

A survey of Australian prosthodontists: The use of posts in endodontically treated teeth.

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Abstract and key words:

The aim of this study was to assess the use of posts for the restoration of an endodontically treated tooth by Australian Prosthodontists. A questionnaire was sent to the Prosthodontists, designed to gain insight into the common clinical practices and reasoning used when utilising a post. The questionnaire contained 17 questions comprising both open- and closed- format with the option for multiple responses.

The survey results indicated that the primary purpose of a post was to retain a core. The decision to place a post was affected by the quantity of remaining tooth structure and the type of planned restoration. Whilst the 'ideal' length for a post differed amongst respondents, there was appreciation for maintaining an apical seal of 4-5mm of gutta percha. The most commonly employed post was a custom cast metal post and there was no preferred technique for its fabrication.

Overall, the results highlighted how choice of materials and techniques reflect the clinical situation, that is, when utilising a post for an endodontically treated tooth, there is no 'one post fits all canals' approach by Prosthodontists in Australia.

Keywords: Endodontically treated tooth, Posts, Questionnaire, Prosthodontics

Abbreviations and acronyms: ETT = endodontically treated tooth, GIC = glass ionomer cement, GP = gutta percha, RM-GIC = resin modified glass ionomer cement

Introduction:

An important consideration for clinicians when restoring an endodontically treated tooth (ETT) is the need for a post. If a post is deemed necessary, then the clinician is challenged by the different options available for 'correct' or 'ideal' post placement. There are countless types of post systems available that differ not only in material and geometry, but also the clinical technique employed.

To date, there is little clinical evidence to support one particular post type over another for restoring an ETT.^{1,2} In a systematic review it was concluded that there was no specific post and core system that should be used,³ nonetheless it has also been recognised that despite the current lack of strong evidence for a particular treatment in post selection, this does not necessarily imply that treatment is either inferior or clinically ineffective.⁴

Despite the lack of evidence for a particular post, various post options have been justified for clinical use with explanations such as: (i) improved stress distribution,⁵ (ii) reduction in root fractures,⁶ (iii) conservation of tooth structure,⁷ and (iv) aesthetics.⁸ Though, as previously highlighted, the volume of literature easily facilitates selective referencing to support a product or technique resulting in information regarding the use of posts being both controversial and confusing.⁹ Similarly, critical appraisal by Browning and Swift on clinical studies of posts highlighted the issue of biases if a pre-determined perception regarding treatment existed.¹⁰ Consequently, the existing literature on the use of posts remains perplexing for the clinician.

Regardless, the clinical reality is that clinicians need to make choices when restoring an ETT on a frequent basis. It has been suggested, and perhaps somewhat controversial, that evidence-based dentistry should not be rigid for clinical procedures, nor should it dictate what

a clinician does, but rather, provide guidance in addition to an individual's clinical expertise and a patient's treatment needs.⁴ Subsequently, is it possible to gain meaningful insight into clinical behaviour with respect to restorative procedures undertaken by clinicians through the use of a questionnaire?

To understand current practices of dentists when restoring an ETT, a number of questionnaires have been conducted analysing how an ETT might be restored. In 2006, Naumann et al. questioned German dental practitioners on their treatment concepts for the restoration of an ETT.¹¹ Approximately 10 year later, Naumann et al. repeated a modified version of the questionnaire.¹² These two studies assessed opinions, techniques and materials for the restoration of an ETT. It is interesting to note that from the survey in 2006 the most frequently used post was a cast post and core, whilst in 2015 the preference had changed to a fibre post with a resin composite core. Sarkis-Onofre et al. assessed the preference for using posts to restore the ETT and evaluated if years of clinical experience or specialist training influenced preference for post utilisation.¹³ Whilst the scope of the questionnaire was limited, the authors concluded that continuing education was a factor influencing post selection. The study by Eckerbom and Magnusson compared differences in opinion between general practitioners and board-certified prosthodontists in Sweden when restoring an ETT and identified a disparity in opinion between the general practitioners and prosthodontists.¹⁴ Two studies concluded that clinicians understood the principles of restoring an ETT^{15,16} whilst others^{11,17,18} concluded that there was a lack of familiarity or understanding of management of the ETT by respondents as supported by the literature.

To date, no study has been conducted to assess the attitudes of Australian prosthodontists in their use of posts when restoring an ETT. Therefore, the aim of this study was to assess the use of posts in ETT by Australian Prosthodontists by conducting a questionnaire survey. The questions were designed to elicit responses to enable an opportunity to discuss current clinical behaviours in association with current clinical evidence related to the management of ETT. This study is important to assess and understand treatment approaches and philosophies for the use of posts in restoring an ETT.

Materials and Methods:

A voluntary, anonymous questionnaire was mailed to dental practitioners who were registered as Prosthodontists throughout Australia. Prosthodontists whose addresses were publicly listed, either from the Australian and New Zealand Academy of Prosthodontists website or via a manual search of telephone directories (n = 171) were identified. The questionnaire comprised 17 questions, some of which had multiple parts or respondents were able to enter multiple responses to a single question. The format consisted of both open- and closed- questions.

The questionnaire was accompanied with a letter explaining the study objectives and requesting anonymous participation. All questionnaires were de-identified and coded to ensure confidentiality. The return mail envelope had an identifier number that allowed a follow up questionnaire to be mailed to non-responders one month after the first mail-out. Human Ethics approval was obtained from The University of Melbourne Human Research Ethics Committee (HREC number 1544789.1).

The questionnaire was designed to gain insight into the respondents' opinions regarding their common practices and reasoning when using a post for restoring ETT. The data collection period extended from September 2015 to March 2016.

The data were entered manually into a Microsoft® Excel spread sheet (Microsoft Corporation, WA, USA). Each possible response to each question was allocated its own column and any non-numerical data were numerically coded for ease of data manipulation. Frequency of responses to each question was used for descriptive statistical representation of the results.

Results:

Of the 171 questionnaires mailed out, a total of 108 questionnaires were returned (63 per cent). Of the questionnaires returned, 13 were excluded as the respondent had either retired or the mailing address was incorrect. The number of completed questionnaires used for data analysis was 95 or 55% of the total number of questionnaires sent.

Demographics

The first question was in three parts asking the respondents to indicate the university of specialty training (n=95), the state that they currently work in (n=100) and the year of registration as a Prosthodontist (n=95). Twenty-eight (29%) of the respondents graduated from the University of Melbourne, 25 (26%) from the University of Sydney, 18 (19%) graduated outside of Australia, 16 (17%) trained at the University of Adelaide, 7 (7%) trained at the University of Queensland and only one respondent (1%) from the University of Western Australia. The responses to “state of work” are shown in Table 1. Three respondents indicated that they work in more than one state, whilst one respondent failed to indicate the work location. Year of specialist registration was grouped into 5-year bands (Fig 1.).

Purpose of a post

The next question asked respondents to indicate, yes or no, if the purpose of a post was (i) to reinforce an ETT and (ii) to retain a core. An overwhelming majority of respondents (99%, n=94) indicated that the purpose of a post was to retain a core and 93% (n=88) of respondents indicated that a post does not reinforce an ETT.

Factors that influence the decision to place a post

The following question contained multiple parts relating to the factors that influence the decision to place a post. Respondents were asked, yes or no, if the decision to place a post was affected by (i) quantity of remaining tooth structure, (ii) location of tooth in the arch, and (iii) type of planned restoration, and the responses are listed in Table 2. Seven per cent (n=7) of respondents provided ‘other’ factors which influenced their decision to place a post.

Frequency of post placement by tooth location

Respondents were given the option of indicating if post placement was rare, sometimes or frequent for a given tooth location. Tooth location was defined as maxillary anterior, premolar, and molar, or mandibular anterior, premolar and molar. Figure 2 illustrates the percentage frequency of post placement by tooth location. The most frequent response, independent of tooth type, was ‘sometimes’ representing 44% of responses. This was followed by ‘rarely’ at 38% and frequently at 18%.

Who prepares the post space?

Respondents were asked to indicate either rarely, sometimes or usually to questions regarding preparation of the post space. Table 3 illustrates the frequency of responses to each question.

What is the ideal post length?

Respondents were asked to indicate ‘What is the ideal post length?’. This question allowed multiple answers with a total of 154 responses recorded. See Table 4.

Respondents were asked to indicate their preference for measuring the post length from a list of possible markers commonly used clinically. Respondents could provide more than one preference, with 98 responses received. Of these, 56% (n=55) indicated post length was measured from the incisal/occlusal height of the remaining tooth structure, 24% (n=24) took measurements from the pulp chamber floor, 9% (n=9) from the crestal bone, and 10% (n=10) provided an alternative response.

Maintenance of the apical seal

Respondents were asked to indicate the requirements for remaining gutta percha (GP) to ensure an apical seal was maintained. See Table 5.

How is post diameter established?

Respondents were asked to indicate how they established the post diameter from a given list, with the opportunity to indicate more than one option if appropriate. In total, there were 111 responses to the question, where 44% (n=49) indicated that post diameter is established by conforming to the existing canal with preparation of the apical portion only, and 35% (n=39) indicated that post diameter is established by conforming to the existing canal diameter. Canal diameter was established by increasing the diameter to fit a prefabricated post for 13% (n=14) of responses and increasing the canal diameter to strengthen a post was indicated by 8% of responses (n=9).

How is post geometry established?

The next question investigated how post geometry was established, with 117 responses collected. Sixty-one (52%) respondents indicated that their preparation would conform to the existing canal shape. The second highest response frequency was preparing the canal with a parallel form, with 24 (21%) responses. The option for preparing the canal with a tapered form received 20 (17%) responses. Only 12 (10%) responses indicated that post geometry is established by preparing the canal to a prefabricated post shape.

Preferences for post type and reason

The questionnaire asked for respondents to indicate their preference for post type and provide an explanation. There were 172 responses for post type and the results are presented in Table 6. There were 50 different reasons given as an explanation for post use. For custom cast metal posts, the most popular reason was related to the intimacy of fit of the post to the canal wall. Other explanations included strength, integrity of post-core and when there had been extensive tooth loss. A number of respondents also indicated that they considered the custom cast post to be most conservative. For a prefabricated metal post, ease of use was recorded as the most frequent reason. Other reasons included use for posterior teeth and to allow direct build-up. The prefabricated fibre reinforced post was utilised predominantly for aesthetic reasons and anterior teeth. The predominant reason for custom ceramic and zirconia post placement was for aesthetic purposes.

Technique for cast post fabrication

The next question was linked to how the practitioners typically fabricate their custom posts. There was an even distribution between the options given with 31% (n=29) indicating that they used a direct pattern method, while a marginally greater number, 33% (n=31), indicated a preference for an indirect (or impression) technique. The remainder 35% (n=33) indicated

that they used both techniques. Two responders failed to indicate the technique for fabricating a custom post.

Preference for post surface texture

This question asked respondents to indicate, yes or no, their preference for post surface texture. No respondent indicated a preference for an active screw or threaded type post. For the option of a rough, passive post, 75% indicated yes, whilst 24% indicated no. A smooth post received a 40% positive response compared to 60% negative response. It is clear there was a preference for posts to be passive in the root canal with a non-smooth surface texture.

Use of radiographs

The use of and when, radiographs for canal preparation would be taken was asked and the responses illustrated in Table 7. Interestingly, the most frequent positive response was prior to commencing post preparation, however, there after it was slightly more common for this group of practitioners not to take any further radiographs.

Use of rubber dam

Only 44% (n=42) of the responses (n=95) indicated that a rubber dam is used routinely.

Irrigation of the post space

The use of irrigation or specific canal cleansing during the stages of canal preparation, canal impression and cementation of the post was questioned. The majority of clinicians indicated that irrigation or cleansing the canal routinely took place throughout the restorative process with 76% irrigating at canal preparation, 58% at canal impression and 86% at the time of cementing the post.

Cement used for post cementation

Information relating to the type of cement used for post cementation and for which type of post with the option for multiple responses was questioned. A total of 217 responses were received with resin composite cement most frequently used (39%). Both resin modified glass ionomer cement (RM-GIC) and glass ionomer cement (GIC) were equally distributed at 25% each. Zinc phosphate was least frequently used (11%). In assessing the cement used against each post type, for both prefabricated metal and fibre reinforced posts, the most frequently used cement was resin composite at 40% and 85% respectively yet GIC was the most frequently used cement for cast posts representing 34% of the responses. For cast posts, the next most popular cement was RM-GIC (27%), followed by resin composite (25%) and zinc phosphate (13%).

Core build-up material

Associated with prefabricated post placement is the choice of core material used. This question also allowed for multiple responses and the responses illustrated in Table 8.

Discussion:

This questionnaire aimed to gain some insight into the clinical rationale and decisions used by Prosthodontic Specialists in Australia when placing a post in an ETT. The results indicate that while there is a lot of commonalities, there are also some clear differences amongst how the Australian Prosthodontists utilise posts. The variety of multiple responses received for a number of the questions in this survey suggest that the material and technique employed by

Australian Prosthodontists will often be influenced by the tooth that is being restored, and there is no 'one-fits-all' method used.

The number of returned questionnaires received for analysis was 55% of the total mailed out, which is slightly lower than comparable questionnaires in other countries.¹²⁻¹⁶ The geographic distribution of the respondents was not dissimilar to a previous questionnaire to Australian Prosthodontists.¹⁹ The questionnaire did capture a diverse spread of respondents by date of registration, and therefore years of practice as a specialist Prosthodontist. Unfortunately, the number of respondents was insufficient to make comparisons across years since specialist registration.

Almost all respondents indicated that the purpose of a post was to retain a core. The majority of respondents also acknowledged that the quantity of remaining tooth structure plays an important role in the decision of when to utilise a post. These responses are consistent with the current evidence which recognises that a post does not reinforce the tooth²⁰⁻²² and the amount of remaining tooth structure influences treatment outcomes.^{8,23}

For the majority of respondents the type of planned restoration and the location of the tooth in the arch were important considerations when deciding to place a post. The impact of tooth position was reinforced by the differences seen in the responses when asked to indicate the frequency of post placement relative to the regions of the dental arch. Based on the responses, the frequency for post placement is more likely in maxillary anterior sites, maxillary premolar sites and mandibular premolar sites. Whilst, post placement is less likely for teeth located in the mandibular anterior region, maxillary and mandibular molar regions. It is worth noting that the most common response was 'sometimes' used for 43% of responses, suggesting that the majority did not assume the need for a post in every case.

In response to the questions regarding length for post space preparation, there was no consensus on what 'dictates' the ideal length though the majority of positive responses were for preparing a post as long as possible without disturbing the apical seal (34%). In addition, 77% indicated that to ensure an apical seal, 4-5mm of gutta percha is required to be present. This highlights the challenge that faces the clinician, where there is the intention to achieve a post as long as possible to facilitate retention but there is also the important need to maintain an apical seal²².

For both post diameter and geometry, the respondents were consistent with a majority indicating for both questions that post dimensions are established predominantly by conforming to the existing canal. Research has illustrated that increasing post diameter during preparation of the canal risks compromising the structural integrity of the root itself.^{22,24} Yet, 44% of the respondents indicated that they would prepare the apical portion. The decision to prepare the apical portion, can in fact, exacerbate the risk of compromising the integrity of the root given the irregular cross-sectional shape of many roots.²⁵ For both post diameter and geometry, it was not common practice to modify the canal shape for a prefabricated post (13% and 10% respectively). This brings into discussion if intimacy of fit or the cement are the primary determinants of post retention.

The majority of responses indicated that rubber dam is not routinely used during post preparation and placement. This point is interesting, as it is inconsistent with a recent clinical study that recommended rubber dam should be used during prosthetic treatment of an ETT to improve endodontic outcomes.²⁶

With the advent of many newer materials and different post systems, the use of cast posts may be considered old fashioned when restoring an ETT, but it remains popular with the Prosthodontic specialist community in this survey.

When using a prefabricated post, dual-cured resin composite 34%, light-cured composite 29% and amalgam 28% were the most commonly used materials in order of popularity. The use of glass ionomer cement (GIC) and resin-modified GIC were rarely used as a build-up material. This is presumably because of the inherent brittleness of these materials and their relatively low fracture strength in comparison with the alternative materials.

A range of cements for different posts were employed when restoring an ETT. Resin cement was the most popular cement and it was used for all post types. Unfortunately, the survey did not explore the reasoning for the choice of cement. Whilst it is known that resin cements are resistant to fracture, they do not adhere well to dentine. Also, they can increase the difficulty of post removal relative to the alternative cements available. Interestingly, zinc phosphate is still being used by a number of the respondents even though it is known zinc phosphate cement is the most soluble amongst all the luting cements used. To date, there are no clear guidelines for cement choice with post placement.²⁷ It is surmised that luting cement selection may well be based on practitioner preference, clinical experience and possibly perceived loads on the post and core.

Conclusion:

Without clear recommendations, clinicians are often left questioning, 'what is the best treatment?' when faced with utilising a post in an ETT. This paper describes how Australian Prosthodontists rationalise the use, selection and placement of posts in endodontically treated teeth. Despite the limited response to the questionnaire, the results provide an interesting example of how, even at a specialist level, the similarities and variations which exists in philosophies and clinical management. The variety of responses to many of the questions highlight how the respondents vary the procedure or material choice based on the individual clinical situation encountered. That is, the use of one type of posts is not universal solution but rather the different clinical options provide a toolbox to enable effective management depending on the clinical situation. Whilst, as clinicians, we want to know 'which works best', perhaps with posts, we can modify our thinking to consider, 'what works well in which situation'. It is clear that the evidence-base for post utilisation clinically remains very limited.

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Tables

Table 1 Geographic characteristics of respondents (percentage values in parenthesis)

State	Respondents
ACT	2 (2)
NSW	27 (27)
NT	1 (1)
SA	9 (9)
TAS	1 (1)
QLD	16 (16)
VIC	32 (32)
WA	11 (11)
No response	1 (1)
Total	100 (100)

Table 2 What influences the decision to place a post? (percentage values in parenthesis)

Questions	Number of responses	Yes	No
Quantity of remaining tooth structure	95	91 (96)	4 (4)
Location of tooth in arch	95	55 (58)	40 (42)
Type of planned restoration	95	68 (72)	27 (28)

Table 3 Who prepares the post space? (percentage values in parenthesis)

Questions	Number of responses	Usually	Sometimes	Rarely
I prepare the post space	n=95	65 (68)	23 (24)	7 (7)
An endodontist prepares the post space	n=92	20 (22)	40 (43)	32 (35)
I provide instructions to the endodontist	n=86	43 (50)	11 (13)	32 (37)

Table 4 What is the ideal post length? (percentage values in parenthesis)

Options	Responses
As long as possible without disturbing the apical seal	52 (34)
Post length is longer than the crown	33 (21)
Post length is equal to length of crown	26 (17)
Post length is 2/3 the root length	20 (13)
Other	15 (10)
Post length is 1/2 root length	5 (3)
Post length is 4/5 root length	3 (2)
Total number of responses	154 (100)

Table 5 What are the apical seal requirements? (percentage values in parenthesis)

Options	Responses
4-5mm GP	73 (76.8)
>5mm GP	11 (11.6)
2-3mm GP	10 (10.5)
Other	1 (1.0)
<2mm GP	0 (0.0)
Total number of responses	95 (100)

Table 6 What is your preference for post type? (percentage values in parenthesis)

Options	Responses
Custom cast metal	85 (49)
Prefabricated metal	46 (27)
Prefabricated fibre reinforced	28 (16)
Custom pressed ceramic	9 (5)
Prefabricated zirconia	3 (2)
Other	1 (0)
Total number of responses	172 (100)

Table 7 When are radiographs taken? (percentage values in parenthesis)

Questions	Number of responses	Yes	No
After endodontic treatment	94	72 (77)	22 (23)
Before post preparation	94	45 (48)	49 (52)
During post preparation	95	38 (40)	57 (60)
After post preparation	95	36 (38)	59 (62)
After post insertion	94	32 (34)	62 (66)
After restoration placement	93	36 (39)	57 (61)

Table 8 Core build up material used with a prefabricated post (percentage values in parenthesis)

Options	Responses
Resin composite (dual cured)	54 (34)
Resin composite (light cured)	46 (29)
Amalgam	45 (28)
Pressed ceramic	7 (4)
Resin modified GIC	3 (2)
GIC	3 (2)
Total number of responses	158 (100)

Figures

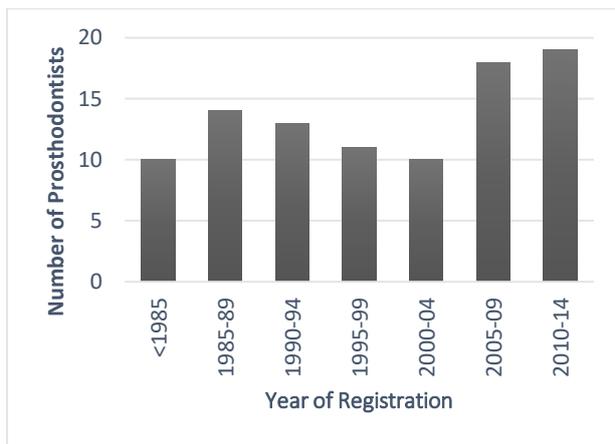


Fig 1. Distribution of respondents by year of specialist registration.

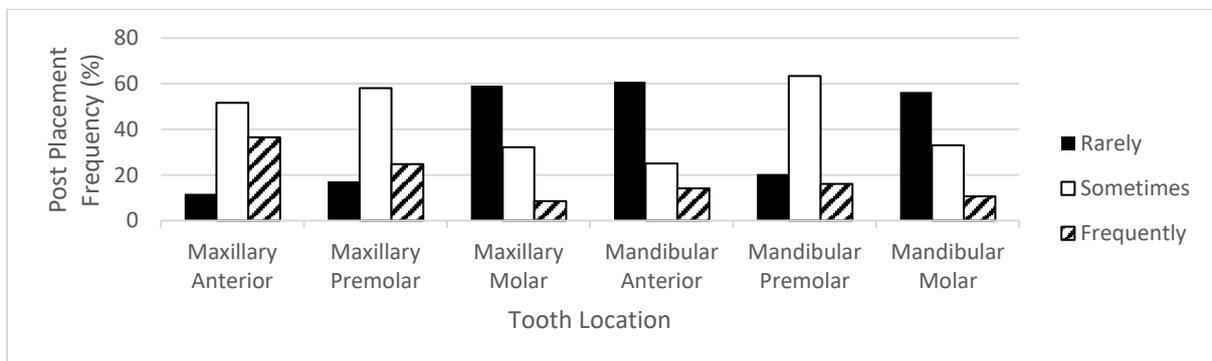


Fig 2. Percentage frequency of post placement based on tooth location.