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The management of deep carious lesions and the exposed pulp among members of two European endodontic societies: a questionnaire-based Study

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ABSTRACT

Aims To investigate and compare views on management of deep caries and the exposed pulp by Endodontic Society members in Ireland (Irish Endodontic Society [IES]) and Italy, (Accademia Italiana di Endodonzia [AIE]). Further aims were to investigate the influence of patient-related factors (age, symptoms) and operator-related factors (material choice, antibiotics) on management.

Methodology A structured online questionnaire containing two cases (an 18 and 45-year-old) and two scenarios (+/- mild symptoms), including history and radiograph, was sent to IES and AIE members. The answers were analysed using Chi-square and Fisher's exact test ($p<0.05$).

Results In total, 120 dentists participated, representing 49% of the AIE and 48% of the IES membership. Age-distribution was similar between the societies; however, most AIE members had no further qualifications (63%), while IES respondents generally had a postgraduate endodontic qualification (71%). AIE respondents carried out a higher volume of vital pulp treatment (VPT) per month, with 69% carrying out over five cases, compared with 22% of IES respondents. The presence of patient symptoms significantly altered treatment planning decisions ($p<0.001$) with root canal treatment (RCT) more frequently selected in both societies. Patient-age significantly influenced treatment choice in the absence ($p=0.043$) or presence ($p=0.012$) of symptoms with less VPT advocated in older patients. There were no significant differences in the treatment of a young patient in the presence ($p=0.302$) or absence of symptoms ($p=0.297$), however, older patient management differed between the Societies for symptomatic ($p=0.041$) and asymptomatic scenarios ($p=0.044$) with significantly more RCTs carried out in the AIE than the IES. Hydraulic-calcium-silicate materials (HCSMs) were commonly selected, accounting for 81% of IES and 69% of AIE VPT materials, although younger members of the AIE preferred calcium hydroxide materials. Younger dentists in both societies prescribed less RCT than older age groups.

Conclusions: Although vital pulp treatment is carried out by members of both societies there was no consistency regarding the most appropriate management for the exposed pulp or the VPT material of choice. Patient symptoms and age significantly influence the decision-making process and invasiveness of treatment. Hydraulic-calcium-silicate materials were the most commonly advocated material in all groups except young AIE members who preferred calcium hydroxide.

INTRODUCTION

Maintaining the health and vitality of the dental pulp is a principle goal of Operative Dentistry and Endodontics (Duncan *et al*. 2019). Although, the management of deep caries and the exposed pulp has been carried out for many years, it has traditionally been considered to have a poor outcome (Barthel *et al*. 2000, Bjørndal *et al*. 2010), which limited its indication to the treatment of teeth with immature apices or after traumatic pulp exposures (ESE 2006). Recently, vital pulp treatments (VPTs) have undergone a renaissance with good success reported after one and two-visit selective removal techniques to avoid pulp exposure, as well carious exposures treated by pulp capping (Bogen *et al*. 2008, Marques *et al*. 2015), partial pulpotomy (Taha & Khazali 2017) and full/coronal pulpotomy (Simon *et al.* 2013), even in case with signs and symptoms indicative of irreversible pulpitis (Taha *et al*. 2017, Cushley *et al.* 2019). Notably, the recent increase in the success of VPT in teeth with deep carious lesions, has largely been in studies carried out by endodontic researchers, employing enhanced protocols (Bjørndal *et al*. 2019), including disinfectant lavage of the pulpal wound, magnification and application of hydraulic calcium silicate cements (HCSCs) (Bogen *et al*. 2008, Simon *et al.* 2013, Marques *et al*. 2015, Taha *et al*. 2017). Ironically, endodontists may not be the principle group treating the bulk of carious exposures due to the nature of the referral system or their scope of practice (Bjørndal *et al*. 2019).

For many years calcium hydroxide [$Ca(OH_{2)}$], has been considered the material of choice for management of the exposed pulp (Glass & Zander 1949, Stanley & Lundy 1972, Tronstad 1974), however, it is limited by incomplete hard tissue bridge formation and poor sealing qualities and has been superseded by HCSCs such as mineral trioxide aggregate (MTA) or Biodentine as the material of choice (Nair *et al.* 2008, Hilton *et al*. 2013, Duncan *et al*. 2019). Questionnaire-based surveys in which dentists examine radiographs of carious lesions and describe treatment options, have highlighted the dilemma of whether a tooth should be treated conservatively by VPT or whether a more invasive approach is required (Oen *et al*. 2007, Stangvaltaite *et al.* 2017). The results have demonstrated a huge variance between respondents and highlighted that there is no uniform decision-making for the management of deep carious lesions (Chin *et al.* 2016). Currently, the majority of dentists adopt an invasive approach choosing to expose the pulp or perform a pulpectomy and root canal treatment (RCT), rather than avoiding pulp exposure (Stangvaltaite *et al*. 2017, Schwendicke *et al.* 2017). However, at present the bulk of these questionnaire-based studies are carried out in general practice and it is unclear the effect of further education in endodontics or geographical location has on decision-making for the management of deep carious lesions.

As there appears to be no consistency amongst general dental practitioners in Europe on the most appropriate way to management of deep carious lesions, the aim of this study was to investigate

whether being a member of an Endodontic society resulted in more standardised treatment protocols in this area. As a result, a survey for members of two European Endodontic Societies in countries without a nationally recognised specialist list, the Irish Endodontic Society (IES) and Accademia Italiana di Endodonzia (AIE), was created to investigate the views regarding management of deep carious lesions.

METHODS

Objectives

- To investigate and compare how the management of deep carious lesions and the exposed pulp by is carried out by members of the Irish (IES) and Italian (AIE) Endodontic Societies.
- To investigate the influence of patient-related factors, including age and symptoms on the decision-making process for the management of deep carious lesions.
- To investigate the influence of operator-related factors, including material choice and antibiotic use between members of endodontic national societies of two different countries used to manage the exposed pulp.

Questionnaire

Ethical approval was granted for the study from St James's Hospital, Dublin Research Ethics Committee (REC/2017/04/1). A structured online questionnaire-based study was sent to all registered members of two endodontic societies (IES and AIE) as an e-mail link in 2018. The questionnaire was designed by the principle researcher (RCD) and principle investigator (HD) and was based around two radiographs highlighting deep carious lesions with two scenarios for both radiographs **(Figure 1a & b)**. In order to confirm that the questionnaire could be completed within 10 minutes and that the questions and flow of the survey were coherent and logical, a small pilot study was organised and evaluated using three endodontists in Dublin. This was carried out in paper format, with the average time to complete the survey five minutes. The evaluators were encouraged to be critical; however, the feedback was positive. In order to avoid possible misunderstandings and longer time to complete the survey by AIE members, it was translated in Italian by the principle researcher (RCD), who speaks both languages fluently. There was no difference in content between the two versions of the questionnaire.

After completion of the pilot study, and subsequent minor modifications, an online version was created using 'Google Docs' (https://docs.google.com/forms). The investigators elected to use this platform as it was familiar and data could be collected without asking the participants to download software or other required actions. This online version was created using RCD's account and verified through a 'test link'. After confirming that the survey displayed correctly and that the sample answers were coherent, the survey was deemed ready for distribution.

Initially, the principle researcher (RCD) contacted the Presidents of the two endodontic societies, the AIE in Italy and the IES in Ireland, in order to confirm that they were willing to participate in an online research study, which asked their members to discuss management of deep carious lesions. After both societies agreed to engage in the study, a final copy of the questionnaire was sent to both the AIE and IES committees for their formal approval. The questionnaire was appraised by the committee of the AIE and IES who agreed with the format of the questionnaire. Finally, on 19th April 2018 they distributed the survey via email to all members of the AIE (197 members) and the IES (50 members), who had provided their email address to the society with a deadline of completion of three weeks. Subsequently, an invitation reminder was sent on the 3rd May 2018 asking participants to complete the survey was sent to the secretary of both Societies.

Demographic component of questionnaire

Within the questionnaire format, a series of general demographic questions were asked in order to collect as much information as possible, related to age, experience and training **(Table 1).** Qualifications and numbers of years since obtaining the primary degree were recorded, as well as the nation where the participant obtained the primary degree and currently based their practice. Finally, in order to quantify the experience of the participant, the number of VPT procedures carried out every month was requested (**Table 1**).

Clinical component of questionnaire

Periapical radiographs from two separate patients demonstrating deep carious lesions were used as the basis of the scenarios (Case 1 and 2). For the purposes of this study deep caries was defined as 'Caries reaching the inner quarter of dentine, but with a zone of hard or firm dentine between the caries and the pulp, which is radiographically detectable when located on an interproximal or occlusal surface. There is a risk of pulp exposure during operative treatment' (Duncan *et al*. 2019). Case 1 was based on a radiograph demonstrating a radiolucency indicative of a deep carious lesion in the 36 (lower left molar) in 18-year-old patient (**Figure 1a),** while case two **(Figure 1b)** was based on a radiograph showing a similar radiolucency of the 46 (lower right first molar) in a 45-year-old patient. In both case 1 and 2, the clinical examination described the pulp as being "exposed during complete carious tissue excavation". Within both case 1 and 2 there were two additional scenarios, which differed in their description of the presence or the absence of symptoms. In scenario 1, there was a complete absence of any pulpal symptoms, while in scenario 2, the patient reported mild symptoms triggered by cold and sweet substances and on examination the tooth was tender to percussion (TTP).

Four further multiple-choice questions were asked about each of the scenarios (**Figure 2)**. The first question related to the treatment of choice for each scenario, with a range of answers from

minimally invasive techniques to RCT (patient-related question). The second question related to the material of choice for VPT, while the third question asked for the specific reason behind the choice of material choice, again selecting from a list of options (operator-related). A fourth and final question was asked whether the use of an antibiotic, either topical or systemic would be considered (operator-related) **(Figure 2).**

Data collection and statistical analysis

The participants received the survey as a link, specific to the AIE (https://forms.gle/qDVkUD1NEeQujUj28) and specific to the IES (https://forms.gle/tzZov6Etzzfw7Mow8). After accessing the link, the participant was redirected to a webpage to complete the questionnaire. At the end of the questionnaire the information was automatically and anonymously forwarded to a 'Google Doc' account of the principal researcher (RCD). The responses were individually analysed initially for completeness and then transferred and collated into an electronic database for analysis. The Chi-square and Fisher's exact test was used for evaluation of the results. The *P*-value <0.05 was considered significant.

RESULTS

Demographic results

From a total of 197 AIE members, 96 responded and from a total of 50 IES members, 24 responded (total 120). This represents a response rate of 49% for the AIE and 48% for the IES. Demographic data revealed a broadly similar age distribution between the two societies **(Table 2a)**. In terms of further education in Endodontics, the majority of AIE members had no further qualifications (63%), while the majority of IES respondents had a masters in endodontics (71%). Five AIE, but no IES respondents had a PhD **(Table 2b).** The reported volume of VPT carried out per month differed between the two societies. AIE respondents reported a range of VPTs per month, with 1–5 cases completed in 32%, 5-10 in 33% and over 10 completed in 36%, while in comparison IES respondents reported completing less VPT with 1-5 cases in 61%, 5-10 in 13%, over 10 in 9%, with 18% not carrying out any VPT.

Patient-related results

Do patient symptoms alter the decision-making process?

After pooling the results of both societies, the presence or absence of symptoms significantly altered treatment planning decisions (p<0.001). The younger asymptomatic patient described in Case 1 Scenario 1 resulted in more conservative-treatment options, while there was a significant increase in the selection of RCT when symptoms were added to the history (Case 1 Scenario 2) **(Table 3)**. Symptoms had a similar impact on older patients, with the absence of symptoms (Case 2 Scenario 1) resulting in more VPT than if symptoms were present (Case 2 Scenario 2) (P<0.0001) **(Table 3)**. The presence of symptoms led to more

invasive treatment choices, with a 27% increase in RCTs in the young (Case 1) and 32% in the older patient (Case 2). Pulpotomies were selected more often in both societies for young symptomatic patients, compared with asymptomatic cases (partial pulpotomy 24% versus 18%; full pulpotomy 12% versus 8%); however, this pattern was not evident in the older patient. Pulp capping was commonly selected treatment modality for asymptomatic carious exposure regardless of age **(Table 3).**

Does the patient's age alter the decision-making process?

Patient age significantly influenced the treatment choice. There was a significant difference between younger (Case 1) and older patient's (Case 2) treatment plans in both absence (p=0.043) or presence (p=0.012) of symptoms when the results were pooled **(Table 3)**. In the older patient, participants tended to carry out less VPT and be more invasive selecting RCT 14% more often for asymptomatic older patients and 19% for the older symptomatic cases compared with younger cohorts **(Table 3).**

If the overall responses of the AIE and IES are compared, there were no significant differences in the treatment of a young patient (Case 1) in the presence (p=0.302) or absence of symptoms (p=0.297). Treatment decisions for an older patient (Case 2), demonstrated a significant difference between the two Societies for both symptomatic (p=0.041) and asymptomatic scenarios (p=0.044) with significantly more RCTS carried out in the AIE than the IES **(Table 4)**.

Operator-related results

What vital pulp treatment materials were most commonly chosen?

HCSMs were the most commonly selected **(Figure 3)**, with Biodentine and MTA combined accounting 81% of IES and 69% of AIE selected VPT materials. A smaller percentage of IES members choose Biodentine (17%) over MTA (64%), compared with AIE respondents (Biodentine 28% and MTA 31%). Both hard and non-setting $Ca(OH_2)$ materials were also commonly used (40% of AIE, 19% of IES), with hard setting materials more common in both societies **(Figure 4).** No other materials were commonly used by either society.

Did the age/experience of the operator make a difference to treatment plan?

To gauge the influence of experience on the treatment plan, respondents from both societies were categorized by age group. In general, younger dentists (25-35 years and 35-45 years) prescribe less RCT than the older groups (45-55 years and 55+ years) **(Table 5).** When the youngest age group (25-35 years) was compared with older dentists (45-55 years and 55+ years), the older cohorts selected RCT as the most appropriate choice in all Cases and Scenarios in both societies. Overall the most invasive cohort for both societies was the 45-55-year group, while for all age groups, symptomatology increased invasiveness in all groups. **(Table 5).**

Did the age/experience of the operator alter material choice?

In the AIE, $CaOH_2$ (hard and non-setting) was chosen as the most suitable material by 60% of the 25-35 year-olds, while HCSMs (Biodentine and MTA) were the first choice in all other age groups (35-45 years 63%; 45-55 years 62%; 55+ years 76%) **(Figure 4).** Biodentine and MTA were chosen similarly within all age groups (25-35 years BD 19%, MTA 21%; 35-45 years BD 37%, MTA 32%; 45-55 years BD 27%, MTA 33%; 55+ years BD 24%, MTA 36%).

For the IES, the age group 25-35 years selected $CaOH_2$ as material of choice in 45% of cases and a HCSM in 55%, while in every other age group choose calcium silicates was the overwhelming choice (35-34 years 83%; 45-55 years 79%; 55+ years 78%) **(Figure 4).** For Irish respondents, MTA was selected more than Biodentine in all age groups with 83% of 35-45 year-olds, 63% of 45-55 year olds and 56% of 55 years+ selecting MTA over Biodentine.

What was the reason for choosing a material?

The dominant factor for the material choice was the predictability of outcome (AIE 59%, IES 86%), followed by the handling of the product (AIE 17%, IES 5%). Cost was only considered an issue by less than 5% of both society members.

Were antibiotics prescribed?

The use of antibiotics was considered unnecessary by almost all the respondents. Only two respondents indicated using antibiotics, both for case 2 (older patient, with or without symptoms). Both respondents were members of the AIE.

DISCUSSION

The questionnaire was designed to be easy to read and straightforward to complete. The survey was carried out online, avoiding the need for member addresses, postage, printing and stamped envelopes for subsequent return of the questionnaire. It was hoped that this would increase engagement with the study. Indeed, the response rate of nearly 50% is good in comparison with similar recent postal studies carried out in this subject area (Chin *et al*. 2016, Ha *et al*. 2016, Schwendicke *et al*. 2017). Although effectively half of the membership of the two societies responded, the IES and AIE differ markedly in their member numbers, so it is accepted that the study is limited by the fact that many more views were analysed from the Italian cohort. Notably, more respondents from the IES reported having a taught Master's degree in Endodontics, while the majority of AIE members have no structured postgraduate education. By contrast, five AIE members had a PhD, while no IES respondents possessed a doctorate. This is all likelihood reflects different traditions in the two jurisdictions as there is no history of structured endodontic training in Italy and equally no history of postgraduate research activity by endodontists in Ireland. A potential limitation of this study is the representativeness of the sample chosen, which is not a

general dentist population. This was by design as although several studies have analysed views of general dental practitioners in VPT (Oen *et al*. 2007, Stangvaltaite *et al.* 2017, Schwendicke *et al.* 2017), there is an absence of studies analysing the view of endodontists. As neither Italy or Ireland officially recognise the speciality of Endodontics, members of the endodontic societies represented a group aligned to the subject in those countries. As endodontists have recently become the principle group driving minimally-invasive VPT for the exposed pulp (Bjørndal *et al*. 2019, Duncan *et al*. 2019) this group view on VPT was of particular interest.

Over the last 10-15 years MTA has become the international 'gold standard' material for use in VPT (Dammaschke 2008, Nair *et al*. 2008, Ricucci *et al.* 2020). As a result, it was hypothesised during the planning stages of this study that MTA and other HCSMs (e.g. Biodentine) would be the most popular material choices, particularly amongst younger respondents. Particularly within Italy, calcium hydroxide materials remained as popular as MTA and Biodentine, and perhaps more surprisingly younger AIE and IES members preferred $Ca(OH_2)$ over HCSMs, compared with older respondents. The reasons for this are unclear, but is likely to relate at least in part to undergraduate teaching and training, where the influence is still stronger for those just qualified than for those who have been qualified for a longer period. Older practitioners may be more influenced by experts speaking at conferences and practical courses, as there has been much evolution in the area of VPT since they qualified. MTA and Biodentine are significantly more expensive than $Ca(OH_2)$; however, this was considered a minor reason not to use the material being highlighted by less than 4% of respondents in both territories. Of course, younger dentists in reality are more likely to be working for someone else and are often not in the position to select the materials they would prefer. HCSMs are awkward to handle clinically and therefore we were interested in whether this was a factor determining material choice. Although, it was noted to be important by 17% of AIE respondents, it was only a minor concern for IES respondents with only 5% suggesting it influenced their choice of material. It may be a reason as to why younger people are using the more recently introduced Biodentine, which has shown to be easier to handle (Careddu & Duncan 2018, Rajasekharan *et al.* 2018).

Biodentine was used relatively more by AIE members than IES members in all except the youngest age group. Again, this may reflect differing teaching practices in the two jurisdictions, but it may also reflect the impact of the marketing on material choice and it is possible that in Italy the distribution and advertisement for Biodentine has been more consistent and aggressive than in Ireland. Septodont as a company have traditionally been involved in the sale of dental anaesthetic products rather than dental materials in Ireland, although a recent change in direction has started the promotion of biomaterials such as Biodentine and Bioroot RCS in dental schools.

In the AIE VPT techniques were more common carried out with an almost equal number of responses for the three groups (1-5, 5-10, 10+ VPT in a month). On the contrary, Irish respondents were less inclined to perform VPT with the majority of them performing not more than 5 treatments in a month and many respondents reporting that they did not to carry out these procedures at all. This could be related to a difference in teaching received at University as well as the fact that in Italy, Endodontists often perform some general practice while in Ireland there is a stronger referral-based system in place.

In general, the presence of pulpal symptoms increased the number of respondents who would perform a RCT, rather than VPT both in AIE and IES. This is a clear indication that, even mild/moderate symptoms are considered a characteristic that may lead to failure of a conservative approach. This is in light of the fact that there is not a good correlation between diagnosis based on clinical symptoms and actual status of the pulp (Mejàre *et al.* 2012). This has been challenged recently when a good correspondence between clinical findings, and the reversible/irreversible pulpits histologically was demonstrated (Ricucci *et al.* 2014). In this study, the cases highlighted the presence of mild symptoms, more indicative of reversible than irreversible pulpitis; however, this was sufficient for respondents to select pulpectomy more often than a VPT procedure if symptoms were present.

Patient age appeared to have a considerable influence on the decision-making process in both societies. In both the presence of absence of pulpal symptoms, participants adopted a less conservative approach in older patients, which cannot be attributed to the level of root formation as in both cases, as root formation was complete. This supports other questionnaire-based studies examining operator choice in a range of scenarios, which have highlighted more invasive choices in older patients (Frisk *et al.* 2013). When considering why patient age is considered important, it should be noted that there is no firm clinical evidence to suggest that age is a significant factor for the success of VPT. Although, a recent prospective pulp capping study compared results in patients above and below 40 years and concluded that treatment was less successful in older patients (Marques *et al*. 2015); other studies with a similar age ranges have showed no difference (Matsuo *et al*. 1996, Mente *et al*. 2014). There is certainly a perception that young people and indeed pulp heals more predictably with prospective studies analysing the histological response to VPT materials invariably involving young patients (Hörsted-Bindslev *et al.* 2003, Accorinte *et al.* 2008, Nair *et al.* 2008) as do clinical pulp capping outcome studies in carious teeth (Farsi *et al*. 2006, Taha & Khazali 2017). Younger patients, under the age of 20 years, are selected due to the greater blood supply, the potential for open root apices and increased cellularity of their pulps; it has been suggested that these characteristics should result in more predictable healing (Massler 1972).

A further point of interest, was that when we analysed the age since qualification older groups were more inclined to perform RCT than the younger, especially in absence of symptoms. This may be due

to younger dentists being more aware of the latest developments in VPT (Bjørndal *et al.* 2010, Wolters *et al.* 2017), or it may reflect experience dictating that RCT was more predictable in their 'hands' than VPT. On a positive note it appears that the need to reduce antibiotic prescribing and the lack of rationale for using antibiotics for 'toothache' has been effective at least for this cohort of participants (Agnihotry *et al.* 2019).

CONCLUSIONS

Within the limitations of this study it is clear that VPT is carried out frequently by both members of the IES and AIE. There is no consistency in approach about the most appropriate management for the exposed pulp or the VPT material of choice. Patient symptoms and age influence the decision-making process. $Ca(OH_2)$ was the most commonly used material only in the youngest AIE respondents, while MTA was the most commonly selected material from all ages of IES respondents. Members of both societies suggested that the predictability of the results, rather than cost or handling was the principle reason behind material choice.

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Conflict of Interest statement

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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FIGURE LEGENDS

Figure 1a Case 1: An 18-year-old patient presenting with a deep carious lesion on 36. Tooth remained vital and the pulp was accidentally exposed during non-selective carious tissue excavation. There were two scenarios; in scenario one there were no symptoms, while in scenario two there were mild symptoms triggered by cold/sweet and tenderness when biting. **1b** Case 2: A 45-year-old patient presenting with a deep carious lesion on 46. The tooth remained vital and the pulp was accidentally exposed during non-selective carious-tissue excavation. There were two scenarios; in scenario one there were no symptoms, while in scenario two there were mild symptoms triggered by cold/sweet and tenderness when biting.

Figure 2 Multiple choice questions asked about each of 4 scenarios in the questionnaire. The same template was used for both cases and scenarios.

Figure 3 Overall VPT material choice in both societies. HS CH = Hard setting calcium hydroxide; NS CH = Non setting calcium hydroxide; BD = Biodentine; MTA = Mineral trioxide aggregate

Figure 4 Choice of vital pulp treatment materials in the AIE and IES by age group

Table 1 Questions related to demographic information and volume of VPT carried out per month.

DEMOGRAPHIC DATA COLLECTED
- Age - Country where you work - Country of primary qualification - Number of years after obtaining primary dental qualification - Qualifications - List any university-accredited post-graduate qualifications you have in endodontics (e.g. certificate, diploma, masters, PhD, Royal College of Surgeons examination) - How many vital pulp treatments would you carry out per month? (0, 0-5, 5-10, 10+)

Table 2a Age distribution between the two societies.

AGE (years)	25-35	35-45	45-55	55+
AIE	26.3%	30.5%	22.1%	21.1%
IES	25.1%	20.8%	33.3%	20.8%

Table 2b Post-Graduate Endodontic education reported by participants. Figure in brackets = number of participants.

	PhD	MSc	Diploma	None
AIE (96)	5 (5.21%)	20 (20.83%)	11 (11.46%)	60 (62.50%)
IES (24)	0	17 (70.83%)	2 (8.33%)	5 (20.83%)

Table 3 Pooled results of AIE and IES (total 120) with regard to symptoms. Difference in treatment planning in absence (Scenario 1 – S1) or presence (Scenario 2 – S2) of symptoms for younger (Case 1 - C1) and older patient (Case 2 – C2).

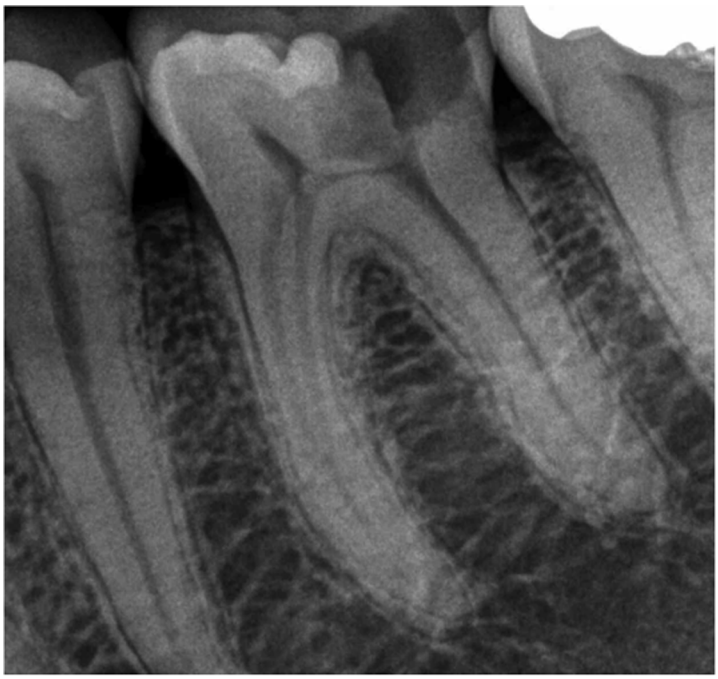
	Pulp Capping	**Partial Pulptomy**	**Full Pulpotomy**	**RCT**
C1 – S1	64 (53%)	22 (18%)	9 (8%)	25 (21%)
C1 – S2	19 (16%)	29 (24%)	14 (12%)	58 (48%)
C2 – S1	52 (43.5%)	22 (18.5%)	4 (3%)	42 (35%)
C2 – S2	17 (14%)	18 (15%)	5 (4%)	80 (67%)

Table 4 Separated results of AIE (96 respondents) and IES (24 respondents) with regard to older patient (Case 2). Difference in treatment planning in absence (Scenario 1 – S1) or presence (Scenario 2 – S2) of symptoms illustrated.

Case 2	Society	Pulp Capping	Partial Pulptomy	Full Pulpotomy	RCT
S1	**AIE**	44 (46%)	13 (13.5%)	2 (2%)	37 (38.5%)
S1	**IES**	8 (33.5%)	9 (37.5%)	1 (4%)	6 (25%)
S2	**AIE**	15 (15.5%)	12 (12.5%)	2 (2%)	67 (70%)
S2	**IES**	2 (8.5%)	6 (25%)	3 (12.5%)	13 (54%)

Table 5 Percentage RCT proposed for Case 1 (younger patient) and Case 2 (older patient) in the absence (Scenario 1) and presence of symptoms (Scenario 2)

	Case 1 Scenario 1		Case 1 Scenario 2		Case 2 Scenario 1		Case 2 Scenario 2	
	AIE	**IES**	**AIE**	**IES**	**AIE**	**IES**	**AIE**	**IES**
AIE IES 25-35 yrs	16%	0%	43%	33%	27%	0%	60%	17%
AIE IES 35-45 yrs	21%	0%	58%	25%	24%	50%	72%	75%
AIE IES 45-55 yrs	25%	37%	47%	50%	60%	37%	80%	75%
AIE IES 55+ yrs	29%	20%	44%	40%	43%	20%	70%	40%



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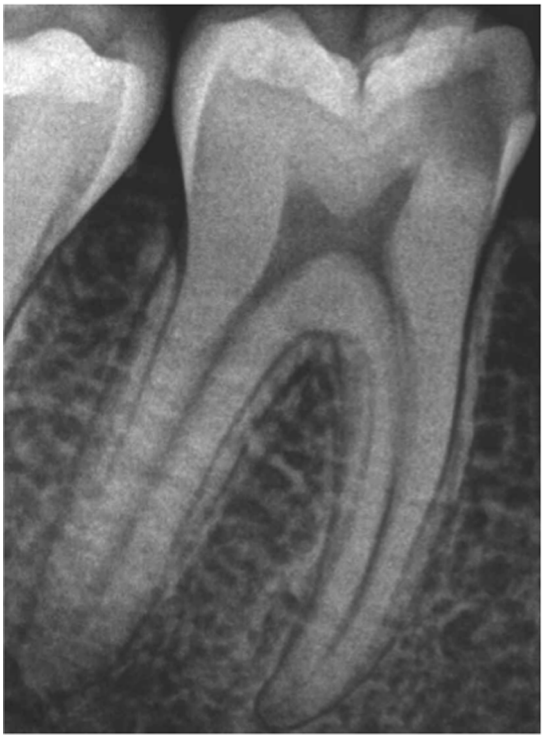

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1. HOW WOULD YOU TREAT THIS TOOTH?

- ☐ Pulp Capping
- ☐ Partial Pulpotomy (or Cvek pulpotomy)
- ☐ Full coronal pulpotomy
- ☐ Pulpectomy and root canal treatment

2. IF PULPOTOMY IS PERFORMED WHAT MATERIAL WOULD YOU CHOOSE?

- ☐ Hard setting calcium hydroxide
- ☐ MTA
- ☐ Biodentine
- ☐ Non-setting calcium hydroxide
- ☐ Ledermix/ Odontopaste
- ☐ Other_____

3. WHY?

- ☐ It gives me predictable outcomes
- ☐ I was trained to use it at college
- ☐ I am not familiar with the others
- ☐ It is easiest to handle
- ☐ Expense

Other_____

4. WOULD YOU USE ANTIBIOTICS (EITHER TOPICAL [E.G. LEDERMIX] OR SYSTEMIC)

Y N

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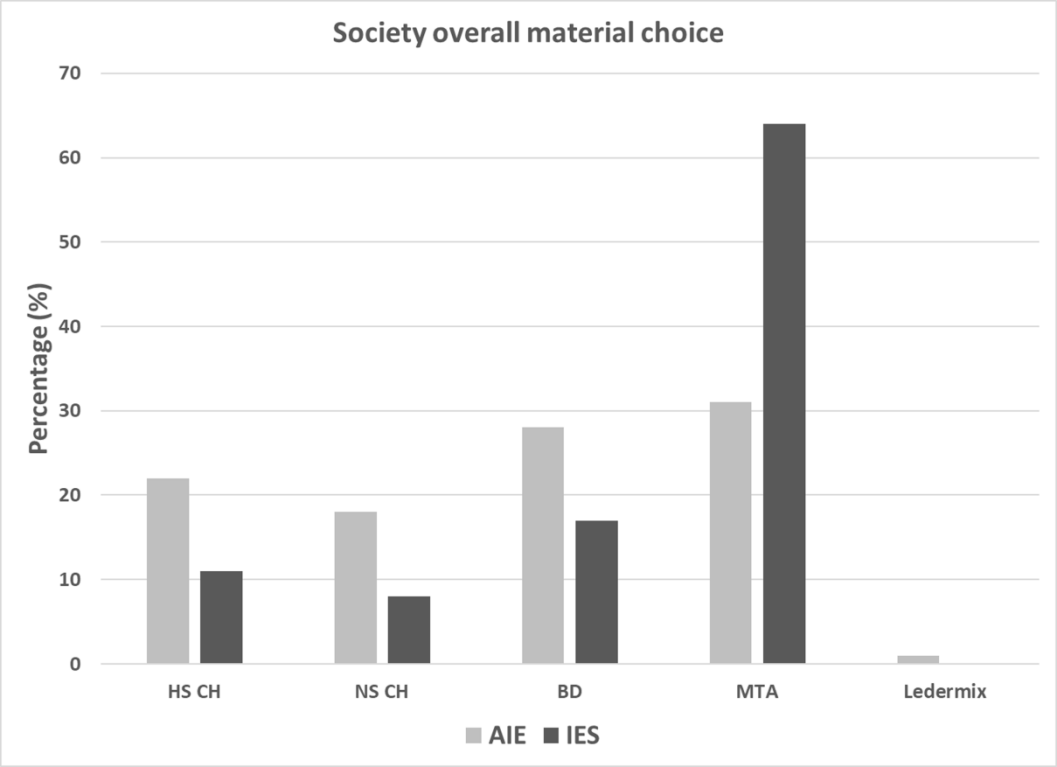

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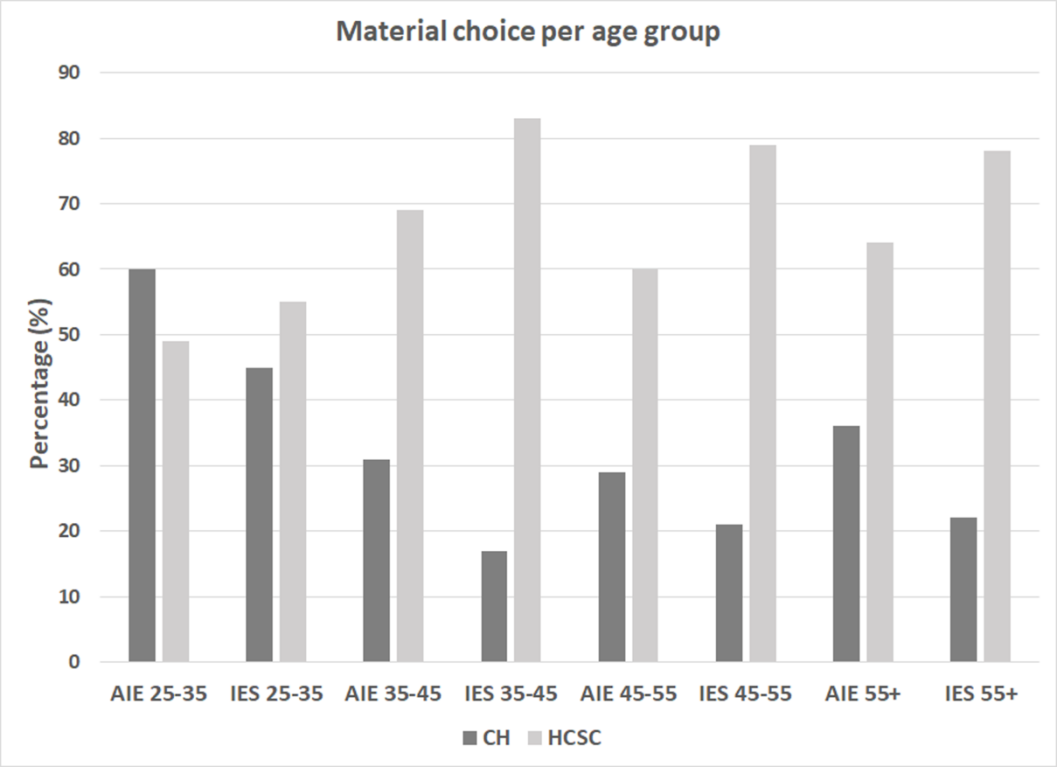

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