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Endodontic Treatment in Switzerland

A National Survey

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SUMMARY

The purpose of this study was to collect information about current treatment protocols of endodontic procedures among general practitioners (GP), endodontically interested practitioners (EI) and endodontic specialists (ES) in Switzerland and to compare them with available endodontic quality guidelines and former surveys.

A questionnaire was distributed to 1,522 attendees of two national conferences (Swiss Dental Association, 2015; Swiss Society for Endodontology, 2016) addressing socio-demographic characteristics and specific questions about root canal treatments (RCT) including techniques and materials used. Five hundred and six surveys were collected comprising data of 81.8% GP, 14.4% EI and 3.8% ES (response rate: 33.2%). The majority of respondents was male (59.9%), 40–59 years old (55.9%) with >20 years of clinical experience (54.3%). 498 participants (98.4%) stated to perform RCT. Rubber dam was always used in 52.2%

of GP, 69.9% of EI and 89.5% of ES, while *never-user* accounted for 14.1%. Overall, 63.9% used loupes and 13.7% microscopes (mostly by ES). Rotating instruments were selected in 43.2%, followed by conventional hand-instruments (37.8%) and reciprocating instruments (19%). GP rarely activated irrigants and applied NaOCl in lower concentrations (>0.5–1%) compared to ES. GP preferred lateral compaction (57%), ES performed vertical compaction in 89.5%. 92% completed RCT after two or more visits. The majority of dentists in Switzerland follow the available quality guidelines and the present findings are coherent with internationally published surveys. Nonetheless, discrepancies are still present between daily practice and endodontic quality guidelines, especially with the routine use of rubber dam and working length determination, predominantly within the endodontic non-specialists.

Introduction

A recent nationwide survey including the data of 18,357 Swiss households highlights improvements of the oral health over 20 years focusing on tooth retention and tooth replacement methods (SCHNEIDER ET AL. 2017). More than 90% of the study population exhibited a fully functional dentition in 2012 with less than nine teeth missing up to the age of 75 to 85 year-old, and only 2.2% were found edentulous (SCHNEIDER ET AL. 2017). Even though the periapical health status has not been investigated in the above-mentioned survey, other data from a smaller Swiss population reveal the presence of periapical lesions in 3.8% to 12% depending on various factors (male, female, smoking etc.) (RODRIGUEZ ET AL. 2013). The fact of more teeth being retained at older ages might affect the presence of periapical pathologies in future and hence increase the potential need of endodontic treatment/retreatment in general practice. According to the quality guidelines of the European Society of Endodontology (ESE) and the Swiss Society for Endodontology (SSE), endodontic procedures such as root canal treatment (RCT) aim at preserving periapical health or if diseased, restoring the periradicular tissues with the ultimate goal to maintain a healthy, natural dentition (ESE 2006; SSE 2014).

Multiple studies have been published on RCT, which associate the success and failure of endodontic procedures with clinical aspects (e.g. previous apical periodontitis, sinus tract) and the quality of the root canal treatments and highlight the need of improving the technical standards in general dental practice (SJOEGREN ET AL. 1990; SAUNDERS ET AL. 1997; WEIGER ET AL. 1997; NG ET AL. 2011; CONNERT ET AL. 2018B). Recent nationwide surveys provided insight into prevailing trends in endodontic treatment amongst general practitioners (GP) in Belgium and the USA (SAVANI ET AL. 2014; NEUKERMANS ET AL. 2015). For dentists in Switzerland only one survey representing national scale data is available dating back to 1995, from which the use of obsolete materials and techniques can be depicted, emphasizing a great difference to today's protocol (BARBAKOW ET AL. 1995A). The continuous development of advanced treatment technologies, the broad variety of chemical solutions and the use of new materials in endodontics are steadily evolving, focusing on efficient and simplified treatment approaches. However, no data is present as to how these advances correlate with endodontic treatments of Swiss-based dentists at their daily routine.

The purpose of this study was to collect information about the performance on endodontic treatment of different groups of dentists: general practitioners (GP), endodontically interested practitioners (EI) and endodontic specialists (ES) in Switzerland and to investigate the types of RCT completed (single-/multi-rooted, revision), the techniques, instruments and materials used and socio-demographic characteristics of the participants. Furthermore, the present standard of root canal treatments was compared to former surveys and assessed whether the available quality guidelines for endodontic treatments were respected.

Materials and Methods

Questionnaire

The design of the questionnaire was adapted and modified from SAVANI AND COLLEAGUES (2014) comprising a total of 21 questions covering the socio-demographic distribution of the participants: age, gender, years of clinical experience, location of practice and university of graduation. Further questions referred to the frequency and type of treated root canals, tech-

niques and materials used during routine endodontic treatment, the amount of hours accumulated in continuing education in endodontology (CE) and memberships of dental societies as well as completed clinical specialties (Fig. 1).

The questionnaires were distributed to attendees of two dental conferences in Switzerland: the annual three-day conference of the Swiss Dental Association (SSO) held in Montreux (May 2015) and the two-day conference of the Swiss Society for Endodontology (SSE) held in Lausanne (January 2016). Upon distribution at the SSE, participants were reminded of the previous distribution at the SSO and were asked to fill-in only one questionnaire in total in order to diminish a possible overlap. According to the administration offices, 1,232 dentists attended the SSO conference and approximately 290 visited the SSE congress, making a total of 1,522 dentists. The SSO congress commonly addresses general practitioners (GP) while endodontic specialists (ES) and endodontically interested practitioners (EI) more frequently attend the SSE conference. The questionnaire was composed bilingually in German and English and all returned questionnaires were treated anonymously.

Analysis

Data was collected and entered in Excel spread sheets (Microsoft, Redmond, WA, USA) by one operator (A.S.) and verified in a second, independent run. Data was considered "missing" if no answer, unclear or multiple answers were present. In difficult/unclear cases, a second operator (M.A.) was consulted and the data was adjusted upon agreement. The results were weighted according to the response of question No. 1. Only participants with "yes" were included in the subsequent analysis regarding RCT. To assess socio-demographic characteristics (questions No. 1, 15-21) the data of all participants were included.

Descriptive statistics was applied and results were described in percentages (%). Questions with the possibility of multiple answers were given as whole numbers, since they would exceed the maximum percentage value. Missing answers were not stated separately as "missing" in tables but account for the remaining percentages if the sum of partial answers did not equal 100%.

Results

Data Structuring

A total of 506 surveys were returned, indicating a response rate of 33.2% by assumption that every participant received a questionnaire. The questionnaires were divided into three groups based on their distribution (SSO, SSE) and response of question No. 16 (specialisation in Endodontology). The first group consisted of 414 participants (81.8%) representing the general practitioners (GP) attending the SSO congress and negating question No. 16. Endodontically interested respondents (EI) mainly visited the SSE conference and formed the second group with 73 participants negating question No. 16 (14.4%). The third group of 19 participants (3.8%) defined the endodontic specialist group (ES), which was composed of 4 specialists registered at the SSO conference and of 15 specialists registered at the SSE conference.

Characteristics of the respondents

The socio-demographic and clinical characteristics of the 506 respondents are presented in Table I. Overall, 498 participants (98.4%) stated to perform root canal treatments. The



Umfrage zum aktuellen Stand der Endodontologie in der Schweiz

Sehr geehrte Zahnärztinnen und Zahnärzte der Schweiz, wir wären Ihnen dankbar, wenn Sie die folgenden Fragen beantworten könnten. Die Daten bleiben anonym. Sie können den Fragebogen beim Ausgang abgeben. Wir danken Ihnen für Ihre Mitarbeit.

Dear dentists of Switzerland, we would appreciate your contribution to this survey by answering the following questions. The data will stay anonymous. You may drop the completed questionnaire off at the exit. Thank you for your collaboration.

-
1. **Führen Sie Wurzelkanalbehandlungen (WB) selbst durch? Falls "Nein", fahren Sie bitte mit Frage 15 fort.** *Do you treat root canals yourself? If „No“, please proceed to Question n. 15.*
- Ja Yes Nein No
-
2. **Wie viele WB therapieren Sie durchschnittlich in einem Monat?**
How many root canal treatments (RCT) do you approximately treat in one month?
- 1-10 11-20 >20
-
3. **Welche von den unten aufgeführten Fällen behandeln Sie und wie oft?**
Which of the below listed types of RCT do you attend to and in which occasion?
- | | regelmässig
<i>often</i> | manchmal
<i>sometimes</i> | selten
<i>rarely</i> | nie
<i>never</i> |
|---|-----------------------------|------------------------------|--------------------------|--------------------------|
| Einwurzelige:
<i>Single-rooted:</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Mehrwurzelige:
<i>Multi-rooted:</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Revisionen:
<i>Retreatment:</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
-
4. **Wie oft verwenden Sie Kofferdam?** *How often do you use rubber dam?*
- immer
always meistens
frequently manchmal
sometimes nie
never
-
5. **Benützen Sie Vergrößerungshilfen?** *Do you use magnification?*
- Lupenbrille
Loupes Mikroskop
Microscope andere
other Nein
No
-
6. **Wie bestimmen Sie Ihre Arbeitslänge?** *How do you define your working length?*
- radiologisch
radiologically endometrisch
electronically beides
both andere
other
-
7. **Mit welchen Instrumenten arbeiten Sie regelmässig?**
Which instruments do you use regularly?
- Handinstrumente
Hand-Instruments Rotierende
Rotary Reziproke
Reciprocating
-
8. **Verwenden Sie Natriumhypochlorit (NaOCl) als Hauptspüllösung?**
Do you use sodium hypochlorite (NaOCl) as your main irrigant?
- Ja Yes: _____% Andere Other: _____
-
9. **Setzen Sie aktivierte Spüllösungen ein (z.B. Schall, Ultraschall, etc.)?**
Do you apply any activated solutions during irrigation (e.g. sonic, ultrasonic, etc.)?
- Ja Yes Nein No
-

Fig.1 Questionnaire adapted and modified from SAVANI AND COLLEAGUES (2014) in German and English

10. Entfernen Sie die Schmierschicht (Smear Layer)? *Do you remove the smear layer?*

Ja Yes Nein No

11. Wie viele Sitzungen benötigen Sie durchschnittlich für eine WB? *How many appointments do you generally require for a RCT?*

eine one zwei two mehr als zwei more than two

12. Was verwenden Sie routinemässig als medizinische Einlage? *What do you regularly apply for your intracanal dressing?*

Kalziumhydroxid, Ca(OH)₂ andere other,
Calcium hydroxide z.B. e.g.: _____

Ledermix® keine none

13. Belassen Sie die Kanäle offen für eine Drainage? *Do you leave teeth open for drainage?*

Ja Yes Nein No manchmal sometimes

14. Welche Technik für die Wurzelfüllung verwenden Sie am häufigsten? *Which obturation method do you frequently use?*

Laterale Kondensation Carrier basierte Füllung Silberstift
Lateral Compaction *Carrier-Based Obturator* *Silver Point*

Vertikale Kondensation Pastenfüllung andere
Vertical Compaction *Paste Filling* *other*

15. Wie viele Fortbildungsstunden haben Sie in den letzten fünf Jahren durchschnittlich in der Endodontologie absolviert? *How many hours of continuing education have you approximately accomplished in Endodontology in the past five years?*

1-10 11-20 >20 keine none

16. Sind Sie spezialisiert oder haben ein Weiterbildungsprogramm (WBA) abgeschlossen? *Have you specialized or finished a postgraduate Diploma (WBA)?*

in Endodontologie in Endodontology andere other Nein No

17. Sind Sie Mitglied einer Zahnärzte-Gesellschaft? *Are you member of a swiss dental association?*

SSO SSE andere other Nein No

18. Wie viel Berufserfahrung haben Sie schon (Jahre)? *How much working experience do you have (in years)?*

0-10 11-20 >20

19. In welchem Kanton arbeiten Sie zurzeit? *In which canton do you currently work?*

20. Wo haben Sie Ihr Studium abgeschlossen? *Where have you accomplished your studies?*

21. Bitte geben Sie Ihr Alter und Geschlecht an: *Please specify age and gender:*

Alter age: _____ Jahre years weiblich männlich
(female) (male)

Vielen Dank für Ihre Teilnahme *Thank you for your participation*

Fig.1 Questionnaire adapted and modified from SAVANI AND COLLEAGUES (2014) in German and English

majority is between 40 and 59 years old (55.9%) and more than 20 years of clinical experience were indicated by 54.3%. Of all respondents, the majority was male (59.9%), which was coherent throughout all subgroups (GP/EI/ES).

The hours of continuous education (CE) in endodontology in the past five years differed among the three subgroups: the ma-

majority of GP (54.1%) attended 1 to 10 hours, whereas the majority of ES (94.7%) and EI (43.8%) absolved more than 20 hours of CE in endodontology in the past 5 years. Of all 506 respondents, 355 did not complete a specialisation or postgraduate diploma, of which 300 were GP and 55 were EI. 467 respondents stated to be members of the SSO and 69 of the SSE while 24 participants were not affiliated with any dental association.

Figure 2 shows the geographical distribution of the working place within Switzerland (Canton) representing respondents from 22 out of 26 cantons. 12.5% of the participants studied abroad, 1% studied abroad and in Switzerland and 1.7% did not give any indication of their study place. Of the remaining 84.8% Swiss absolvents, most graduated from the university of Bern (34.8%), followed by Basel (24.1%), Zurich (22.6%) and Geneva (18.5%).

Tab. I Socio-demographic and clinical characteristics of the respondents

	GP n = 414	EI n = 73	ES n = 19	All n = 506
	Frequency (in %)			
Performing endodontic treatment				
Yes	98.1	100.0	100.0	98.4
No	1.9	0.0	0.0	1.6
Clinical experience (years)				
0-10	22.9	24.7	15.8	22.9
11-20	23.4	15.1	21.1	22.1
>20	53.1	60.3	57.9	54.3
Age (years)				
20-39	26.8	28.8	15.8	26.7
40-59	54.3	61.6	68.4	55.9
>60	17.1	9.6	10.5	15.8
Gender				
Female	39.4	39.7	42.1	39.5
Male	60.4	57.5	57.9	59.9
Hours of CE in endodontology in the past 5 years				
1-10	54.1	21.9	0	47.4
11-20	25.4	31.5	0	25.3
>20	10.1	43.8	94.7	18.2
None	8.7	2.7	0	7.51
	Frequency (in numbers)			
Specialisation or postgraduate diploma				
In endodontology	0	0	19	19
Other	112	18	2	132
No	300	55	0	355
Membership of a dental association				
SSO	392	59	16	467
SSE	26	29	14	69
Other	73	22	6	101
None	15	8	1	24

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, CE = continuous education, lighter background indicates highest value

Performance of RCT

Table II shows the information on the frequency and type of RCT of all 498 participants with the response "yes" in question No. 1. Most of the GP (67.0%) and EI (61.6%) treated up to 10 RCT per month, while 57.9% of the ES performed more than

Tab. II Information about the frequency of root canal treatment

	GP n = 406	EI n = 73	ES n = 19	All n = 498
	Frequency (in %)			
RCT per month				
0-10	67.0	61.6	10.5	64.1
11-20	28.3	26.0	31.6	28.1
>20	4.4	9.6	57.9	7.2
Type of RCT performed				
Single-rooted				
Often	74.9	65.8	68.4	73.3
Sometimes	20.7	31.5	21.1	22.3
Rarely	2.7	2.7	5.3	2.8
Never	0.0	0.0	0.0	0.0
Multi-rooted				
Often	78.6	80.8	94.7	79.5
Sometimes	17.5	16.4	0.0	16.7
Rarely	3.2	1.4	0.0	2.8
Never	0.0	0.0	0.0	0.0
Retreatments				
Often	13.8	17.8	89.5	17.3
Sometimes	33.5	41.1	5.3	33.5
Rarely	43.8	35.6	0.0	41.0
Never	5.9	2.7	0.0	5.2

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, RCT = root canal treatment, lighter background indicates highest value

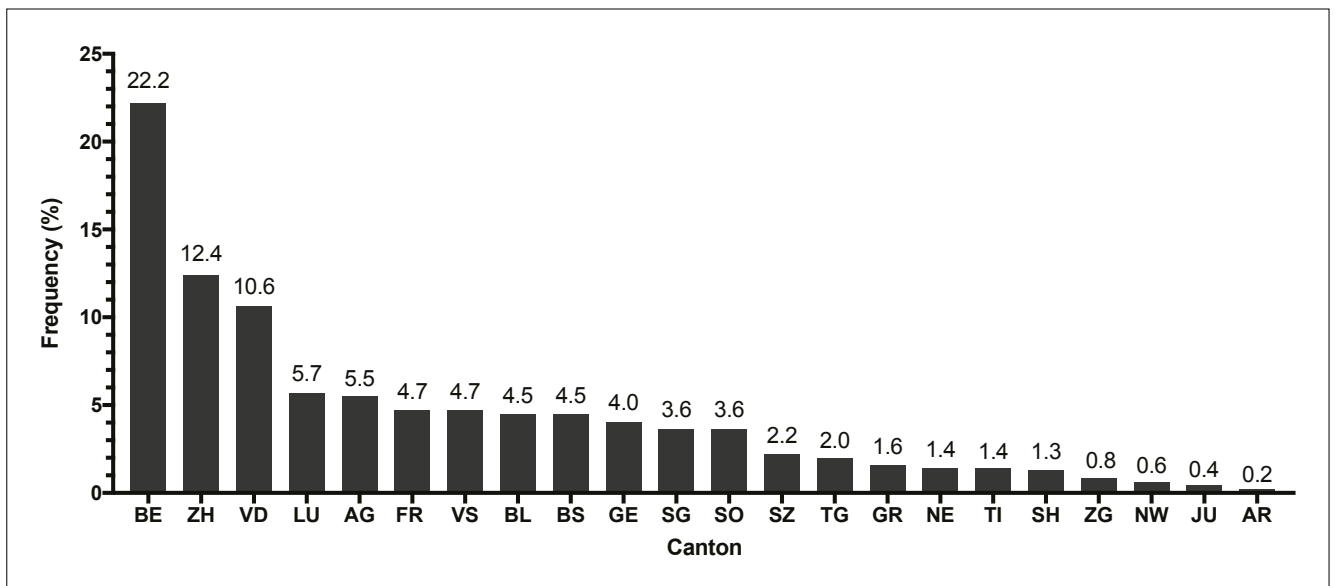


Fig. 2 Geographical distribution of the working place within Switzerland (Cantons) of all respondents: BE = Bern, ZH = Zurich, VD = Vaud, LU = Lucerne, AG = Aargau, FR = Fribourg, VS = Valais, BL = Baselland, BS = Basel-Stadt, GE = Geneva, SG = St. Gallen, SO = Solothurn, SZ = Schwyz, TG = Thurgau, GR = Graubünden, NE = Neuchâtel, TI = Ticino, SH = Schaffhausen, ZG = Zug, NW = Nidwalden, JU = Jura, AR = Appenzel Ausser rhoden

20 RCT per month. Overall, all groups performed RCTs on single- (73.3%) and multi-rooted (79.5%) teeth. A difference among the subgroups was present for root canal retreatments; ES indicated to retreat often (89.5%), EI sometimes (41.1%) and GP rarely (43.8%).

The type of appliances, aid devices and treatment techniques used by the participants are displayed in Table III. The majority of respondents from each group met the available quality guidelines for endodontic treatments released by the European Society of Endodontology (ESE 2006), which are indicated by asterisks in Table III. The majority of participants claimed to always use rubber dam with 52.2% for GP, 69.9% for EI and 89.5% for ES. Only in the groups GP and EI dentists stated to never use rubber dam, summing up to 14.1%. In terms of magnification, 63.9% of all respondents used loupes and 13.7% microscopes, from the latter the majority belonged to the ES group (76.3%). The working length determination occurred mostly by a combination of radiological and electronic verification (56.2%). During root canal preparation, rotating instruments (43.2%) accounted for the most frequently selected, followed by conventional hand instruments (37.8%) and reciprocating systems (19%) with no remarkable difference among the subgroups. As the main disinfecting irrigation solution, the majority of GP (46.8%) used sodium hypochlorite (NaOCl) in concentrations between 0.5 and 1%, whereas the majority of ES (68.4%) and EI (65.1%) applied concentrations greater than 1%. Frequently, additional irrigation solutions were named by the respondents, which are summarised in Table IV. Overall, 23.5% of all participants activated their solutions during irrigation, indicating a decrease from ES (activation in 89.5%) to EI (43.8%) followed by GP (16.7%), but the majority of all participants undertook measures to remove the smear layer (GP 64.3%; EI 79.5% and ES 94.7%).

RCT was carried out mainly in two appointments (68.5%) or more (24%) preferring calcium hydroxide (Ca(OH)₂) (55.2%) to Ledermix (37.9%) as inter-appointment dressing. Other inter-appointment dressings are presented in Table V. While Chlorhexidine (CHX) pastes accounted for the sole alternative

Tab. III Participants' information about the treatment of root canals

	GP n = 406	EI n = 73	ES n = 19	All n = 498
Frequency (in %)				
Use of rubber dam				
Always*	52.2	69.9	89.5	56.2
Frequently	16.3	16.4	5.3	15.9
Sometimes	15.3	6.8	0.0	13.5
Never	15.8	6.8	0.0	14.1
Use of magnification*				
Loupes	66.1	63.0	18.4	63.9
Microscope	9.5	20.5	76.3	13.7
None	24.4	16.4	5.3	22.5
Determination of working length				
Radiological	9.1	5.5	5.3	8.4
Electronic	33.6	43.8	26.3	34.8
Radiological and electronic*	56.7	50.7	68.4	56.2
Other	0.6	0.0	0.0	0.5
Type of instruments used				
Hand instruments	39.0	31.5	36.8	37.8
Rotary	40.7	58.2	39.5	43.2
Reciprocating	20.4	10.3	23.7	19.0

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, * recommended by the European Society of Endodontology where applicable (ESE 2006), lighter background indicates highest value

Tab. III Participants' information about the treatment of root canals

continued

	GP n = 406	EI n = 73	ES n = 19	All n = 498
Frequency (in %)				
Sodium hypochlorite as main irrigant				
Yes				
0.5–1%	46.8	30.1	31.6	43.8
>1%	42.9	65.1	68.4	47.1
Other (Table IV)	9.1	3.4	0.0	7.9
Use of activated solutions during irrigation				
Yes(*)	16.7	43.8	89.5	23.5
No	83.0	56.2	10.5	76.3
Removal of smear layer				
Yes	64.3	79.5	94.7	67.7
No	31.0	19.2	0.0	28.1
Average number of appointments				
One	6.4	5.3	7.9	6.3
Two	67.5	70.3	81.6	68.5
>Two	25.0	23.1	5.3	24.0
Type of intracanal dressing				
Ca(OH) ₂	52.8	63.7	75.4	55.2
Ledermix	40.2	28.8	22.8	37.9
Other (Table V)	5.1	6.2	1.8	5.1
None	0.5	0.0	0.0	0.4
Leaving teeth open for drainage				
Yes	4.9	5.5	5.3	5.0
No*	62.1	72.6	94.7	64.9
Sometimes	31.8	21.9	0.0	29.1
Obturation method most frequently used				
Lateral compaction	57.0	47.9	2.6	53.6
Vertical compaction	14.8	24.0	89.5	19.0
Carrier-based obturator	13.1	19.9	5.3	13.8
Paste filling	9.3	4.8	2.6	8.4
Silver point	0.0	0.0	0.0	0.0
Other	4.6	3.4	0.0	4.3

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, * recommended by the European Society of Endodontology where applicable (ESE 2006), lighter background indicates highest value

inter-appointment dressing in the ES group, a wider range is reported by EI and GP naming the three most common: Asphaltine (50.0% GP; 35.7% EI), Iodine (15.3% GP; 21.4% EI)

Tab. IV Other irrigation solutions used by certain participants

	GP (9.1%)	EI (3.4%)	ES (0%)	All (7.9%)
Frequency (in %)				
Irrigation Solution				
H ₂ O ₂	52.0	25.0	0.0	51.0
CHX	42.9	75.0	0.0	44.1
Neomycin	2.0	0.0	0.0	2.0
Ringer	2.0	0.0	0.0	2.0
Alcohol	1.0	0.0	0.0	1.0

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, H₂O₂ = hydrogen peroxide, CHX = chlorhexidine, lighter background indicates highest value

Tab. V Other intracanal dressings used by certain participants

	GP (5.1%)	EI (6.2%)	ES (1.8%)	All (5.1%)
Frequency (in %)				
Intracanal dressing				
Asphaltine	50.0	35.7	0.0	44.3
Iodine	15.3	21.4	0.0	17.0
CHX	5.6	0.0	100.0	9.1
Vitapex	2.8	28.6	0.0	4.5
Walkhoff-Paste	2.8	14.3	0.0	3.4
Asphaltine Temp	0.0	0.0	0.0	2.3
Ca(OH) ₂ combined	5.6	0.0	0.0	2.3
CHKM	2.8	0.0	0.0	2.3
Cresopliene (Russian Red)	2.8	0.0	0.0	2.3
Fucidin	2.8	0.0	0.0	2.3
Pulpitan/W1	0.0	0.0	0.0	2.3
Septomixine	2.8	0.0	0.0	2.3
Terracortril, Topsym	2.8	0.0	0.0	2.3
W3	2.8	0.0	0.0	2.3
N2	1.4	0.0	0.0	1.1

GP = general practitioner, EI = endodontically interested practitioner, ES = endodontic specialist, CHX = chlorhexidine, Ca(OH)₂ = calcium hydroxide, CHKM = chlorophenol, camphor and menthol solution, W3 = Walkhoff-Paste (iodine paste with CHKM), N2 = zinc oxide, eugenol and paraformaldehyde, lighter background indicates highest value

and Vitapex (2.8% GP; 28.6% EI). GP tended to leave teeth open for drainage sometimes (31.8%) while a great majority of ES (94.7%) did not report of coronal drainage. The overall obturation method was lateral compaction (LC) 53.6% followed by vertical compaction (VC) (19%) and carrier-based obturation (13.8%). At subgroup level, a discrepancy was present between

ES and GP/EI with the VC being favoured by ES in 89.5% using LC in only 2.6%. Silver points were not used anymore.

Discussion

This study highlights the current trends in endodontics amongst dentists in Switzerland and provides an insight into the endodontic case selection and treatment procedures of general practitioners (GP), endodontically interested practitioners (EI) and endodontic specialists (ES). Satisfactory, the majority of respondents from each group met the available quality guidelines for endodontic treatments released by the European Society of Endodontology (ESE 2006) and Swiss Society for Endodontology (SSE 2014), which will be specified and discussed more detailed below. In an international comparison, similar patterns in terms of applied techniques during root canal preparation and irrigation are reflected (SAVANI ET AL. 2014; NEUKERMANS ET AL. 2015). Within Switzerland, endodontic treatment procedures have evolved over the past 20 years especially in the field of root canal preparation (more machine-driven instruments), working length determination (increased electronic measurements) and irrigation (NaOCl standard) (BARBAKOW ET AL. 1995A).

Study design and population

The 506 participants from this investigation represent around 8.6% of the 5,854 registered dentists in Switzerland per December 2016 (BAG 2017). While interpreting the present data, one needs to be aware, that the geographical distribution was not equal, the response rate (Rr) was rather low (33.2%) and the sample size represents a margin of error of about 4% if scaled up to the whole Swiss dentist population. Hence, nationwide conclusions might be drawn with reservation. Nonetheless, similar recent surveys are available from the USA (Rr 24%, n = 479) (SAVANI ET AL. 2014) and Belgium (Rr 18.5%, n = 827) (NEUKERMANS ET AL. 2015) and former ones from Switzerland (Rr 62.4%, n = 2091) (BARBAKOW ET AL. 1995A) allowing a comparison of the current findings. In contrary to the above-mentioned studies, the method of distribution of this questionnaire was neither by mail nor attached to newspapers, but handed out at two national conferences. It still did not achieve such a successful completion rate as reported by HOMMEZ AND COLLEAGUES (2003) (99.4%, n = 312), which used a similar procedure. One factor that might have affected the response rate could be attributed to the language design of the questionnaire. Both congresses were held in the French-speaking area of Switzerland, in the canton of Vaud. The survey was designed in a simple layout in German and English only. Perhaps, a French and Italian version would have led to a higher response rate, since this might have been more inviting to Swiss-French-/Italian-speaking participants. Nonetheless, the respondents' geographical distribution covers 22 out of 26 cantons including French- and Italian-speaking regions with the third most participants from the canton of Vaud (10.6%), which is just behind Zurich (12.4%) and Bern (22.2%). Another factor addressing the low response rate could be attributed to the performance of RCTs itself due to a selection bias of the study participants. Dentists who do not perform RCTs at their daily routine might not have filled in or returned the questionnaires despite question No. 1, potentially leading to an overestimation of GP performing RCT (98.1%) in Switzerland.

A clear difference between the specialists and the remaining groups was seen in the amount of RCT per month (>20 ES;

0–10 EI/GP) and the frequency of retreatments, demonstrating an obvious preference of retreatment cases in the specialist group (ES). This has been investigated by other studies where GP tended to observe or extract teeth more frequently instead of choosing retreatment (BALTO & AL-MADI 2004; WENTELER ET AL. 2015). Of the current cohort, EI are seen to be similar to GP but with a special interest in endodontics. Overall, 59% of EI performed retreatments often or sometimes opposed to 47% of GP. This finding might be attributed to more hours of CE in endodontology (SAVANI ET AL. 2014), which was present for EI. More hours of CE have been correlated with more retreatments and more endodontic procedures on molars (SAVANI ET AL. 2014). Regarding the tooth type (multi/single-rooted) a similar distribution was observed among the present participants.

Use of rubber dam

The primary aim of rubber dam during endodontic treatment is to prevent salivary and bacterial contamination of the root canal system and secondly to eliminate the risk of inhalation, ingestion and exposure of instruments and irrigating solutions into the oral cavity (ESE 2006). Both, national (SSE 2014) and international guidelines (ESE 2006) recommend the use of rubber dam throughout the whole endodontic procedure, and a positive outcome of tooth survival has been reported by using rubber dam during initial endodontic treatments (LIN ET AL. 2014). Compared to the Swiss national survey from 1995 (BARBAKOW ET AL. 1995B) the use of rubber dam in Switzerland increased from 31% to 56% and correlates with the results reported by SAVANI AND COLLEAGUES (2014) (60% always, 16% usually, 13% sometimes and 11% never). While looking at the subgroup level, the current data indicate a gap between GP and ES/EI. Notably, ES and EI used rubber dam always in 90% and 70% opposed to 52% in the GP group. *Never-users* were predominantly in the GP group (15.8%). The high number of *never-users* is striking considering that the use of rubber dam during endodontic treatment has been taught mandatory at university level in Switzerland for decades. Still, the majority of the participants respected the current guidelines, but improvements of the use of rubber dam during the daily routine should be addressed, especially amongst GP.

The current guidelines recommend magnification and additional light sources during RCT in order to facilitate the identification of the root canal anatomy (ESE 2006; SSE 2014). Recent data indicate around 80% of American GP use some kind of magnification during endodontic procedures (SAVANI ET AL. 2014). The present investigation illustrates similar findings with 78% of all respondents using either loupes or microscopes. GP and EI preferred loupes while ES predominantly work with microscopes. Although there is no clinical evidence yet of improving the endodontic long term success by microscopes (PERRIN ET AL. 2014), magnification has its benefit in endodontic acuity e.g. detecting vertical fractures, eliminating obstacles or finding the second mesiobuccal canal more frequently (BUHRLEY ET AL. 2002; HASAN & RAZA KHAN 2014).

Root canal preparation and irrigation

For root canal preparation and irrigation, quality guidelines do not specify any recommendation of types of instruments or solutions to favour, but are predicated on the principles of eliminating microorganisms while maintaining the original root canal anatomy (ESE 2006; SSE 2014). Over the past 20 years, a clear trend towards the acceptance of machine-driven root canal

instruments (rotating and reciprocating) is visible within Switzerland. While manual debridement was the most common technique in 1995 (60% manual, 38% combined manual/machined) (BARBAKOW ET AL. 1995A), around 62% used either rotary (43%) or reciprocating (19%) file systems to date. Higher success rates and shorter treatment times have been attributed to the use of rotating instruments, which could be one explanation for the current trend (CHEUNG & LIU 2009; CONNERT ET AL. 2018B). SAVANI ET AL. (2014) observed in their study a possible relationship between the use of rotary nickel-titanium (NiTi) files (74%) and single-visit treatments (63%), which could not be shown in this study.

Sodium hypochlorite (NaOCl) dominated as main solution during RCT according to the present investigation (91%), whereas in 1995 hydrogen peroxide (H₂O₂) was used just as often as NaOCl (BARBAKOW ET AL. 1995A). This finding is well in agreement with the current available literature, stating NaOCl as the most widely distributed irrigation solution due to its advanced characteristics of tissue-dissolving properties and highly antibacterial efficiency (SIQUEIRA ET AL. 2000; ZEHNDER ET AL. 2002, 2003, 2006; HOMMEZ ET AL. 2003; NAENNI ET AL. 2004; SAVANI ET AL. 2014; NEUKERMANS ET AL. 2015; WILLERSHAUSEN ET AL. 2015; VERMA ET AL. 2019). No remarkable difference between the use of lower (0.5–1%) and the use of higher (>1%) concentrated NaOCl could be distinguished among Swiss GP, but EI and ES favoured higher concentrated NaOCl (>1%) at a ratio of 2:1. The explanation for this trend in EI and ES is unclear since no official statement is currently implying to use NaOCl at concentrations higher than 1% in terms of the antibacterial impact and clinical outcome (SIQUEIRA ET AL. 2000; ZEHNDER ET AL. 2003, 2006; NG ET AL. 2011; VERMA ET AL. 2019). Despite the well-researched benefits of NaOCl, 9.1% of GP and 3.4% of EI still used other main irrigants during RCT. H₂O₂ was slightly favoured over CHX by GP, whereas EI clearly preferred CHX to H₂O₂. The use of alternative irrigation solution could be linked with the years of working experience: WILLERSHAUSEN AND COLLEAGUES (2015) found a direct correlation between the use of H₂O₂ and dentists with more years of practice.

Modern techniques and aid devices like activated irrigation systems can help to improve the quality of RCT in terms of enhanced dentin debris removal (JIANG ET AL. 2010). In the current study a discrimination between specialists and GP is present; 89.5% of ES activated their irrigation, but the majority of GP (83.0%) did not, which is congruent with the data from American GP (SAVANI ET AL. 2014) but is still higher than the respective number of GP activating irrigants reported from Germany (WILLERSHAUSEN ET AL. 2015) and Belgium (NEUKERMANS ET AL. 2015). With regard to the smear layer removal a decrease about 15% between each group is present from ES to EI to GP, but still, more than two third of all participants removed it routinely. These results are consistent with other international surveys (HOMMEZ ET AL. 2003; SAVANI ET AL. 2014; WILLERSHAUSEN ET AL. 2015) indicating, that the knowledge about the additional antibacterial benefit of EDTA in combination with NaOCl is present. According to the replies of today's dentists in Switzerland the authors conclude that the quality standards of irrigation are met by all subgroups.

Inter-appointment medication

The number of appointments required for root canal treatment deflects the need for inter-appointment medication. The overwhelming majority of the participants (92%) indicated two or

more appointments for the completion of RCT with almost no difference among the three groups, highlighting the need of intracanal medication in Switzerland. Twenty years ago, Leder-mix was widest spread (81.2%) followed by Asphaline (67.6%) and Ca(OH)₂ (60.2%) (BARBAKOW ET AL. 1995A). To date Ca(OH)₂ (52.8%) and Ledermix (40.2%) share an almost equivalent preference among Swiss GP. However, a different proportion is seen among specialists choosing Ca(OH)₂ over Ledermix. Among the intracanal dressings named “other” by the participants Asphaline and Iodine accounted for the majority. Some of the currently named medications including Terracor-trill, Pulpitan, Septomixine and N2 were also used in 1995 according to BARBAKOW AND COLLEAGUES (1995A). Not only N2 but also Asphaline relies on formaldehyde release. Disinfecting solutions and pastes should depend on organic contents and such comprising phenols or aldehydes are not suggested by current guidelines anymore due to their toxicity (SSE 2014).

Root canal filling and length determination

The objective of the root canal filling is to prevent microorganisms from passing along the root canal by sealing the whole canal system, including dentinal tubules and accessory canals (ESE 2006). From a clinical view, classic root canal filling techniques, e.g., single-cone, lateral or vertical compaction, carrier-based obturation techniques etc., stood the test of time in order to achieve the above-mentioned criteria (LI ET AL. 2014). The cold lateral compaction technique (LC) was the most common obturation method mentioned by GP (57.0%) of the current investigation, showing a similar occurrence in other countries as well (SLAUS & BOTTENBERG 2002; NEUKERMANS ET AL. 2015). In 1995 LC accounted for 34.4% with the single-cone technique as main obturation method (58.4%) leaving the vertical condensation to only 4.4% (BARBAKOW ET AL. 1995A). In contrast to today's GP, ES predominantly used the vertical compaction technique (89.5%), which might be attributed to the high distribution of dental microscopes among specialists and the up-to-date knowledge of endodontic trends and techniques (KERSTEN ET AL. 2008; WENTELER ET AL. 2015). The Toronto study elucidated the root-filling technique as significant outcome predictor for teeth with apical periodontitis 4–6 years after initial treatment (DE CHEVIGNY ET AL. 2008). In total, 77% of the cases filled with LC and 87% filled with vertical compaction (VC) were labelled as healed (DE CHEVIGNY ET AL. 2008). An overextension of gutta-percha, however, is more likely to happen with the warm compaction technique (PENG ET AL. 2007) possibly affecting the outcome negatively (NG ET AL. 2011). In the USA, GP have shifted from LC (40%) to some sort of warm gutta-percha compaction (54%), which was explained with a simultaneous increase in hours of CE (SAVANI ET AL. 2014). This trend, however, could not be seen amongst Swiss GP, but both, EI and ES, showed predominant use of vertical compaction techniques with concurrent high hours of CE supporting recent findings (SAVANI ET AL. 2014).

More than half of all participants of the current investigation (56.2%) determined the working length radiologically and electronically matching the results from SAVANI AND COLLEAGUES (2014) with 52%. In 1995 just 2.1% determined the working length with electronic devices (BARBAKOW ET AL. 1995A). Subgroup analysis showed that specialists (ES) used the combination more frequently than GP, which has also been reported previously from the United Kingdom (ORAFI & RUSHTON 2013). The current guidelines suggest to determine the working

length electronically and to validate the measurements with a radiograph (ESE 2006; SSE 2014). Although electronic apex locators are accurate in the determination of the working length *in vitro* (CONNERT ET AL. 2018A), a singular technique has not been proven to seem applicable on its own since electronic devices still have some limitations (GORDON & CHANDLER 2004) and radiographs alone can lead to overestimations and to unintentional widening of the apical foramen with possible overextensions past the apex (ELAYOUTI ET AL. 2002). With regard to the endodontic success, a precise determination of the working length (electronic and radiological) is important (NG ET AL. 2011).

Drainage via open tooth

Microorganisms are the main cause of acute endodontic emergencies like pulpitis, swelling and abscess formation. Leaving a tooth open for drainage results in immediate relief for the patient, however, it has been associated with severe recurrent exacerbations and increased appointments to complete root canal therapy almost 50 years ago (CLEM 1970; WEINE ET AL. 1975). From a bacteriological point of view, leaving the tooth open is strongly not recommended due to heavy colonisation of the root canal system (SIQUEIRA 2003). Citing the current guidelines from the European Society of Endodontology “the purpose of RCT is either to maintain asepsis of the root canal system or to disinfect it adequately” (ESE 2006). They address this topic implying not to leave a tooth open for drainage. In the guidelines from the Swiss Society for Endodontology the drainage is discussed within the chapter “endodontic surgery” and a drainage for a maximum of 24 h following surgical incision either coronally or via drain is recommended (SSE 2014). In the current study, drainage was not seen as standard procedure; but still, one third of the GP (31.8%) and one fifth of the EI (22%) performed it sometimes. The specialists (ES) on the other hand did not leave a tooth open for drainage in 94.7%. Similar findings amongst GPs were reported from the UK and USA (ELIYAS ET AL. 2013; SAVANI ET AL. 2014) showing that drainage is still widely applied. A possible explanation is the age of the respondents with more than 20 years of experience, who probably have learned this procedure during their studies. Age is important, as dentists with increased working years adhere more frequently to what they learned during their university education (WILLERSHAUSEN ET AL. 2015). This was also shown in a Turkish study where age was correlated with the use of outdated (e.g., arsenic- and aldehyde-containing) agents without rubber dam isolation despite the current knowledge (UNAL ET AL. 2012).

The present study reveals the current state of how dentists in Switzerland perform RCT and how it evolved over the past 20 years indicating prevalently satisfactory data regarding techniques, instruments and aid devices used in correlation with applicable quality guidelines (ESE 2006; SSE 2014) and comparable literature from other countries (SAVANI ET AL. 2014; NEUKERMANS ET AL. 2015). The fact that the majority of participants has graduated from Swiss universities (84.8%) and more than 92% are members of the SSO implies that they should be aware of and know the current treatment guidelines. Nonetheless, certain discrepancies are still present between daily practice and academic teaching recommendations/endodontic quality guidelines, especially with the routine use of rubber dam and working length determination, predominantly within the endodontic non-specialists.

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Zusammenfassung

Einleitung

Wurzelkanalbehandlungen (WKB) kommen in der Zahnmedizin häufig vor und werden oftmals durch Allgemeinzahnärzt/innen (*general practitioners [GP]*) durchgeführt. Aufgrund der stetig fortschreitenden technischen Entwicklung in der Endodontologie stellt sich die Frage, auf welchem wissenschaftlichen Stand die Endodontologie heutzutage in der Schweiz praktiziert wird. Ziel dieser Studie war, herauszufinden, wie Wurzelkanalbehandlungen aktuell und im Vergleich zu früheren Studien mit GP, endodontisch interessierten Zahnärzt/innen (*endodontically interested practitioners [EI]*) und Spezialist/innen (*endodontic specialists [ES]*) durchgeführt werden und ob sie in Einklang mit den geltenden Qualitätsleitlinien sind.

Material und Methoden

Es wurden Bögen mit 21 Fragen an zwei zahnärztlichen Kongressen in der Schweiz ausgehändigt (SSO 2015 und SSE 2016). Die Fragen betrafen soziodemografische Merkmale, die Ausübung von WKB und die fachliche Ausbildung. Die Befragten wurden in drei unterschiedliche Gruppen unterteilt: GP, EI und ES. Die Auswertung erfolgte mittels Excel-Tabellen und deskriptiver Statistik.

Resultate

Es wurden von insgesamt 1522 Besuchern beider Kongresse 506 Umfragen in die Auswertung eingeschlossen (Rücklaufquote: 33,2%). Die Mehrheit führte Wurzelkanalbehandlungen durch (98,4%). Das durchschnittliche Alter lag bei 55,9% zwischen 40 und 59 Jahren und die klinische Erfahrung bei 54,3% über 20 Jahren. Der Grossteil war männlich (59,9%). Die Anzahl erfolgter Weiterbildungsstunden in Endodontologie (CE) während der letzten 5 Jahre lag bei 54,1% der GP zwischen 1 und 10 Stunden, wohingegen 94,7% der ES über 20 Weiterbildungsstunden absolvierten.

Es zeigte sich, dass die meisten GP (67,0%) und EI (61,6%) bis zu 10 WKB im Monat durchführen und 57,9% der ES über 20 WKB. WKB-Revisionen wurden häufig von ES behandelt (89,5%). 89,5% der ES benutzten immer Kofferdam, gefolgt von 69,9% der EI und 52,2% der GP. Insgesamt gaben 14,1% aller Befragten an, kein Kofferdam zu verwenden. Vergrösserungshilfen im Sinne von Lupenbrillen wurden von 63,9% angewandt, wobei Mikroskope insgesamt von 13,7% verwendet wurden. Im Vergleich der Gruppen zeichnete sich eine deutliche Präferenz für Mikroskope bei den ES ab (76,3%). Die Arbeitslänge wurde in allen Gruppen meistens radiologisch und elektronisch gemessen (56,2%). Rotierende Instrumente wurden häufiger verwendet (43,2%) als konventionelle Handinstrumente (37,8%), wobei reziprozierende Instrumente die geringste Verbreitung aufwiesen (19%). Am häufigsten wurde in der GP-Gruppe 0,5%iges bis 1%iges Natriumhypochlorit (NaOCl) gewählt. 68,4% der ES hingegen benutzten NaOCl in Konzentrationen über 1%. Mehrheitlich erfolgte die WKB in zwei Sitzungen (68,5%) oder mehr (24%). Als medikamentöse Einlage dienten Kalziumhydroxid (55,2%) und Ledermix (37,9%). 31,8% der GP liessen den Zahn gelegentlich offen zur Drainage, wobei dies bei den ES in 94,7% der Fälle nie vorkam.

Als Wurzelfüllmethode wurde von den GP und den EI die laterale Kompaktion bevorzugt (57% und 47,9%) und die vertikale Kompaktion bei 89,5% der ES.

Diskussion

Aus der Umfrage geht hervor, dass sich die Mehrheit der Zahnärzt/innen in der Schweiz an die Qualitätsrichtlinien halten und die vorliegenden Daten sich mit international vergleichbaren Untersuchungen decken. Im Vergleich zu einer Schweizer Umfrage aus dem Jahre 1995 werden Materialien wie Kofferdam, rotierende Instrumente, NaOCl oder Kalziumhydroxid deutlich häufiger verwendet. Die vorliegende Untersuchung hat gezeigt, dass die von den GP am häufigsten angewandte Wurzelfülltechnik die laterale Kompaktion darstellt. Diese gilt auch im internationalen Vergleich nach wie vor als Goldstandard und ist in der Lage, allen Kriterien einer optimalen Wurzelfüllung gerecht zu werden. Aus der Umfrage geht weiter hervor, dass spezialisierte Zahnärzt/innen (ES) oder solche mit vermehrtem Interesse in Endodontologie (EI) (mehr CE in Endodontologie) eher zu warmen Fülltechniken wie der vertikalen Kompaktion und zur Verwendung von Mikroskopen neigen.

Trotz den positiven Entwicklungen über die letzten 20 Jahre im Bereich Endodontologie in der Schweiz liegen Diskrepanzen zwischen der täglichen klinischen Praxis und den empfohlenen universitären Lehrmeinungen/Qualitätsleitlinien vor. Ein Augenmerk sollte hierbei vor allem auf die routinemässige Anwendung von Kofferdam und die exakte Längenmessung gerichtet werden.

Résumé

Introduction

Les traitements de canal radiculaire (TCR) sont courants en médecine dentaire, et souvent effectués par le médecin-dentiste généraliste (*General Practitioner, GP*). En raison des progrès techniques constants de l'endodontologie, la question se pose de savoir quel est le standard scientifique de l'endodontologie pratiquée en Suisse aujourd'hui. L'objectif de cette étude était de savoir comment les traitements de canal sont actuellement effectués par les médecins-dentistes généralistes (GP), les médecins-dentistes intéressés à l'endodontie (*Endodontically Interested, EI*) et les spécialistes en endodontie (*Endodontic Specialists, ES*) par rapport aux études antérieures, et s'ils sont conformes aux lignes directrices actuelles relatives à la qualité des soins médico-dentaires.

Matériel et méthodes

Des formulaires comprenant 21 questions ont été distribués lors de deux congrès de médecine dentaire en Suisse (SSO 2015 et SSE 2016). Les questions portaient sur les caractéristiques socio-démographiques, la pratique du TCR et la formation professionnelle. Les personnes interrogées ont été divisées en trois groupes: GP, EI et ES. L'évaluation a été effectuée à l'aide de tableaux Excel et de statistiques descriptives.

Résultats

Sur un total de 1522 visiteurs aux deux congrès, 506 sondages ont été inclus dans l'évaluation (taux de réponse: 33,2%). La plupart (98,4%) pratiquaient des traitements de racine. L'âge moyen de 55,9% des répondants était compris entre 40 et 59 ans; la durée de leur expérience clinique était supérieure à 20 ans chez 54,3% d'entre eux. Les hommes étaient majoritaires (59,9%). Au cours des cinq dernières années, 54,1% des

médecins-dentistes généralistes ont suivi entre une et dix heures de formation continue en endodontologie (CE), alors que 94,7% des spécialistes en endodontologie (ES) ont bénéficié de plus de 20 heures de formation continue pendant cette même période.

Il s'est avéré que la plupart des GP (67,0%) et des EI (61,6%) pratiquaient jusqu'à 10 TCR par mois, et 57,9% des ES, plus de 20 TCR. Les révisions de TCR ont souvent été effectuées par des ES (89,5%). Pour réaliser ces interventions, 89,5% des ES ont toujours utilisé une digue en caoutchouc, suivis de 69,9% des EI et de 52,2% des GP. Au total, 14,1% de tous les répondants ont indiqué qu'ils n'utilisaient pas de digue en caoutchouc. Des aides à l'agrandissement de type lunettes de grossissement ont été utilisées dans 63,9% des cas, et des microscopes dans 13,7% des cas. La comparaison des groupes a montré une nette préférence pour le microscope parmi les ES (76,3%). Dans tous les groupes, la longueur de travail (longueur des instruments canaux jusqu'à la jonction cémento-dentinaire) a été mesurée principalement par voies radiologique et électronique (56,2%). Les instruments rotatifs ont été utilisés plus fréquemment (43,2%) que les instruments manuels conventionnels (37,8%), les instruments de réciprocité affichant la distribution la plus faible (19%). Dans le groupe GP, le choix le plus fréquent a été l'hypochlorite de sodium (NaOCl) 0,5 à 1%. Toutefois, 68,4% des ES ont utilisé du NaOCl à des concentrations supérieures à 1%. La majorité des TCR ont été réalisés en deux séances (68,5%) ou plus (24%). L'hydroxyde de calcium (55,2%) et la pâte Ledermix (37,9%) ont été utilisés comme pansements intercalaires. Les GP ont laissé occasionnellement la dent ouverte pour le drainage (31,8% des cas), alors que 94,7% des ES n'ont jamais procédé de cette manière. Pour les GP et EI, la méthode d'obturation radiculaire préférée a été la condensation latérale (57 et respectivement 47,9% des cas), alors que 89,5% des ES ont opté pour le compactage vertical.

Discussion

Cette enquête montre qu'en Suisse, la majorité des médecins-dentistes respectent les lignes directrices en termes de qualité et que les données disponibles concordent avec les évaluations comparables au niveau international. Par rapport à une enquête suisse de 1995, les digues en caoutchouc, les instruments rotatifs, le NaOCl et l'hydroxyde de calcium sont utilisés beaucoup plus fréquemment. La présente étude a montré que la technique d'obturation radiculaire la plus fréquemment utilisée par les GP est la condensation latérale. Elle est toujours considérée comme l'étalon-or, également dans les comparaisons internationales, et répond à tous les critères d'une obturation optimale du canal radiculaire. L'enquête montre également que les médecins-dentistes spécialisés (ES) ou ceux qui s'intéressent plus à l'endodontologie (EI) (davantage d'heures de formation continue en endodontologie, CE) sont plus enclins à utiliser les techniques d'obturation à chaud telles que le compactage vertical, ainsi que le microscope.

En Suisse, malgré les développements positifs des 20 dernières années dans le domaine de l'endodontie, il existe des divergences entre la pratique clinique quotidienne et les enseignements universitaires recommandés ou, respectivement, les lignes directrices en termes de qualité. Une attention particulière devrait être accordée, notamment, à l'utilisation systématique des digues en caoutchouc et à la mesure exacte de la longueur de travail.

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