CLINICAL ORAL IMPLANTS RESEARCH

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Factors influencing treatment decision-making for maintaining or extracting compromised teeth

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Abstract

Aims: To evaluate treatment decision-making with respect to maintaining periodontally compromised teeth among dentists with or without postgraduate qualifications in implant dentistry.

Material and methods: A series of patient scenarios with varying degrees of periodontal disease levels was presented to dental practitioners. Practitioners' decision-making outcome was determined, and intention to retain the compromised teeth was analyzed in bivariate and regression analyses (accounting for postgraduate implant training, gender, years in dental practice, and implant placement experience).

Results: This study involved 30 dental practitioners with postgraduate implant qualifications (GDPP), 33 dental practitioners without postgraduate implant qualifications (GDP), and 27 practitioners undergoing training for postgraduate implant qualifications (GDPT). Variations in treatment decision-making were evident between the three groups. Differences in treatment approaches to retaining compromised teeth were apparent. Furthermore, variations in rehabilitation of extracted scenarios existed in terms of use of implant and number of implants need for rehabilitation. Accounting for dentist and practice factors in regression analyses, GDPP/GDPT were three times as likely to retain periodontally compromised upper molar, with or without pain, compared to GDP (without pain OR 3.10, 95%CI 1.04, 10.62 $P = 0.04$; with pain OR 3.08, 95%CI 1.09, 8.14 $P = 0.03$).

Conclusion: Variations in treatment decision-making with respect to retaining periodontally compromised teeth exist between dental practitioners with and those without postgraduate training in implant dentistry. Furthermore differences in management approaches in how they would retain the teeth or rehabilitate the dental arch were apparent.

Owing to the high survival and success of oral implants, they have become a popular treatment modality to replace missing teeth (Karoussis et al. 2007; Åstrand et al. 2008). Unfortunately however, their popularity may be related to the misconception that periodontally or endodontically compromised teeth should be removed rather than maintained, and the missing tooth replaced by an oral implant (Zitzmann et al. 2009; Donos et al. 2012). The rationale for such a paradigm can only be speculated upon; for example, practitioners may believe that the maintenance of a compromised tooth may damage a presumptive future implant site, or that the incorporation of a compromised tooth into a fixed prosthetic appliance may be too risky (Greenstein et al. 2010). However, the evidence available today suggests that tooth longevity in compromised teeth may be much higher than anticipated (Checchi et al. 2002; Fardal et al. 2004). Even classical studies, performed decades ago, on tooth loss following periodontal therapy reported high survival 10–20 years later (Hirschfeld & Wasserman 1978; McLeod et al. 1997). Likewise, survival following endodontic treatment is high and similar to that of a single tooth-implant reconstruction (Iqbal & Kim 2008). These studies clearly document that in an era where tooth preservation is the highest goal of therapy, severely compromised teeth may be successfully treated and maintained.

To further understand dentist's decision-making with respect to implants, several attempts have been made to construct models for the dilemma of maintaining compromised

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teeth *versus* removing and replacing them with dental implants based on longevity – "survival" (Flemmig & Beikler 2009; Popelut et al. 2010; Zitzmann et al. 2010; Cosyn et al. 2012; Donos et al. 2012). However, survival rates alone cannot account for decision-making because prognosis of survival of teeth depends on the level of periodontal diseases and/or endodontic problems (Flemmig & Beikler 2009). Moreover, the so-called physician-induced demand, other dentists/service factors and individual patient characteristics can influence decision-making (Nguyen & Derrick 1997; Brennan & Spencer 2006; Alani et al. 2011; Cosyn et al. 2012; Donos et al. 2012).

A previous study in Hong Kong explored attitudes toward implant dentistry with respect to perceived superiority, outcome, and placement issues among a random sample of dental practitioners (Lang-Hua et al. 2013). The results indicated considerable variation in their attitudes and specifically with respect to postgraduate training in implant dentistry. This study aimed to develop clinical scenarios for use in implant treatment decision-making and to investigate the factors affecting treatment decision-making process among dentists with and those without postgraduate qualification in implant dentistry.

Material and methods

Sample

Postgraduate qualifications in implant dentistry have been offered by the University of Hong Kong since 2008. At the time of the study, there were 45 graduates (GDPG) and 27 were undergoing postgraduate training in implant dentistry (GDPT). The postgraduate training was offered as a part-time (40%) educational program of two years duration and resulted in conferral of a Master of Science (MSc) degree in implant dentistry. In the group undergoing postgraduate training at the time of the study (GDPT), most of the students were enrolled in a three-year full-time graduate program leading to the conferral of a Master of Dental Surgery (MDS) in implant dentistry. In these programs in Hong Kong, academic educational aspects were prioritized, and the students were taught in treatment planning of complex cases and comprehensive dental care including periodontal and endodontic therapy.

A recent study found that approximately half of the GDP in Hong Kong provided implant therapy. To estimate sample power, a pilot study was conducted among those in training to determine their treatment decision with respect to retaining periodontally compromised teeth. As a key decision-making scenario, decision to extract/retain a periodontally comprised upper right first molar (tooth 26) without pain was considered. Results from a pilot study indicated that >95% of the GDPT would retain the tooth in this scenario. Based on the hypothesis that variations in treatment decision would exist in the magnitude of at least 20%, sample power estimates were derived using Sample power (2.0). A sample size of 27 dentists with or without postgraduate qualifications was considered to have an 80% sample power to identify at least a 30% difference in treatment decision, at a 5% statistical significance level. To account for potential non-response rate of 10% among GDP practitioners without postgraduate qualifications, this study aimed to recruit at least 30 practitioners per group. These were selected at random from the GDP pool providing implant therapy in their practices without having formal academic training.

Data collection

Nine clinical scenarios were constructed outlining various clinical circumstances of a patient with a periodontally compromised dentition and reviewed for content validity. This included charting information (plaque, bleeding, level of attachment, and furcation involvement), clinical photographs and radiographs, and with or without history of pain. To standardize for socio-demographic factors and medical health status, a vignette was presented: *"A 52 year-old manager who had regularly seen his dentist would like to be treated for his oral conditions. In case of any tooth loss, the patient preferred a fixed reconstruction. His financial situation was healthy and there were no financial limitations. No general medical risks were known. He had never smoked."* Outline of scenarios are presented in Table 1.

Dentists were first asked to decide whether they would "retain" or "extract" the compromised tooth described by each scenario. Where decision to maintain the tooth was chosen, they were asked to outline treatment approach (multiple treatment approaches feasible). In cases of extraction, they were asked to choose treatment approach including rehabilitation options with or without implants.

In addition, dentist-related information including years of practice, gender, postgraduate qualifications in implant dentistry, and experience in implant therapy (number of implant placement/year) was obtained.

Data analyses

Data were analyzed using SPSS (version 20 IBM Statistics; IBM Corporation, Chicago, IL, USA). Descriptive statistics were produced of the responses to the nine clinical scenarios with respect to treatment decision (retaining or extracting) and their management approaches following treatment decisions. In bivariate analyses, variation in treatment decision with respect to postgraduate qualifications in implant dentistry was explored employing *chi-square* statistics. Following on, a series of multivariate regression analyses were conducted based on treatment decision of the scenarios (dependent variable) and accounting for gender, years of practice, and postgraduate qualifications in implant dentistry and experience in implant therapy.

This survey was approved by the Institutional Review Board of the University of Hong Kong (HKU/HA HKW IRB Ref. Nr. UW 12-134).

Results

Profile of the practitioners is presented in Table 2. Differences in years of practice and place of gradation were evident, $P < 0.05$. Most opted to retain tooth 26 with or without pain (81% and 19% respectively). Variations in decision to retain the tooth varied with respect to postgraduate training, Fig. 1a: 26 without pain: 70% GDP, 80% GDPP, and 96% GDPT ($P = 0.03$); Fig. 2a: 26 with pain: 57% GDP, 73% GDPP, and 89% GDPT ($P = 0.03$). Amputation of one root was the most common treatment approach to retain the tooth [without pain: 46% GDP, 57% GDPP, and 85% GDPT; with pain: 58% GDP, 73% GDPP, and 89% GDPT]. Some 15% of the GDP opted to treat the tooth with a regenerative procedure, but no GDPP or GDPT proposed this approach. Where extraction was the treatment preference, replacement with an implant or conventional fixed prosthesis was proposed; the latter more frequently recommended by GDP.

With additional consideration of endodontic treatment (scenario 3 and 4), option to retain the tooth (27) was higher without pain than with pain (89% and 11%). No significant variations in decision to retain the tooth with respect to postgraduate training were found ($P > 0.05$), as shown in Figs 1–9. In situations without pain, root canal therapy (retreatment) was most commonly prescribed

Table 1. **Nine Scenarios**

Scenario 1	Tooth 26 is vital. There is *no pain*. Probing depth around 26 is 5, 6, 5 mm from the buccal aspect and 5, 2, 6 mm from the palatal aspect. There is an open furcation involvement between the buccal roots and the distobuccal and palatal roots. Bone loss is evident around the distobuccal root. Plaque and gingival indices are high (>50%)
Scenario 2	The conditions of the tooth 26 are the same as in Scenario 1. However, there is *pain* on percussion
Scenario 3	Tooth 27 is non-vital and has an incomplete root canal filling. There is *no pain* on percussion. Probing depth around 27 is 5, 3, 3 mm from the buccal aspect and 6, 3, 3 mm from the palatal aspect. There is a beginning furcation involvement between the buccal roots. Buccally, there is 2 mm recession of the free gingival margin. Bone loss is evident at the mesio-buccal aspect. Plaque and gingival indices are high (>50%)
Scenario 4	The conditions of the tooth 27 are the same as in Scenario 3. However, there is *pain* on percussion
Scenario 5	The conditions of the upper left posterior region are the same as in Scenario 1 and 3. Because of the pain, the patient had seen a dentist and the teeth 26 and 27 were extracted. You are now supposed to further treat the patient
Scenario 6	Tooth 36 is non-vital. A large peri-apical lesion is clearly visible around the mesial and another lesion around the distal root. There is pain on percussion. Probing depth around 36 is 5, 11, 5 mm from the buccal aspect and 5, 3, 3 mm from the lingual aspect. There is a through-and-through furcation involvement between the roots. The roots are spread. Bone loss is evident around the mesial root and in the furcation. Plaque and gingival indices are high (>50%)
Scenario 7	Tooth 37 is non-vital and has an incomplete root canal filling. A peri-apical lesion is clearly visible. There is no pain on percussion. Probing depth around 37 is 3, 3, 3 mm from the buccal aspect and 3, 4, 3 mm from the lingual aspect. There is a through-and-through furcation involvement between the roots. Bone loss is evident at the mesio-buccal aspect. Plaque and gingival indices are high (>50%)
Scenario 8	The conditions of the tooth 37 are the same as in Scenario 7. However, there is pain on percussion
Scenario 9	The conditions of the lower left posterior region are the same as in Scenario 6 and 7. Because of the pain, the patient had seen a dentist and teeth 36 and 37 were extracted. You are now supposed to further treat the patient

b: Questions to the scenarios 1–9

Scenario 1a and b: Please choose either treatment option (a) or (b)

(a) I would choose to save the tooth 26	(b) I would choose to extract the tooth 26
Which of following treatment options would you choose? (One or more are accepted)	Which of following treatment option would you choose to replace the tooth? (Please choose only one!)
Only Root Canal Treatment (RCT)	Conventional bridge 25X27 (*assuming no problems with 25&27*)
Amputation of the distobuccal root of tooth 26 after RCT	Replacement of tooth 26 with an single implant
Tunnelling of the open furcation	Removable partial denture
Regenerative procedure to close the furcation	Leave the situation un-restored
Leave the situation un-restored	Other, please specify
Other, please specify	

Scenario 2a and b: Please choose either treatment option (a) or (b)

(a) I would choose to save the tooth 26	(b) I would choose to extract the tooth 26
Which of following treatment options would you choose? (One or more are accepted)	Which of following treatment option would you choose to replace the tooth? (Please choose only one!)
Only Root Canal Treatment (RCT)	Conventional bridge 25X27 (*assuming no problem with 25&27*)
Amputation of the distobuccal root of tooth 26 after RCT	Replacement of tooth 26 with an single implant
Tunnelling of the open furcation	Removable partial denture
Regenerative procedure to close the furcation	Leave the situation unrestored
Leave the situation unrestored	Other, please specify
Other, please specify	

Scenario 3a and b: Please choose either treatment option (a) or (b)

(a) I would choose to save the tooth 27	(b) I would choose to extract the tooth 27
Which of following treatment options would you choose? (One or more are accepted)	Which of following treatment option would you choose to replace the tooth? (Please choose only one!)
Redo the Root Canal Treatment (RCT)	Conventional bridge 25 26 X (*assuming no problem with 25&26*)
Amputation of one root of tooth after RCT	Replacement of tooth 27 with an single implant
Regenerative procedure to close the furcation	Removable partial denture
Tunnelling of the open furcation	Leave the free-end situation unrestored
Leave the situation unrestored	Other, please specify
Other, please specify	

Scenario 4a and b: Please choose either treatment option (a) or (b)

(a) I would choose to save the tooth 27	(b) I would choose to extract the tooth 27
Which of following treatment options would you choose? (One or more are accepted)	Which of following treatment option would you choose to replace the tooth? (Please choose only one!)
Redo the Root Canal Treatment (RCT)	Conventional bridge 25 26 X (*assuming no problem with 25&26*)
Amputation of one root of tooth after RCT	Replacement of tooth 27 with an single implant
Regenerative procedure to close the furcation	Removable partial denture
Tunnelling of the open furcation	Leave the free-end situation unrestored
Leave the situation unrestored	Other, please specify
Other, please specify	

Scenario 5:

Which of following treatment option would you choose to replace the missing 26 and 27?

Only one answer is possible!

- Cantilever bridge 24 25 X (*assuming no problem with 24&25*)
- Two implants in region 26, 27
- One implant in region 26 and leave 27 unreplaced
- Removable partial denture
- Leave the free-end situation unrestored
- Other, please specify

Scenario 6a and b: Please choose either treatment option (a) or (b)

(a) I would choose to save the tooth 36 Which of following treatment options would you choose? (One or more are accepted) Amputation of one root of tooth after RCT Regenerative procedure to close the furcation Redo the tunnelling of the open furcation Only redo the Root Canal Treatment Leave the situation unrestored Other, please specify	(b) I would choose to extract the tooth 36 Which of following treatment option would you choose to replace the tooth? (Please choose only one!) Conventional bridge 35X37 (*assuming no problem with 35&37*) Replacement of tooth 36 with an single implant Removable partial denture Leave the situation unrestored Other, please specify
Scenario 7a and b: Please choose either treatment option (a) or (b) (a) I would choose to save the tooth 37 Which of following treatment options would you choose? (One or more are accepted) Only redo the Root Canal Treatment (RCT) Amputation of one root of tooth after RCT Tunnelling to open the furcation Regenerative procedure to close the furcation Leave the situation unrestored Other, please specify	(b) I would choose to extract the tooth 37 Which of following treatment option would you choose to replace the tooth? (Please choose only one!) Conventional bridge 35 36 X (*assuming no problem with 35&36*) Replacement of tooth 37 with an single implant Removable partial denture Leave the free-end situation unrestored Other, please specify
Scenario 8a and b: Please choose either treatment option a) or b) (a) I would choose to save the tooth 37 Which of following treatment options would you choose? (One or more are accepted) Only redo the Root Canal Treatment (RCT) Amputation of one root of tooth after RCT Tunnelling to open the furcation Regenerative procedure to close the furcation Leave the situation unrestored Other, please specify	(b) I would choose to extract the tooth 37 Which of following treatment option would you choose to replace the tooth? (Please choose only one!) Conventional bridge 35 36 X (*assuming no problem with 35&36*) Replacement of tooth 37 with an single implant Removable partial denture Leave the free-end situation unrestored Other, please specify
Scenario 9: Which treatment option would you choose? *Only one answer is possible!* Cantilever bridge 34 35 X (*assuming no problem with 34&35*) Two implants in region 36, 37 One implant in region 36 Removable partial denture Leave the free-end situation unrestored Other, please specify	

Table 2. **Profile of study group**

	MDS-Students % (*N*)	MDS-Graduated % (*N*)	HK-Practitioners no higher diploma % (*N*)	*P*-value
Gender				
Female	44.4 (12)	16.7 (5)	39.4 (13)	0.05
Male	55.6 (15)	83.3 (25)	60.6 (20)	
BDS in Hong Kong				
Yes	55.6 (15)	83.3 (25)	48.5 (16)	0.01
No	44.4 (12)	16.7 (5)	51.5 (17)	
Age				
≤40	100 (27)	66.7 (20)	60.6 (20)	0.001
>40	0 (0)	33.3 (10)	39.4 (13)	
Years of practice				
≤20	96.3 (26)	50 (15)	54.5 (18)	0.001
>20	3.7 (1)	50 (15)	45.5 (15)	
Nr. of treated Pat. with implant therapy per week				
≤10	100 (27)	90 (27)	87.9 (29)	0.18
>10	0 (0)	16.7 (5)	15.2 (5)	

by the practitioners. In situations of pain, additional treatment options were also considered, notably by GDP. Where extraction was the treatment preference, GDPP and GDPT more frequently opted not to rehabilitate compared to GDP.

In scenarios where 26 and 27 were extracted (scenario 5), rehabilitation decision varied with respect to postgraduate training ($P = 0.03$), as shown in Fig. 5. While rehabilitation with implants was commonly prescribed, GDP more frequently considered multiple implants than GDPP and GDPT (46%, 19%, and 37% respectively).

For mandibular molars with or without pain, decision to retain varied from 80% to 20%. In the case of greater bone loss, decision to retain varied with respect to postgraduate training: without pain: 15% GDP, 48% GDPP, and 20% GDPT ($P = 0.01$), as shown in Fig. 7a. Amputation of one root was most commonly prescribed but varied with respect to postgraduate training (15% GDP, 44% GDPP, and 17% GDPT, $P = 0.02$), as shown in Fig. 7a. Where extraction was advocated, rehabilitation approaches were similar among the three groups, with implant rehabilitation most frequently advocated. For the root treated 37 with compromised root morphology where pain was evident, decision to extract was higher than without pain; however, there were no significant variations in treatment decisions ($P > 0.05$), as shown in Fig. 7b. Implant rehabilitation was the most commonly prescribed in cases of extraction.

In scenarios where 36 and 37 were already extracted (scenario 9), rehabilitation with implants was commonly prescribed; GDPs more frequently consider multiple implants than GDPP and GDPT (79%, 67%, 44% respectively).

Findings from the regression analyses identified that postgraduate qualifications/training

Table 3. **Logistic regression analysis**

	Unadjusted				Adjusted			
	B	SE	OR (95%CI)	*P*-value	B	SE	OR (95%CI)	*P*-value
To save tooth 26 no pain (Scenario 1) Practitioners with TGP	1.13	0.55	3.10 (1.05, 9.18)	0.04	1.20	0.59	3.32 (1.04, 10.62)	0.04
To save tooth 26 with pain (Scenario 2) Practitioners with TGP	1.12	0.48	3.08 (1.18, 7.99)	0.02	1.09	0.51	2.99 (1.09, 8.14)	0.03
To save tooth 27 no pain (Scenario 3)				NS				NS
To save tooth 27 with pain (Scenario 4)				NS				NS
To save tooth 36 with pain (Scenario 6)				NS				NS
To save tooth 37 no pain (Scenario 7)				NS				NS
To save tooth 37 with pain (Scenario 8)				NS				NS

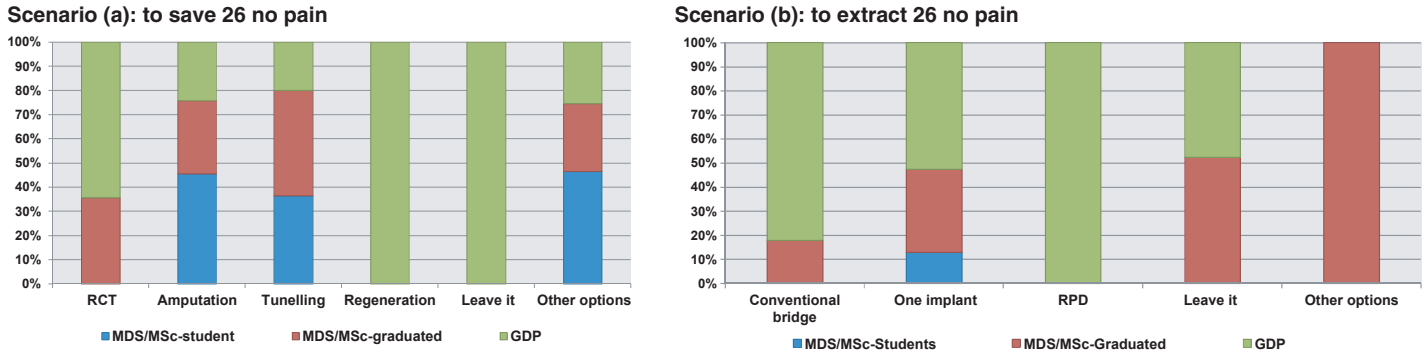

Fig. 1. Scenario 1a: to save 26 no pain. Scenario 1b to extract 26 no pain.

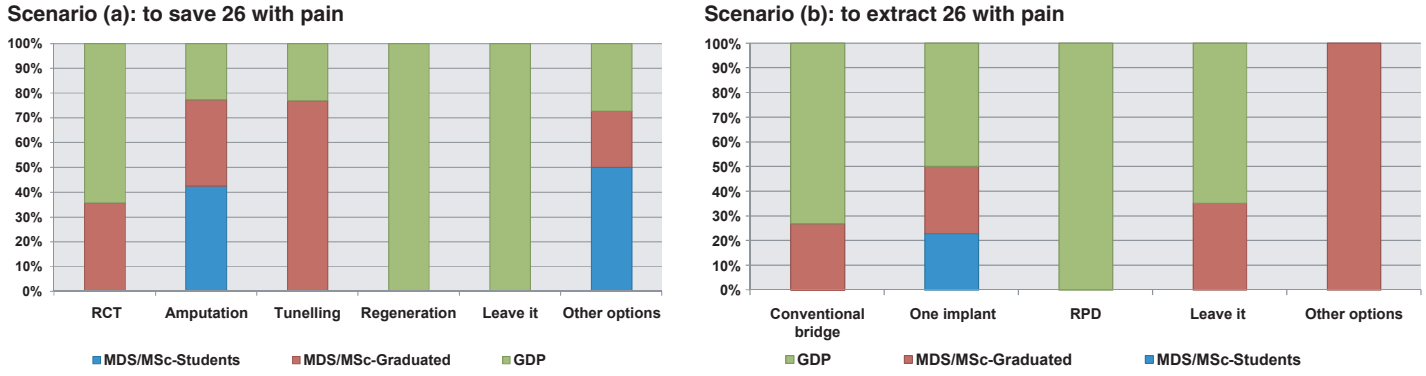

Fig. 2. Scenario 2a: to save 26 with pain. Scenario 2b to extract 26 with pain.

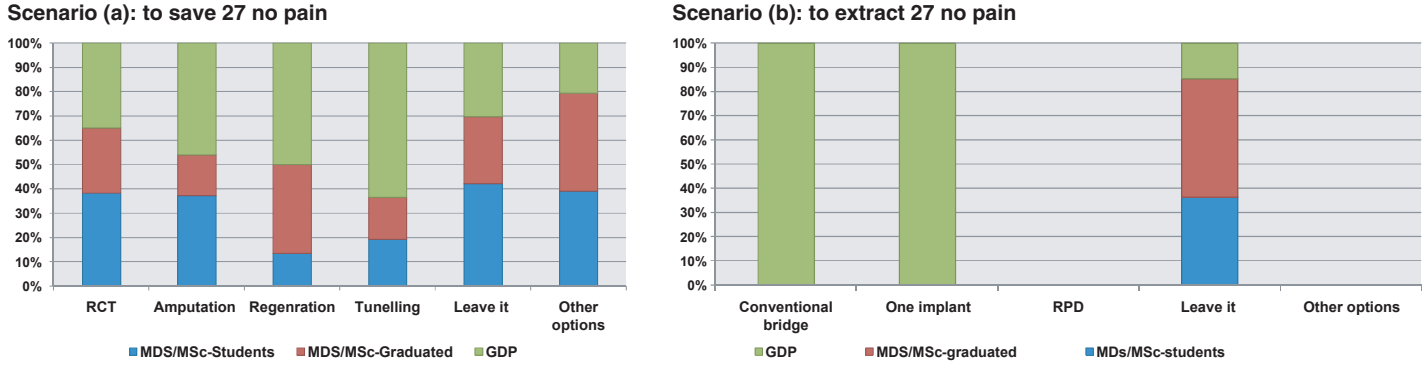

Fig. 3. Scenario 3a: to save 27 no pain. Scenario 3b to extract 27 no pain.

was associated with decision to retain compromised teeth, accounting for dentist factors (gender, years of practice, and experience in implant placement), as shown in Table 3. GDPP and GDPT were three times as likely to retain periodontally compromised upper molar teeth (26) with or without pain. Without pain OR 3.10, 95%CI 1.04, 10.62 $P = 0.04$; with pain OR 3.08, 95% CI 1.09, 8.14 $P = 0.03$.

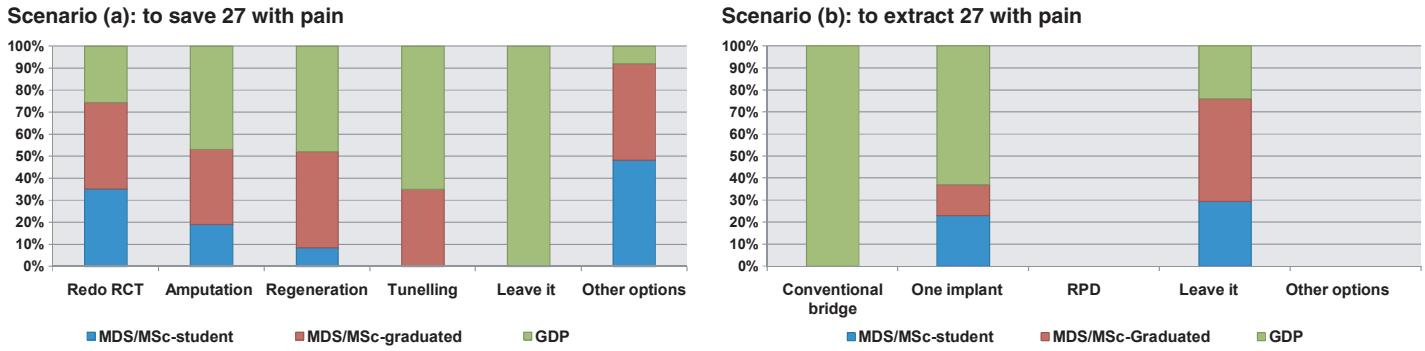

Fig. 4. Scenario 4a: to save 27 with pain. Scenario 4b to extract 27 with pain.

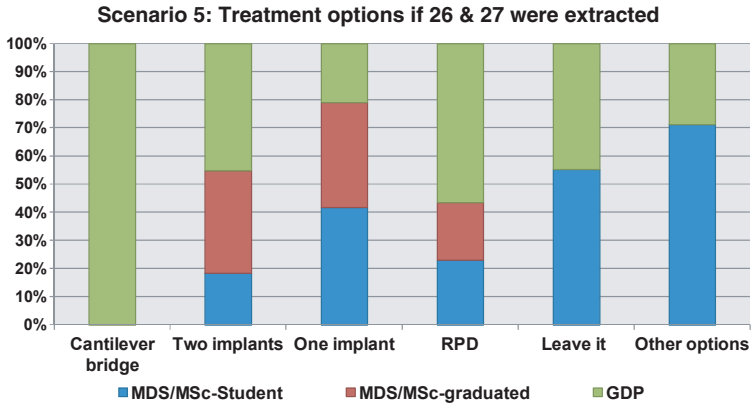

Fig. 5. Scenario 5: Treatment options if 26 and 27 were extracted.

Discussion

Decision to retain periodontal compromised teeth was widespread among the practitioners in this study. This reflects a good understanding of the biology and the potential of periodontal and endodontic treatments. Moreover, advances in treatment approaches such as regenerative procedures, which offer a feasible option even when periodontal status is compromised (Huynh-Ba et al. 2009), in addition to advances in endodontic care contributed to the trend toward maintenance of teeth. Nonetheless, the decision to retain teeth is complex and usually based on multiple aspects where risks for jeopardized survival are considered. Such aspects include the extent of dental caries, the remaining tooth structure, the extent of previous reconstructions, post and core build-ups, the extent of periodontal destruction, and the risks associated with endodontic therapy (Holm-Pederson et al. 2007). Moreover, the strategic importance of a tooth within the dentition, behavioral, and socio-economic as well as cultural aspects may play a major role in the decision-making process to maintain or extract a particular tooth. In an attempt to account for such variations, a range of clinical scenarios were created covering key issues such as level of periodontal compromised, pain and endodontic status, and controlling for patient's socio-demographics. Nine possible scenarios were presented which pertain to key issues and were useful to explore treatment decision-making and its process.

Level of periodontal compromise affected the decision-making. Advanced periodontitis can successfully be managed (Donos et al. 2012) and further periodontal breakdown prevented (Matuliene et al. 2008) in the majority of cases, and moreover, following successful therapy, they can be used as abutments for extensive fixed dental prosthesis with a good long-term prognosis (Lulic et al. 2007). A major therapeutic challenge is teeth with furcation involvement, but nonetheless, a highly predictable outcome can be obtained through non-surgical and surgical mechanical debridement (Huynh-Ba et al. 2009). Furcation involvement affected practitioners' decision to retain compromised teeth with increasing numbers opting to extract despite evidence of long-term survival. Further con-

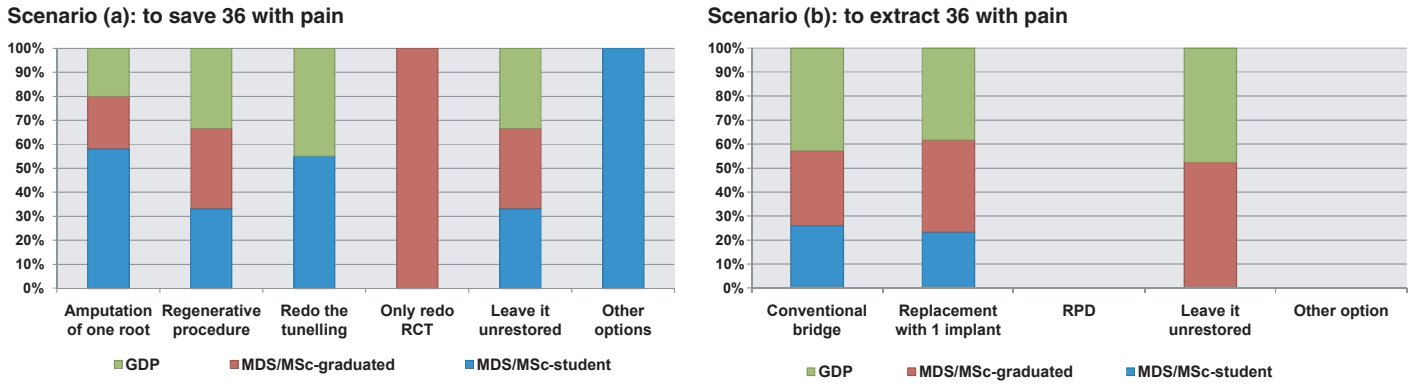

Fig. 6. Scenario 6a: to save 36 with pain. Scenario 6b: to extract 36 with pain.

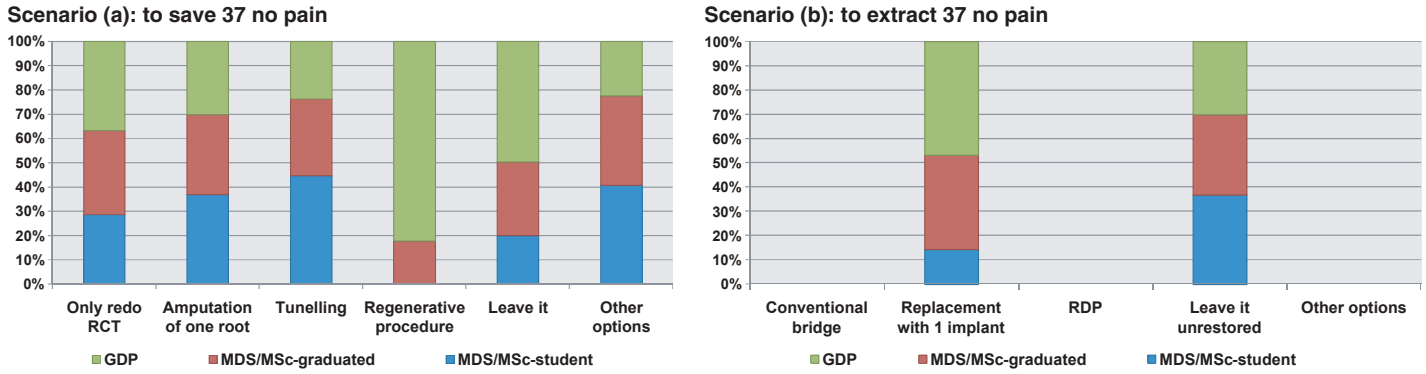

Fig. 7. Scenario 7a: to save 37 no pain. Scenario 7b: to extract 37 no pain.

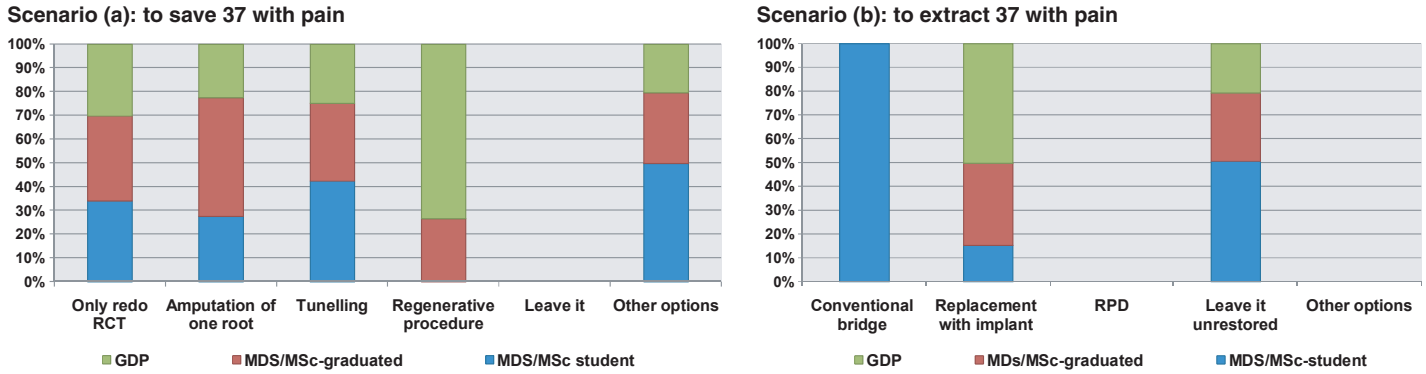

Fig. 8. Scenario 8a: to save 37 with pain. Scenario 8b: to extract 37 with pain.

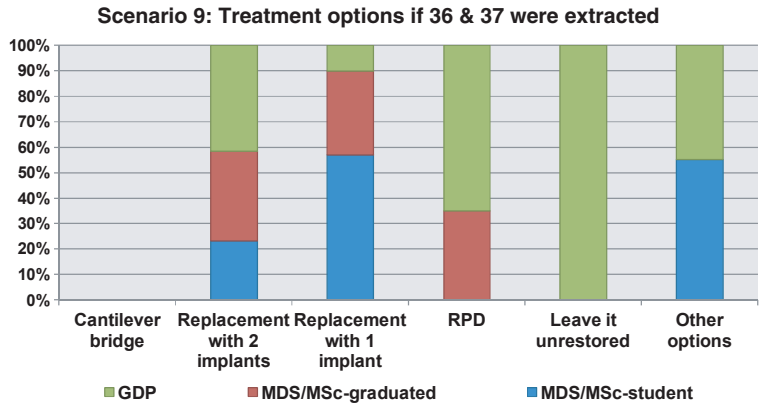

Fig. 9. Scenario 9: Treatment options if 36 and 37 were extracted.

sideration of treatment decision with respect to practice based factors (such as time and financial issues) as well as competency in management of furcations warrants consideration.

Endodontic therapy also influenced treatment decision – vitality, previous endodontic treatment (incomplete), and root morphology. Primary root canal treatment offers high success rate and even good survival for secondary root canal treatment (Ng et al. 2007, 2008). As comparable survival and success rates can be anticipated for either tooth-supported or implant-supported fixed dental prosthesis, attempts to retain natural teeth are advocated (Donos et al.2012). However, in certain situation such as complex root morphology, feasibility of endodontic therapy is limited as was evident in results from scenarios related to tooth 37.

Variations in treatment decisions were evident among practitioners with respect to retaining teeth, and specifically maxillary molar teeth. Those with postgraduate qualifications/training were more than three times as likely to propose to retain teeth as those without postgraduate qualifications/training. It was also noted that variations in approaches to retaining periodontally compromised teeth were evident, with those without qualifications frequently advocating the use of periodontal regeneration techniques despite evidence in the literature to the contrary (Brennan & Spencer 2006; Patel et al. 2010). Furthermore, where extraction was proposed, the decision to rehabilitate and how to rehabilitate varied. For example, in the case of second molar extraction, those with postgraduate qualifications/training more frequently opted not to rehabilitate, unlike those without qualifications/training. In addition, where multiple teeth was missing those without qualifications advocated rehabilitation with multiple implants as opposed to single implant rehabilitation by those with qualifications/training. This would suggest that there is a need to update practitioners on implant treatment decision-making as in some cases, implant rehabilitation may not be necessary despite their high survival and success. Also, judicious use of implants as success-

ful rehabilitation can be obtained from single implant support prosthesis replacing multiple teeth (Lundgren et al.2008).

In conclusion, variations in treatment decision-making with respect to retaining periodontally compromised teeth existed between those with and without postgraduate qualifications/training in implant dentistry. Those without qualification/training more frequently opted to extract periodontal compromised teeth in particular situations. In addition, variations in rehabilitation approaches existed; those with postgraduate qualifications/training more frequently opted for a more conservative approach – not to use implants and when used, single rather than multiple implants.

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