

Peer-reviewed paper; submitted October 2017; accepted November 2017

Flexible Removable Partial Denture Prostheses in New Zealand Dental Practice

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Abstract

Background and objectives: The purpose of this study was to investigate, using a questionnaire, the attitudes and possible differences in the use of flexible removable partial dentures (RPDs) among dentists and clinical dental technicians in New Zealand.

Methods: A questionnaire consisting 18 questions was modified for an online survey of dentists and clinical dental technicians in New Zealand with a valid email address. Collected data were analyzed by chi-square tests at $\alpha = 0.05$ level of significance.

Results: 334 dentists and 57 clinical dental technicians participated in the study with 215 dentists and 40 clinical technicians stating that they provide flexible RPDs as part of their treatment options. Statistical analysis indicated no significant difference between dentists and clinical dental technicians who offered flexible RPDs in respect to gender, age and dental specialization ($P > 0.05$), but significant differences were found in respect to years in practice and education/training on flexible prostheses ($P < 0.001$).

Conclusion: The survey indicated that there was no significant difference between dentists and clinical dental technicians using, selecting and providing flexible RPDs for their patients. Practitioners' age, years in practice and education were associated with the provision of the prostheses; while comfort, aesthetics, cost and metal allergy were the reasons for recommending flexible RPDs. This suggests that although dentists and clinical dental technicians are not formally educated about and/or trained in flexible RPDs, approximately two thirds of respondents offer this treatment option to their patients. Research, particularly clinical research and education are needed to inform clinicians on the use of flexible RPDs.

Clinical implications: Both dentists and clinical dental technicians offer flexible RPDs to their patients although there is little research available on these prostheses and most have not been formally educated about the concept. Research is needed to better inform the use of flexible RPDs.

Introduction

Restoration of the partially dentate patient includes a number of treatment options varying in reversibility and invasiveness of the prosthesis together with risks and benefits to the patient. Patients also have high expectations for the aesthetic and functional outcomes of their treatment and this includes their expectations with conventional removable partial dentures (RPDs). For the

partially dentate patient, one of the disadvantages of an RPD can be the display of metal clasps in aesthetic areas that causes some patients to dislike or avoid RPDs (Hill et al., 2014; Fueki et al., 2014a). As a result, manufacturers and oral healthcare practitioners have sought aesthetic, natural-looking materials for fabricating removable partial dentures. One option, which has been available since the 1950s, is a partial denture made of thermoplastic resins (Ardelean et al., 2007; Tannamala et al., 2012). There are many types of thermoplastic materials that can be used to fabricate RPDs and these include nylon (polyamides), polyesters (polyethylene terephthalate), polycarbonates, acrylics (polymethyl methacrylate), polypropylenes and acetal resin (polyoxymethylene) (Takabayashi, 2010; Fueki et al., 2014a). Of these, nylon, acetal resin, polypropylene and acrylics are the most widely used (Hill et al., 2014).

Thermoplastic RPDs are most commonly referred to as flexible partial dentures but other terms used are non-clasp dentures, metal-free dentures, clasp free dentures and non-metal clasp dentures (Fueki et al., 2014a; Polyzois et al., 2015). An advantage that these materials have compared with conventional RPDs is their flexibility. This facilitates engagement of undercuts, providing the possibility of clasplless retention that facilitates easier insertion in the mouth; this is especially useful in the cases of microstomia (e.g. scleroderma) (Fueki et al., 2014a). Thermoplastic materials are also resistant to plastic deformation, therefore denture bases can be manufactured thinner than acrylic dentures, and there is no risk of an allergic reaction from residual monomer (Parvizi et al., 2004; Polyzois et al., 2015).

Even though flexible RPDs have been available to the dental profession for almost 65 years, there is almost no evidence in the literature concerning the incidence data, clinical performance, or follow-up of these prostheses (Takabayashi, 2010; Hill et al., 2014; Polyzois et al., 2015). Of the literature available, most evaluate the physicommechanical properties of thermoplastic material or report a single case or a case series (Naylor and Manor, 1983; Lowe, 2004; Gladstone et al., 2012; Yavuz and Aykent, 2012). There are, however, relatively few case publications. The clinical performance and patient acceptance of nylon RPDs and complete dentures compared to acrylic resin prostheses were evaluated for 18 months in two studies (Dhiman and Roy Chowdhury, 2009; Singh et al., 2011). In the first study (Dhiman and Roy Chowdhury, 2009) although two cases of midline fracture were reported, mastication, phonetics

and tolerance were found to be improved with flexible maxillary dentures opposing natural mandibular teeth. Patients, however, reported teeth debonding and gradual colour fading of the nylon. In the second study (Singh et al., 2011) where 18 patients replaced their acrylic resin prostheses with a flexible prosthesis, a preference was reported for the flexible partial dentures in all functional parameters evaluated, including the incidence of halitosis, fracture of the prosthesis and comfort.

In a recent investigation by Polyzois and colleagues (Polyzois et al., 2015), an online survey of dentists in Greece and Croatia on the use of flexible RPDs found that 1/3 to 1/5 of respondents offered their patients a flexible partial denture as an alternative to the conventional metal-based or acrylic RPD. Older and more experienced general practitioners were found to provide flexible RPDs more commonly than specialist dentists and younger and/or less experienced dentists (Polyzois et al., 2015). Of those providing these RPDs, 75% were still satisfied with their performance after 1 year; base discoloration, clasp fracture and tooth debonding were the main problems reported.

In a survey of five dental laboratories in Wisconsin, demographic or incidence data for flexible RPDs were reported over a 4-month period (Pun et al., 2011). In this study, the incidence of flexible RPDs was 5.2% of the 903 RPDs fabricated in the survey time period.

From the information available in the peer-reviewed literature, there is a lack of data on the awareness, knowledge and attitudes of dentists on flexible RPDs. The purpose of this study was to investigate through an online questionnaire, the attitudes, experience, and possible differences in the use of flexible RPDs among dentists and clinical dental technicians in New Zealand.

Methods

A questionnaire consisting 18 questions was created online using the PollDaddy's survey tool (www.polldaddy.com, Automattic Inc, San Francisco, CA, USA). The questionnaire was an adaptation of a 16 question online survey sent to 4000 dentists each in Greece and Croatia (Polyzois et al., 2015); the additional two questions in our questionnaire collected demographic data related to ethnicity and region of practice. The URLs for the questionnaire were created online using the PollDaddy survey tool, and sent by email to 1196 dentists and dental specialists and 101 clinical dental technicians with valid email addresses obtained from the Dental Council (New Zealand). In the information sheet accompanying the survey, participants were advised the purpose of the study was to survey dentists and clinical dental technicians in New Zealand to determine the current level of the use of flexible dentures by these oral health practitioners, and to investigate reasons for using flexible dentures and the experience clinicians have had with this material. Participants were also advised that they could not be identified from the information supplied. A predefined minimum response was set at 331 dentists and 55 clinical dental technicians in order to have a 5% confidence interval (CI) and 95% confidence level. Ethical approval for the survey was

obtained from the University of Otago Human Ethics Committee (D14/154).

The created online surveys contained dichotomous and polytomous (nominal and ordinal) closed-ended questions, as well as a start message informing the participants about the aims of the study, its confidentiality and anonymity together with informed consent information. Fourteen questions were mandatory, rank ordered questions were randomized and only one response per computer was allowed.

Progress and response rate of the survey was monitored over a 3 month period, with three reminder emails being sent before the final predetermined sample number was reached; the cross-sectional surveys of dentists and clinical dental technicians were completed in the same time period. Collected data were evaluated for their accuracy and consistency, and was analyzed statistically by chi-square tests at $\alpha=0.05$ level of significance.

Results

A total of 334 dentists (27.9% response rate representing a 4.6% CI) and 57 clinical dental technicians (47.5% response rate representing a 9.4% CI) participated in the study. Fifteen respondents skipped at least one non-obligatory question and for this reason the percentages were based on the actual number of respondents for each question. Table 1 shows respondents' gender, age, years in practice, dental specialty, education and provision of flexible prostheses. Statistical analysis (chi square test) revealed significant differences between dentists and clinical dental technicians in respect to years of practice, specialty, and education and/or training on the use of flexible RPDs of the respondents (Table 1).

From the survey, 215 dentists and 40 clinical dental technicians stated that they provide flexible RPDs as part of their treatment options and their profile is shown in Table 2. Statistical analysis indicated no significant difference between dentists and clinical dental technicians in respect to gender, age and for dentists, specialization ($P>0.05$), but significant differences in respect to years in practice and education on flexible prostheses ($P<0.001$) (Table 2).

The preference of respondents for RPD type was recorded as weighted ranks. RPDs with a metallic framework had the lowest (best) score (1.38), acrylics the second lowest (2.24) and flexible RPDs the highest (worst) (2.38). The reasons for the provision of flexible RPDs were also ranked and the weighted scores showed that "more comfort for the patient" was the reason with the lowest score (1.6), followed by "better aesthetics" (2.22), "less fabrication time" (3.61), "less cost" (3.64) and "allergy to metal" (3.88). No significant differences between dentists and clinical dental technicians were noted, either for the preferences ($P=0.060$) or for the reasons to use a flexible RPD ($P>0.152$).

The reasons for providing and replacing flexible RPDs are shown in Table 3. Flexible RPDs were recommended by dentists and clinical dental technicians for use as provisional, and also as permanent prostheses,

Table 1. Respondents' profile and differences between Dentists and Clinical Dental Technicians

Item	Group	Dentists no (%)	CDTs no (%)	Total no (%)	P_{D-T}
Gender	Male	225 (67.6)	43 (75.4)	268 (68.7)	0.181
	Female	108 (32.4)	14 (24.6)	122 (31.3)	
Age	<36	61 (18.3)	12 (21.1)	73 (18.7)	0.880
	36-45	75 (22.5)	12 (21.1)	87 (22.3)	
	>45	197 (59.2)	33 (57.8)	230 (59.0)	
Years of practice	<11	54 (16.2)	27 (47.3)	81 (20.8)	<0.001
	11-20	79 (23.7)	14 (24.6)	93 (23.8)	
	>20	200 (60.1)	16 (28.1)	216 (55.4)	
Specialty	No	288 (86.7)	56 (98.2)	344 (88.4)	0.060
	Yes	44 (13.3)	1 (1.8)	45 (11.6)	
Preference	Metallic	259 (77.8)	52 (91.2)	311 (79.7)	0.060
	Acrylic	34 (10.2)	3 (5.3)	37 (9.5)	
	Flexible	40 (12.0)	2 (3.5)	42 (10.8)	
Instructed in flexible RPDs	No	229 (69.0)	22 (38.6)	251 (64.5)	<0.001
	Yes	103 (31.0)	35 (61.4)	138 (35.5)	
Provision of flexible RPDs	No	118 (35.4)	17 (29.8)	135 (34.6)	0.501
	Yes	215 (64.6)	40 (70.2)	255 (65.4)	

P_{D-T} = probability for differences in respondent's percentages between dentists and technicians.

Table 2. Number (no) and percentage (%) * of flexible RPDs providers in respect to their gender, age, years in practice, specialization and education/training.

Groups	Dentists no (%)	CDTs no (%)	Total no (%)	P_{D-T}
Male	151 (70.2)	28 (70.0)	179 (70.2)	0.874
Female	64 (29.8)	12 (30.0)	76 (29.8)	
Age <36 y	39 (18.1)	7 (17.5)	46 (23.9)	0.937
Age 36-45 y	43 (20.0)	9 (22.5)	52 (30.3)	
Age >45 y	133 (61.9)	24 (60.0)	157 (32.1)	
Practice <11 y	33 (15.3)	19 (47.5)	52 (20.4)	0.003
Practice 11-20	51 (23.7)	9 (22.5)	60 (23.5)	
Practice >21y	131 (61.0)	12 (30.0)	143 (56.1)	
Gen.Dent/CDT	203 (94.4)	38 (95.0)	241 (94.5)	0.599
Specialist	12 (5.6)	2 (5.0)	14 (5.5)	
No education	131 (60.9)	12 (30.0)	143 (56.1)	0.001
Educated	84 (39.1)	28 (70.0)	112 (43.9)	

*Percentages are based on providers' number in each group

Column P_{D-T} shows statistical differences between dentists and technicians for the same horizontal group.

and polyamide was the material mainly used for the fabrication of flexible RPDs by dentists and clinical dental technicians.

Their performance after 1 year *in situ* is shown in Table 3. The most common problems reported were discoloration of the base, fracture of clasps and debonding of teeth. Nearly 1/3 of the respondents related the need to replace a flexible RPDs to problems with the abutment teeth, mucosa or material; 18.8% were replaced within 2 years of service. Statistical analysis showed no differences between dentists and clinical dental technicians in all comparisons (Table 3).

Discussion

This study investigated the attitudes and experience with flexible RPDs among dentists and clinical dental technicians in New Zealand. The results revealed that although only 1 in 3 dentists compared with 2 in 3 clinical dental technicians had received education and/or training in flexible RPDs, approximately 66% of dentists and 70% of clinical dental technicians provide a flexible prosthesis as an alternative to the conventional metal-based or acrylic RPDs. Provision of flexible RPDs was found to be associated with age, gender, years of practice, specialization and education in flexible RPDs

**Table 3.** Reasons for providing and replacing flexible RPDs.

Question	Answer	Dentists no (%)	CDT no (%)	Total no (%)	PD-T
Decided by	Dentist	110 (53.4)	14 (56.3)	124 (51.2)	0.108
	Patient	96 (46.6)	22 (44.7)	118 (48.8)	
Used as	Provisional	32 (15.5)	6 (10.9)	38 (15.7)	0.958
	Permanent	56 (27.2)	9 (41.3)	65 (26.9)	
	Both	118 (57.3)	21 (47.8)	139 (57.4)	
Reasons for providing flexible RPDs	Aesthetics	55 (26.7)	16 (42.1)	71 (29.1)	0.332
	Comfort	119 (57.8)	17 (44.8)	136 (55.8)	
	Cost	12 (5.8)	1 (2.6)	13 (5.3)	
	Time	2 (1.0)	0 (0.0)	2 (0.8)	
	Allergy	18 (8.7)	4 (10.5)	22 (9.0)	
Problems Noticed	Base discoloration	100 (54.0)	15 (44.1)	115 (52.5)	0.244
	Clasp fracture	9 (4.9)	4 (11.8)	13 (5.9)	
	Tooth debonding	22 (11.9)	8 (23.5)	30 (13.7)	
	Base fracture	7 (3.8)	0 (0.0)	7 (3.2)	
	None	47 (25.4)	7 (20.6)	54 (24.7)	
Replacement Reasons	Teeth	74 (35.9)	15 (42.9)	89 (36.9)	0.332
	Mucosa	65 (31.6)	13 (37.1)	78 (32.4)	
	Material	67 (32.5)	7 (20.0)	74 (30.7)	
Replacement Time	0-2y	39 (19.1)	6 (17.6)	45 (18.8)	0.129
	3-4y	65 (31.7)	15 (44.1)	80 (33.5)	
	5-6y	55 (26.8)	11 (32.4)	66 (27.6)	
	>6y	46 (22.4)	2 (5.9)	48 (20.1)	
Satisfied after 1 y	Not or Little	44 (21.4)	10 (27.8)	54 (22.3)	0.393
	Enough or More	162 (78.6)	26 (72.2)	188 (77.7)	

Column P_{D-T} shows statistical differences between dentists and technicians in the frequencies for the same group.

of the respondent practitioners. This finding is similar to that reported by Polyzois and colleagues (Polyzois et al., 2015) except that their study found that the provision of flexible RPDs was not gender related.

Age, gender and years in practice were found to play a significant role in the provision of flexible RPDs, even within dentists and clinical dental technicians. Age was also found to play a significant role in the provision of flexible RPDs and older practitioners were found to provide flexible RPDs in a higher percent, suggesting that younger clinicians may be more reluctant to adopt new techniques, or may provide removable prostheses less commonly. Years in practice seems to follow the same general pattern with age, and this may explain the difference between gender as there were more male than female practitioners in the older age groups. Also, if years in practice means more experience, practitioners with more experience seem to provide flexible RPDs more commonly than less experienced clinicians. This finding has also been reported by Hill et al. (2014). Education on the use of flexible RPDs is commonly given by promotional literature not in academic institutions. This may explain why older practitioners recommend flexible prostheses more commonly than younger and/or less experienced dentists and clinical dental technicians who may be providing treatment options more closely aligned to their education in an academic institution. Specialization was found to play a negative role in the provision of flexible RPDs as it was found in our survey

that more general practitioners than specialists provide flexible prostheses to their patients. The same finding was reported by Polyzois and colleagues (Polyzois et al., 2015). This may be because there is still insufficient clinical evidence for the use of flexible RPDs, and promotional literature may contribute to the treatment decisions of general dentists more commonly than specialists (Hill et al., 2014).

Those who have not received education in flexible RPDs appear to be more reluctant to recommend and provide this type of prosthesis due to the absence of experience and training (Pun et al., 2011; Polyzois et al., 2015). Therefore, while education appears to have contributed to the decision by dentists to provide flexible RPDs, this was not found with the clinical dental technicians group. This may be explained by the narrower scope of practice that clinical dental technicians have compared with dentists, and the closer interaction they may have with the suppliers of the material. Also, teaching and education on the use of flexible RPDs are commonly given by promoting literature provided by manufacturing companies and dental laboratories rather than by academic institutions, which may be another factor contributing to the decision by clinical dental technicians to offer flexible RPDs than dentists.

In general, only 1 in 10 respondents from the dentists group and 1 in 20 respondents from the clinical dental technicians group prefer flexible and/

or acrylic prostheses to metal-based RPDs and this is similar to the results of the survey by Pun et al. (2011). The decision to use a flexible RPD was similar in the two professions, although metal-based RPDs were the preferred option for dentists (77.8%) and clinical dental technicians (91.2%). The decision to provide a flexible RPD was made more commonly by dentists (53.4%) and clinical dental technicians (56.3%) than by the patient, although patients also commonly requested this type of prosthesis. This may reflect the experience these oral health professionals and patients have had with flexible prostheses previously, or may be the result of a choice where other options haven't been successful.

Both dentists and clinical dental technicians planned flexible RPDs for use more commonly as a permanent prosthesis, although both groups reported using flexible prostheses for both permanent and provisional use. The main reason dentists gave for providing flexible prostheses was comfort for the patient (57.8%), while for clinical dental technicians, it was comfort (44.8%) and aesthetics (42.1%); the main problem reported by both groups related to the flexible RPD, was discoloration of the base. There was little difference in the reasons reported by dentists for replacing flexible prostheses, which were related in a decreasing order with problems in abutment teeth (35.9%), denture base material (32.5%) and the supporting tissues (31.6%). For clinical dental technicians, the most common reasons were problems in abutment teeth (42.9%), and the supporting tissues (37.1%). Satisfaction with flexible RPDs after 1 year in place was high, with satisfaction being slightly higher with dentists (78.6%) than clinical dental technicians (72.2%); the most commonly reported time period for replacement was 3 to 4 years for both dentists (31.7%)

and clinical dental technicians (44.1%). These findings are similar to those reported in the survey by Polyzois and colleagues (Polyzois et al., 2015).

Despite this survey finding that many of the respondents have had experience with flexible RPDs, little evidence currently exists in the scientific literature on their performance, clinical usage, and long-term performance (Hill et al., 2014; Fueki et al., 2014a; 2014b; Polyzois et al., 2015). For these reasons, studies are needed to find ways of overcoming the inherent material problems along with clinical studies to investigate their value in terms of their long-term performance and patient satisfaction.

Conclusion

Within the limitations of this study, this survey indicated differences on the use of flexible RPDs between dentists and clinical dental technicians using, selecting and providing these prostheses as an alternative to acrylic and metal-based RPDs. While dentists (77.8%) and clinical dental technicians (91.2%) chose metal-based RPDs as the removable prosthesis of choice, 64.6% of dentists and 70.2% of clinical dental technicians indicated that they provide flexible RPDs for their patients, based on the responses to the survey. For clinical dental technicians, age, and for dentists, age, years in practice and education on the use of flexible RPDs were all related to the provision of these dentures. Around 3/4 of respondents were satisfied with the performance of flexible RPDs after 1 year, with base discoloration being the main problem reported, however, 1/4 of dentists and 1/5 of clinical dental technicians reported no problems; comfort and aesthetics were the main reasons reported for deciding to use flexible RPDs.

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News and comment

Innovative health facility opens at the School of Dentistry

A new iwi-driven health village for Māori, Pasifika and low-income families opened its doors on the 30th of April. It is housed in the former College Street School building in Caversham. Te Kāika (the village) is a partnership between Te Pūtahitanga o Te Wāipounamu the South Island Whānau Ora Commissioning agency, Ngāi Tahu, the University of Otago, Arai Te Uru Whare Hauora and the Pacific Community.

The centre will provide a number of primary health and wellbeing services and will also be used by the University of Otago to train students from medicine, dentistry, pharmacy and physiotherapy. The dental area features four chairs, all equipped with X-ray machines and intraoral cameras. Four final year students will work in the clinic at any one time, supervised by a member of staff from the dental school. They will be helped by two dental assistants. The facility is almost certainly New Zealand's most modern dental surgery suite.