in their main practice, practice activity measures (i.e., patients per hour, hours per year worked, patients per year treated and appointment time) and number of full-time equivalent support staff (i.e., chairside assistants, hygienists, managers, secretaries, other staff). All further analyses were restricted to private general dental practitioners (i.e., non-specialist dentists working in the private sector providing dental treatment on a fee-for-service basis) who supplied service data.

Overall, there were 276 male dentists (80 per cent) and 69 female dentists (20 per cent). The majority of dentists were in the age groups 30–39 (27.6 per cent) and 40–49 (29.3 per cent) years. Male dentists had an older age distribution than females, with higher percentages in the age groups 40–49 years (30.8 per cent v. 23.2 per cent), 50–59 years (20.3 per cent v. 10.1 per cent), and 60+ years (13.4 per cent v. 0.0 per cent). The responding practitioners had an age distribution similar to the dentist population.[10]

In the follow-up survey in 2004, a total of 203 dentists responded (response rate = 76.8 per cent), with a total of 177 matched longitudinal cases with complete data being available for analysis. Compared

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*Note the exact wording of these scenarios was 'Crown v. Amalgam or composite build-up on a posterior tooth', 'Root canal therapy v. Extraction of a posterior tooth', 'Fixed bridge v. Removable partial denture for missing anterior tooth', 'Prophylaxis (mechanical cleaning) v. Subgingival curettage or periodontal scaling', 'Visual exam only v. X-rays as a diagnostic aid for a posterior tooth' and 'Preventive intervention v. Restoration for an initial carious lesion in an occlusal surface of a posterior tooth'.
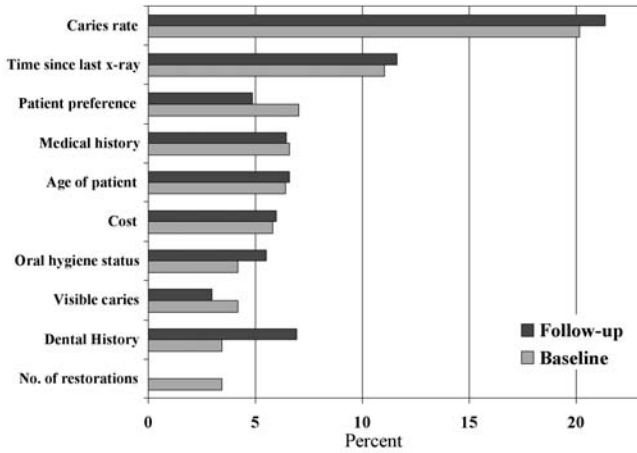
Fig 1. Highest ranked response items to the treatment scenario 'visual examination v. x-ray'.
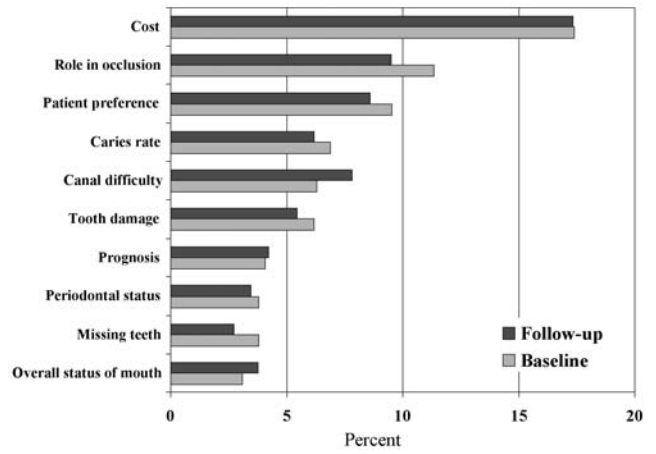

Fig 4. Highest ranked response items to the treatment scenario 'root canal v. extraction'.

to the dentists who responded at baseline but not at follow-up, the baseline characteristics of the longitudinal respondents were similar in terms of age, gender, geographic location, time since graduation, per cent of time spent in their main practice, numbers of

patients treated (per hour, per year, per day), time worked (total hours per day, hours per day chairside, hours per year, days per week, weeks per year) and waiting time for an appointment. A higher percentage of the dentists providing longitudinal data worked in

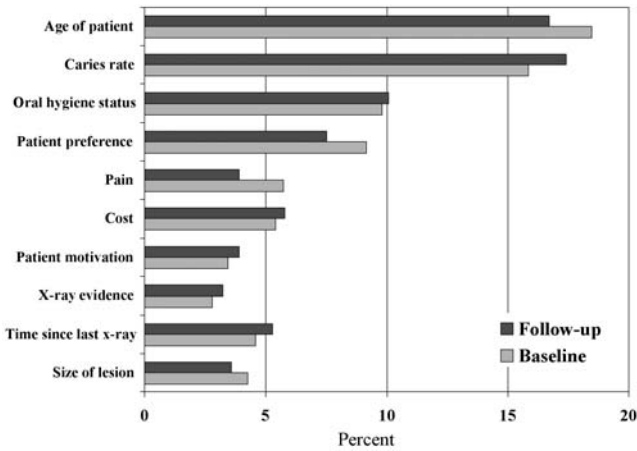**Fig 2.** Highest ranked response items to the treatment scenario 'preventive intervention v. restoration'.
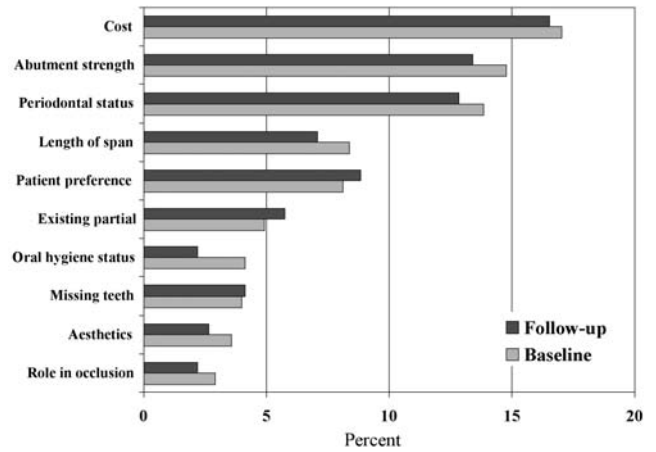

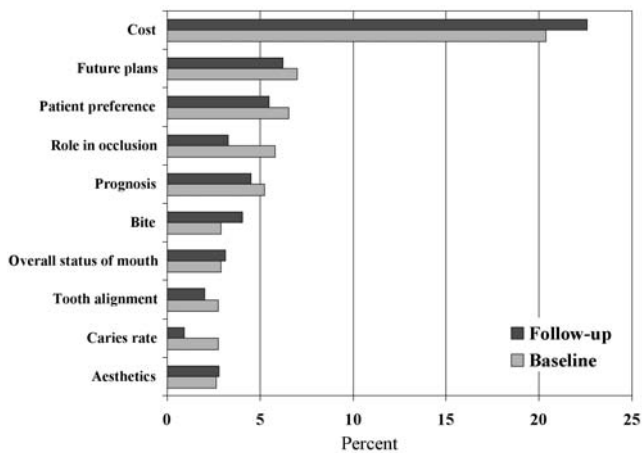**Fig 5.** Highest ranked response items to the treatment scenario 'bridge v. denture'.

Fig 3. Highest ranked response items to the treatment scenario 'crown v. build-up'.
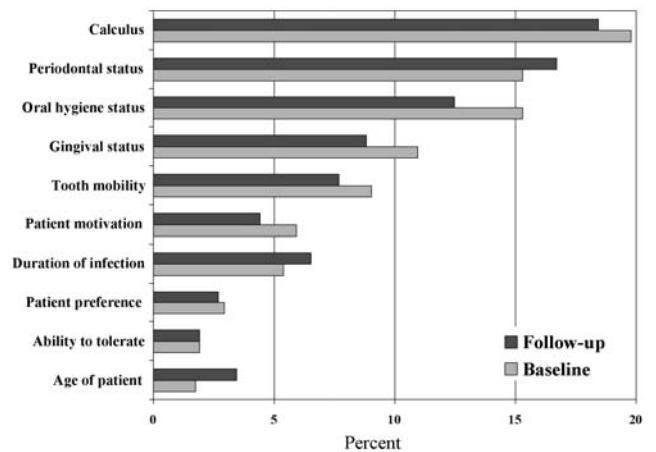

Fig 6. Highest ranked response items to the treatment scenario 'prophylaxis v. scaling'.

Table 1. Responses to choice of substitutable treatments classified into groups

Group	Responses
Background:	Age of patient; Medical history/general health; Dental fear/anxiety; Pregnancy; Diet/lifestyle; Gagging; Occupation/ sport; Family history
Caries:	Caries rate/risk; Interproximal caries, restorations; Recurrent caries; Arrested caries
Mouth status:	Number of missing teeth; Oral hygiene status; Rest of dentition/proximal teeth; Overall status of mouth/extent of other treatment needed; Amount of bone loss
Tooth status:	Alignment/tooth anatomy; Extent of tooth damage; Duration/type of infection; Suitability for restoration/pre-existing filling/fracture; Role in occlusion/function/avoiding dentures; Size of lesion/ amount of healthy tooth/vitality; Which tooth/ tooth position; Number of proximal contacts
Root status:	Root caries/condition; Pulp status/sensitivity; Anatomy/difficulty of canals; Duration of root canal; Root filled/treated; Future/past need for root canal treatment; Root sensitivity
Denture status:	Existing partial denture; Abutment contours/tipping; Length of edentulous span; Abutment strength/condition; Soft tissue contours/damage; Abutment length; Whether abutment for partial denture; Too heavy for temporary bridge
Periodontal status:	Extent of calculus; Periodontal status/pocket depth; Tooth mobility; Gingival status/bleeding
Bite:	Heavy bite; Bite/occlusal force/abrasion problems/retained food particles
Diagnosis:	Colour change/staining; X-ray evidence; Probe/penetration/sticking; Visible caries/clinical appearance; Density of enamel/presence of fillings; Ability to view/accuracy of diagnosis; No need for panoramic of other teeth; Salivary flow; Vitality test
Visit history:	My records/availability of x-ray/legal record; Time since last x-ray/check-up/visit; Dental treatment history; Time since last perio treatment/exam; Public or private patient
Treatment history:	Previous endo treatment; Number of fillings, crowns, implants/age of fillings; Fissure seals present
Treatment constraints:	Preparation for other procedures/need for other treatment; Cost to patient/ affordability; Aesthetics; Time/urgency; Potential problems/difficulty with alternatives; Access to equipment (e.g., micro-abrasive); Access/ease of treatment; Pathology screening
Pain:	Pain control/comfort; Need for anaesthesia; Toothache; Symptoms/pain
Prognosis:	Tooth prognosis/serviceability in the long term; Longevity of restoration; Probability of root canal success; Longer lasting; Nerve prognosis; Need for strength
Plans:	Future plans for tooth/treatment plan; Future plans (partial or bridge)
Fluoride:	Fluoride applications; Fluoride history
Patient:	Patient preference/approval/acceptance of potential difficulties; Patient's ability to tolerate procedure/co-operate; Patient motivation/ dental IQ/ recall compliance
Experience:	Patient previous experience with similar procedures; Patients ability to tolerate prosthesis/type of partial
Convenience:	Convenience to patient; Number of appointments
Dentist:	Ability of dentist/philosophy of dentist; Need for specialist; Practice profit/time-money ratio/convenience to dentist; Radiation to dentist
Choice:	None/always do the latter alternative; None/always do first alternative; Do neither alternative/both

solo practices at baseline which was reflected in their working with lower numbers of other dentists, assistants and secretaries but the numbers of hygienists, managers and other types of personnel were similar to dentists who responded at baseline only.

Factors considered by dentists in treatment choice

Individual responses

Figures 1 to 6 present the highest ranked responses to each of the six treatment choice scenarios. For 'visual exam only v. x-ray' (Fig 1) the highest ranked response item was 'caries rate' followed by 'time since last x-ray'. For 'preventive intervention v. restoration' (Fig 2) the highest ranked response items were 'age of patient' and 'caries rate', followed by 'oral hygiene status' and 'patient preference'. The choice of 'crown v. amalgam or composite build-up' (Fig 3) was dominated by the response 'cost' then followed by a range of next highest responses including responses such as 'future plans', 'patient preference', 'role in occlusion' and 'prognosis'. The choice of 'root canal v. extraction' (Fig 4) was also dominated by the response 'cost', and then followed by 'role in occlusion' and 'patient preference'. 'Cost' was also the highest ranked response item in the choice of a

'bridge v. denture' (Fig 5), followed by 'abutment strength' and 'periodontal status', then 'length of span', 'patient preference' and 'existing partial'. The choice of 'prophylaxis v. scaling' (Fig 6) had 'calculus' as the highest ranked response, then 'periodontal status', 'oral hygiene status', 'gingival status' and 'tooth mobility'.

Responses ordered into groups

Table 1 presents the responses ordered into groups. In total, there were 99 responses to the six substitutable treatment pair scenarios. To simplify the analysis, the remaining results are based on the 10 highest ranked response groups. Table 2 presents the highest ranked response groups across the five factors that dentists were asked to list as important in influencing choice of treatment in the six substitutable treatment pair scenarios. Data presented are proportions in order to control for differing total number of responses between baseline and follow-up. These can be interpreted similarly to a percentage, only ranging from 0 to 1.0, instead of between 0 and 100 (e.g., the background responses to 'exam v. x-ray' had a mean proportion of 0.153 at baseline, equivalent to 15.3 per cent of the total responses to that treatment pair scenario). The choice of 'exam v. x-ray' was dominated by background, caries

Table 2. Baseline and follow-up proportions of responses per treatment scenario

	Pair 1: Exam v. xray		Pair 2: Preventive v. restorative		Pair 3: Crown v. build-up		Pair 4: Root canal v. extraction		Pair 5: Bridge v. denture		Pair 6: Prophy v. scaling	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Background												
Baseline	.153	.013	.220	.015	.022	.005	.029	.006	.020	.005	.032	.008
Follow-up	.144	.013	.207	.014	.029	.007	.021	.006	.029	.007	.043	.008
Caries					*							
Baseline	.214	.011	.175	.014	**.025**	**.006**	.062	.008	.019	.005	.000	.000
Follow-up	.225	.012	.190	.015	**.010**	**.004**	.059	.008	.028	.006	.000	.000
Mouth status	*											
Baseline	**.065**	**.009**	.126	.012	.058	.008	.081	.009	.100	.010	.152	.013
Follow-up	**.080**	**.010**	.122	.013	.076	.010	.092	.011	.126	.013	.131	.013
Tooth status												
Baseline	.019	.006	.065	.012	.280	.013	.213	.015	.039	.007	.058	.009
Follow-up	.005	.003	.054	.011	.278	.016	.215	.015	.024	.006	.048	.008
Root status												
Baseline	.027	.006	.000	.000	.028	.006	.082	.011	.004	.003	.006	.004
Follow-up	.036	.007	.000	.000	.034	.006	.082	.010	.000	.000	.001	.001
Denture status												
Baseline	.001	.001	.000	.000	.006	.003	.010	.003	.288	.016	.000	.000
Follow-up	.000	.000	.000	.000	.003	.002	.004	.002	.267	.018	.000	.000
Periodontal status												
Baseline	.024	.006	.001	.001	.021	.005	.037	.007	.134	.009	.567	.020
Follow-up	.017	.005	.004	.003	.017	.005	.040	.008	.123	.010	.555	.025
Visit history			*									
Baseline	.159	.014	**.049**	**.008**	.017	.004	.001	.001	.003	.002	.016	.005
Follow-up	.194	.015	**.080**	**.011**	.009	.004	.003	.002	.004	.002	.022	.006
Treatment constraints											*	
Baseline	.072	.010	.061	.009	.257	.013	.220	.001	.219	.012	**.010**	**.004**
Follow-up	.059	.009	.059	.009	.280	.012	.208	.013	.205	.013	**.025**	**.006**
Patient												
Baseline	.073	.010	.137	.013	.086	.012	.137	.013	.100	.011	.017	.012
Follow-up	.060	.009	.129	.013	.087	.013	.131	.013	.136	.015	.078	.011

*Significant difference between baseline and follow-up (P<0.05) paired t-test.

and visit history responses, with the only difference over time being a higher proportion of responses in the mouth status group at follow-up compared to baseline. The choice of 'preventive v. restorative intervention' also had high proportions of responses in the background and caries groups, as well as in the mouth status and patient groups, with the only difference over time being a higher proportion of responses in the visit history group at follow-up. The choice of 'crown v. amalgam or composite build-up' was dominated by responses in the tooth status and treatment constraints groups, with the only difference over time being a lower proportion of responses in the caries group at follow-up. The choice of 'root canal v. extraction' was dominated by responses in the tooth status, treatment constraints and patient groups, with no differences observed over time. The choice of a 'bridge v. denture' was also dominated by responses in the treatment constraints group along with denture status, and no differences were observed over time. The choice of 'prophylaxis v. scaling' was dominated by responses in the periodontal status group, with the only difference over time being a higher proportion of responses in the treatment constraints group at follow-up.

Responses ordered into groups by age

Table 3 summarizes the comparison of baseline v. follow-up proportions of responses ordered into groups broken down by age of dentist. Among 20–29 year-old dentists the only difference over time was observed for responses in the background group for 'root canal v. extraction' and in the patient factors group for 'prophylaxis v. scaling'. Among 30–39 year-old dentists the only difference over time was observed for responses in the patient factors group for a 'bridge v. denture'. Among 40–49 year-old dentists differences over time were observed for responses in the caries and treatment constraints groups for 'crown v. build-up' and for the visit history group for 'preventive v. restorative intervention'. Among 50–59 year-old dentists differences over time were observed for responses in the tooth status and denture status groups for a 'bridge v. denture'. Among dentists aged 60+ years the only differences over time were observed for responses in the mouth status and root status groups for 'exam v. x-ray'.

DISCUSSION

It has been reported that the sensitivity of dentists and patients to cost considerations may reflect that dentistry has traditionally been regarded as a discretionary service and provided according to market principles.[11] However, cost and finance factors have not been ranked highly by dentists as a preferred characteristic of patients.[12] While dentists are generally

Table 3. Difference in proportions of responses between baseline and follow-up by age of dentist

	Age of dentist at baseline (years)				
	20-29	30-39	40-49	50-59	60+
Exam v. X-ray	–	–	–	–	*Mouth status(+) *Root status(+)
Preventive v. Restorative	–	–	*Visit history(+)	–	–
Crown v. Build-up	–	–	*Caries(-) *Treatment constraints(+)	–	–
Root canal v. Extraction	*Background(-)	–	–	–	–
Bridge v. Denture	–	*Patient factors(+)	–	*Tooth status(-) *Denture status(-)	–
Prophylaxis v. Scaling	*Patient factors(-)	–	–	–	–

*Significant difference between baseline and follow-up (P<0.05) paired t-test.
+Indicates increased proportion between baseline and follow-up.
-Indicates decreased proportion between baseline and follow-up.

not selective about ability to pay or insurance status, the fact that they take cost into consideration when choosing treatment may indicate dentists act in the role of patient agent or advocate.[6] However, selecting treatment alternatives primarily on the basis of price raises issues of appropriateness of care,[11] and may potentially result in conflict between the dentist's self-interest and the patient's interest.[6]

When looking at treatment choice responses 'patient preference' was among the top five highest ranked responses in five of the six treatment choice scenarios but having a highest ranking of third. The response 'cost' was among the top five highest ranked responses in three of the six scenarios and was ranked first in each of these three scenarios. The response 'caries rate' also occurred in the top five highest ranked responses in three of the six scenarios, ranging from first to third highest ranked. The only other multiple entries among the top five highest ranked responses were for 'age', 'oral hygiene status' and 'periodontal status' which each occurred in two of the six scenarios. Therefore, patient preference tends to be considered as an important, but secondary factor, in treatment choice. However, cost is considered as highly important in treatment choices for more complex interventions such as crowns, endodontic treatment and bridges where significantly cheaper alternative options are available. In choices such as 'exam v. x-ray' and 'preventive v. restorative intervention' where cost differentials of alternative treatment are less of an issue, other factors such as 'age' and 'caries rates' are more important. In the case of 'prophylaxis v. scaling' cost was not a prime consideration, and neither were patient nor background factors, but instead clinical signs such as calculus and periodontal status were most important.

The comparison of treatment choice responses over time showed a high degree of stability in the ranking of most important responses between baseline and follow-up. When responses (e.g., extent of tooth damage, size of lesion) were ordered into groups (e.g., tooth status) and proportions of responses were compared over time, again there was a high degree of stability. There was stability, firstly in terms of the highest ranked groups of responses (e.g., 'exam v. x-ray' was dominated by caries, background and visit history responses at both baseline and follow-up). Secondly, there was also stability in terms of the low number of statistical differences observed between baseline and follow-up, with only one difference observed out of 10 response groups in four of the six scenarios and no differences over time in the remaining two scenarios. None of the differences that were observed occurred in the higher ranked response groups.

The observation that dental students have been shown to rank a larger number of factors as important when choosing treatment compared with dentists, suggests that students have yet to develop routines for decision making,[4] and led to the prediction that younger dentists may show less stability in their treatment choice responses than older dentists. However, the findings of the present study showed little difference in the stability of treatment choice factors between different age groups of dentists, suggesting that if routines are developed these are established before or soon after graduation as a dentist.

CONCLUSIONS

Cost of treatment was a major consideration in situations where significantly cheaper alternatives existed, while patient preference was commonly

included as a secondary consideration across a wide range of treatment choice scenarios. The treatment choice responses showed a high degree of stability over time across all age groups of dentists suggesting that if routines are developed these are established before or soon after graduation as a dentist.

REFERENCES

1. Bader JD. The emergence of appropriateness-of-care issues. J Dent Res 1992;71:502-504.
2. Kress GC. Toward a definition of the appropriateness of dental treatment. Public Health Rep 1980;95:564-571.
3. Grembowski D, Milgrom P, Fiset L. Factors influencing dental decision making. J Public Health Dent 1988;48:159-167.
4. Grembowski D, Milgrom P, Fiset L. Clinical decision making among dental students and general practitioners. J Dent Educ 1989;53:189-192.
5. Brennan DS, Spencer AJ. Factors influencing choice of treatment by private general practitioners. Int J Behav Med 2002;9:94-110.
6. Maryniuk GA. Practice variation: learned and socio-economic factors. Adv Dent Res 1990;4:19-24.
7. Dillman DA. Mail and telephone surveys. The total design method. New York: John Wiley & Sons Inc, 1978.
8. SAS Institute. SAS/STAT User's Guide. Version 6.03. Cary, North Carolina: SAS Institute, 1988.
9. Rothman KJ. Modern epidemiology. Boston: Little, Brown & Company, 1986.
10. Teusner DN, Spencer AJ. Dental labour force, Australia 2000. AIHW Dental Statistics and Research Series No. 28. Canberra: Australian Institute of Health and Welfare, 2003.
11. Bader JD, Shugars DA. Variation, treatment outcomes, and practice guidelines in dental practice. J Dent Educ 1995;59:61-95.
12. O'Shea RM, Corah NL, Ayer WA. Dentists' perceptions of the 'good' adult patient: an exploratory study. J Am Dent Assoc 1983;106:813-816.

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