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Original article

A survey of general dentists regarding orthodontic retention procedures

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Summary

Aim: To explore 1. how Swiss general dentists deal with complications associated with fixed orthodontic retainers, 2. collaboration between general dentists and orthodontists with regards to the organization and responsibility for long-term follow-up of orthodontic retainers, and 3. the need for standardized clinical guidelines regarding orthodontic retention.

Methods: A structured questionnaire was sent to 201 randomly selected dentists. They were asked about their experience with retainers, opinions regarding the advantages and disadvantages of different types of retainers, responsibility for patients wearing bonded retention and the communication between orthodontists and general dentists. Statistical analysis was carried out using SPSS software.

Results: The response rate was 61 per cent. About 55 per cent of the respondents had had experience with bonding fixed retainers and even more were familiar with their follow-up and repair. In case of complications, dentists usually contacted orthodontists according to the following rule: the more severe the complication, the more intense the communication. Most dentists hesitated to remove retainers when requested to do so by the patient and attempted to convince them to continue wearing them. Retainers bonded to all six anterior teeth were considered more efficient than those bonded to canines only; however, possible side effects (e.g. unwanted changes of the torque) were not well known. 66.4 per cent respondents were willing to take responsibility for patients in retention as early as 6 months after retainer placement. 93.2 per cent respondents would welcome the establishment of standardized guidelines.

Conclusions: Swiss general dentists have good knowledge of orthodontic retention and follow-up procedures. Nevertheless, introduction of clinical guidelines including information on the possible side-effects of bonded retention is justified.

Introduction

Retention is usually necessary following active orthodontic treatment to prevent relapse: the tendency of teeth to return to their pre-treatment positions. Relapse is caused by the recoil of periodontal fibres (1) and is influenced by factors such as continuing growth, forces originating from the orofacial musculature and various other factors (2–4). Relapse can be observed to some extent in the vast majority of patients (5). Retention is therefore necessary following orthodontic treatment to prevent relapse of the final occlusal outcome (6). It is essential that orthodontists, patients, and dentists

understand the importance of wearing retainers after orthodontic treatment (7, 8). Bonded lingual retainers have proven to be an effective means of retaining aligned anterior teeth in the post-treatment position long term. In the first retention phase, monitoring is performed mainly by the orthodontist, with the patients being referred to the general practitioner at a later stage.

Many differences in retention protocols regarding the choice of type and duration have been reported (9–14). Two basic designs of fixed lingual bonded retainers are currently in frequent use (15). Rigid mandibular canine-to-canine retainers are attached to the canines only. They are effective in maintaining intercanine width but less so in preventing individual movement of the incisors. Alternatively, retainers bonded to all six anterior teeth have proven more effective in preventing rotation of the bonded teeth (2). These retainers, however, may fail at the wire-composite interface, at the adhesive-enamel interface or fracture under stress, which can result in tooth displacement (2, 16, 17). Flexible spiral wires (FSWs) rarely cause severe complications; the main problems reported concern torque-issues of incisors or canines despite all bonding sites being firmly attached and faultless (18, 19).

The aim of this study was to explore how Swiss general dentists deal with complications associated with fixed orthodontic retainers. We also wanted to evaluate the collaboration between general dentists and orthodontists with regards to the organization and responsibility for long-term follow-up of orthodontic retainers, as well as the need for standardized clinical guidelines regarding orthodontic retention.

Subjects and methods

Two hundred and one practitioners were randomly selected by the Swiss Dental Association (*Schweizerische Zahnärzte-Gesellschaft, SSO*). The list included dentists from all regions who spoke at least one of the three main official languages of Switzerland (German, French, or Italian). The questionnaires were available in German and French. In November 2012, all participants were asked to anonymously answer the structured questionnaire containing multiple-choice and open text questions and return it by mail. Italian-speaking dentists were offered assistance by telephone. A reminder was sent out once, after 1 month.

The questionnaire was specially developed for general practitioners and was organized into six sections. Part one gathered information on the dentist's gender, age, university education, working experience, and employment status (private practice, university, substitute, or retired). The second section referred to the management (placement and repair) of retainers. Part three addressed the monitoring and problem solving for bonded orthodontic retainers in daily practice. The fourth section examined advantages and disadvantages of the different types of bonded retainers, namely retainers attached to all anterior teeth versus retainers bonded to canines only. The two final parts were dedicated to questions concerning the communication between dentists and orthodontists and who is responsible for patients in retention. Finally, the need for clinical guidelines for patients wearing retainers was indicated.

Statistical evaluation was performed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, Illinois, USA; version 20). Unanswered questions were excluded from further analysis. Background information on the individual dentist was described in frequencies (i.e. university attended, employment status), and all other results were presented as percentages. Tests for association between items in the questionnaire were based on the chi-square tests or Fisher's exact tests at a confidence level of 0.05.

Results

General

One hundred and twenty-three dentists (61.2 per cent) responded and returned completed questionnaires. The response rate was higher among French-speaking dentists (75.5 per cent) than their German-speaking colleagues (57.1 per cent).

Section 1—basic data

The majority of participants (73.2 per cent) were male. Years of working experience and employment status are presented in Figures 1 and 2.

The vast majority of general practitioners attended university in Switzerland (87.4 per cent), while eight studied in other European countries and one dentist studied outside Europe. No correlation between place of education and later status of employment was found (*P* value ranged from 0.091 to 1).

Section 2—bonding and repair of orthodontic retainer

55.3 per cent of the dentists reported experience with bonding retainers. 20.3 per cent of respondents offer orthodontic services in their practices and bond retainers in their own patients. These dentists appear to perform more retainer repairs ($P = 0.003$) compared to those who do not perform orthodontic treatments in their practice. There was no association between the place of education

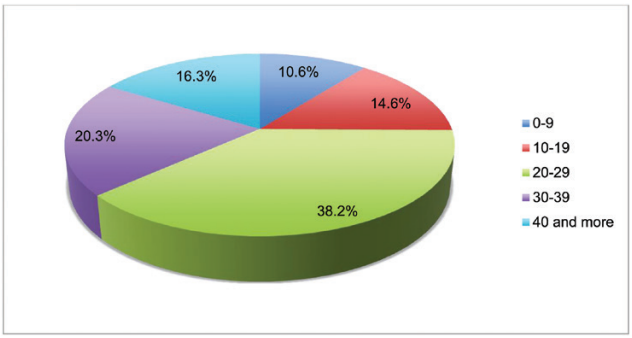

Figure 1. Years of working experience.

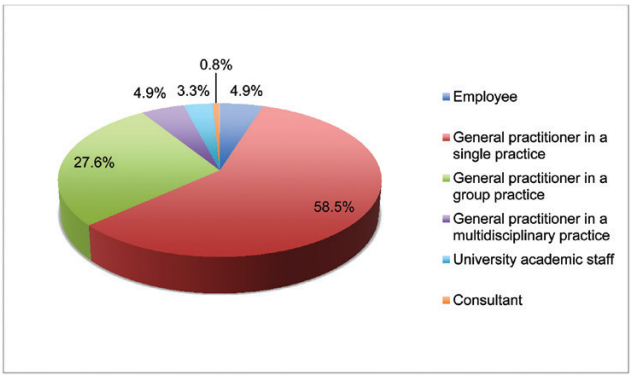

Figure 2. Employment status.

(university) and which general practitioners do orthodontic treatments (P = 0.648). However, dentists with less than 30 years of working experience offered orthodontic treatment to their patients more often than their older colleagues (P = 0.034).

A broken fixed retainer is an unwanted complication. Although it is not common, 66.1 per cent of respondents had detected at least one broken retainer in their careers. There was no agreement among responders as in to which jaw most broken retainers are expected (Figure 3).

Section 3—control of retainers and problem solving

There was a wide range in the number of patients with bonded retention seen by dentists weekly (between 1 and 30), with most clinicians seeing 2–10 patients per week. Nearly all general practitioners (96 per cent) checked the structural integrity of the bonding sites. As a result, the average respondent detected problematic or detached bonding sites in 1–2 patients per month. The number of patients seen per week was not associated with dentist experience (P = 0.202) nor who (orthodontist or dentist) had provided the orthodontic treatment (P = 0.488).

Most respondents (87 per cent) reported detecting the problematic bonding sites easily or very easily, usually with the aid of a dental probe or mirror. Quite often patients themselves drew the dentist's attention to a detached/broken retainer (51.2 per cent) (Figure 4). Practitioners offering orthodontic services seemed to detect loose bonding sites more often than practitioners who don't. In contrast, the extent of professional experience did not correlated with the rate of problematic retention site detection (P > 0.05).

Repairing failed bonding sites was a familiar procedure to general practitioners because the majority of respondents do perform this themselves (Figure 5). Management methods differ between general practitioners who offer orthodontic services and those who do not. The first group rebonded retainers significantly more often than the second group (P = 0.012). Approximately one third of general practitioners advised their patients to contact their orthodontist. This seemed to happen less often with practitioners who performed orthodontic services in their practices (P = 0.09). If a detached retainer was accompanied by tooth displacement, 69.9 per cent of dentists referred patients to an orthodontist.

If a patient asks his dentist to remove a bonded retainer earlier than recommended, 76.5 per cent of general practitioners inform the patient about the negative implications such as a possible relapse and worsening of the occlusion (Figure 6). Moreover, 35 per cent of respondents indicated that they would remove a retainer at a patient's request, whereas 41.5 per cent would leave it *in situ*. Another 36.6 per cent said they refer the patient to the practitioner who placed the retainer. Factors influencing the decision to remove a retainer or not (recorded in the open questions sections) were grouped into five categories (Figure 7).

Information regarding hygiene was provided by 94.7 per cent of general practitioners, with 74.5 per cent stating that they often

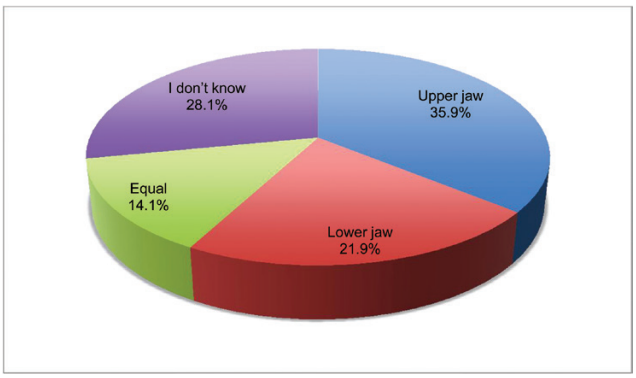

Figure 3 General dentists' opinion as in to which jaw most broken retainers are expected.

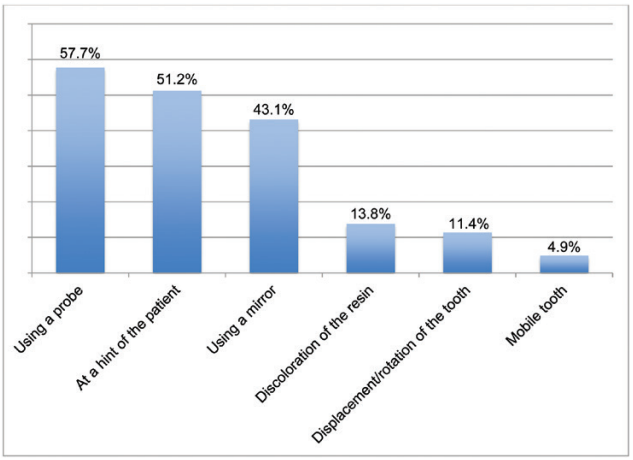

Figure 4. Problematic bonding sites: proportion of respondents showing the way of detection (multiple answers possible).

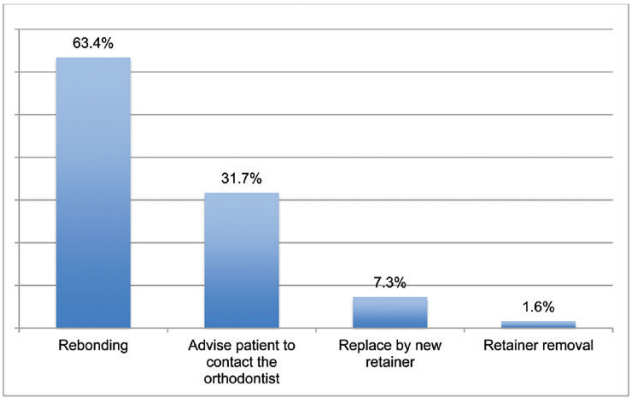

Figure 5. Dentist reaction after detection of a loose retainer (multiple answers possible).

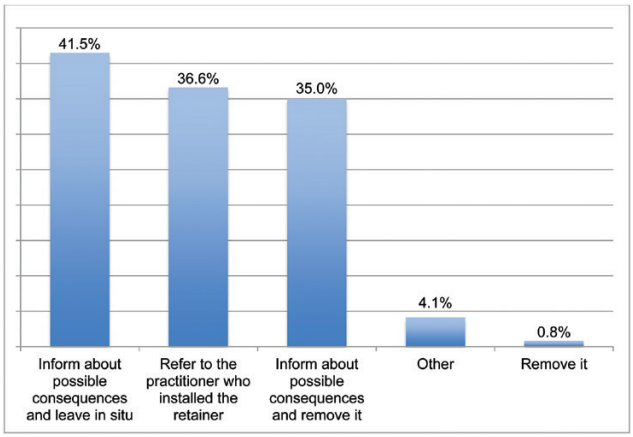

Figure 6. Dentist reaction when requested to remove the bonded retainer (multiple answers possible).

or always provide relevant instruction. The oral hygiene techniques recommended by practitioners are listed in Figure 8.

Section 4—comparison of 3-2-1-1-2-3 and 3-3 bonded retainers

Bonded retainers can be attached solely to canines (3-3 retainers), or to all six anterior teeth (3-2-1-1-2-3 retainers). The practitioners stated that 3-2-1-1-2-3 retainers are highly, or very highly, effective (91.1 per cent) in preventing relapse. In contrast, retainers fixed only to canines were considered to be less effective (54.1 per cent). With regards to calculus removal, 54.1 per cent found that the 3-3 retainer impended professional dental cleaning, compared to 90.1 per cent for the 3-2-1-1-2-3 retainer (Figure 9). Practitioners with over 20 years of experience found both types of bonded retainers to be more of an impediment for the removal of calculus than their younger colleagues ($P = 0.006$ for the 3-3 retainer and $P = 0.002$ for 3-2-1-1-2-3 retainer).

Respondents indicated that restoring teeth is more problematic and additional plaque accumulates when the retainer is fixed to each tooth (90.5 and 97 per cent, respectively) as compared to the 3-3 retainers (71.4 and 85.7 per cent, respectively) (Figure 9). Furthermore, practitioners with >20-year experience found tooth restoration in patients with 3-2-1-1-2-3 retainers to be more difficult than their younger colleagues ($P = 0.003$).

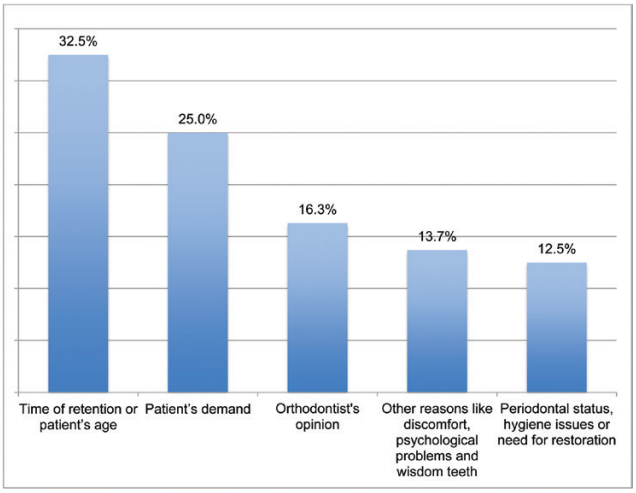

Figure 7. Factors influencing the decision to remove a bonded retainer.

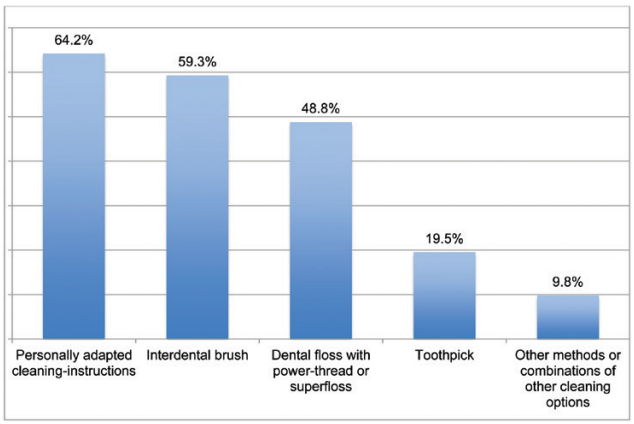

Figure 8. Oral hygiene recommendations given by general dentists to patients with bonded retention (multiple answers possible).

Almost 40 per cent of general practitioners participating in this survey were aware of the possible undesired torque movement of incisors or canines which can arise in connection with 3-2-1-1-2-3 bonded retainers. Of this group, 67.3 per cent clinicians had heard about the side effects of active retainers but had never detected the condition clinically. Buccal or lingual displacement of premolars distal to the 3-2-1-1-2-3 bonded retainer was never observed by 85.5 per cent of the respondents. The length of professional experience did not correlate with the knowledge of side effects of 3-2-1-1-2-3 bonded retainers ($P = 0.209$).

The existence of torque problems of canines with the 3-3-type retainers was unknown to 92.9 per cent of general practitioners. Buccal or lingual displacement of premolars distal to the 3-3 bonded retainer was never observed by 89.8 per cent of the respondents, but 59.8 per cent of the respondents had observed incisor(s) displacement in connection with this type of retainer.

If a defect was detected, the majority of general practitioners informed their patients and then consulted an orthodontist on how to proceed; or referred the patient directly to the orthodontist. For both types of retainers (either bonded to all six anterior teeth or to canines only), general dentists with more working experience detected unwanted premolar movement more often than less experienced practitioners ($P = 0.017$). More experienced practitioners also provided more information concerning possible displacement of premolars and incisors to patients wearing a 3-3 retainer ($P = 0.005$ and 0.001, respectively).

Section 5—communication between general practitioners and orthodontists

Most general practitioners (84.6 per cent) wished to be informed of the termination of active orthodontic treatment and the insertion of retainers, but reported that only 42 per cent of orthodontists provided this information. About 45.3 per cent of general practitioners would also like additional information about the type of retainer that was bonded. They stated that that orthodontists only provided such information for 18 percent of patients even though 84.3 per cent of respondents considered instructions about expected retention length important. Again, it was stated that orthodontists rarely (17 per cent) specified retention details. Additionally, 71.9 per cent of general practitioners indicated that they lacked information concerning the monitoring of retainers and follow-up care for patients.

Section 6—responsibility

An open question (more than one answer could have been selected) regarding who should be responsible for the inserted retainer in the first period of retention produced the responses listed in Figure 10. 78.4 per

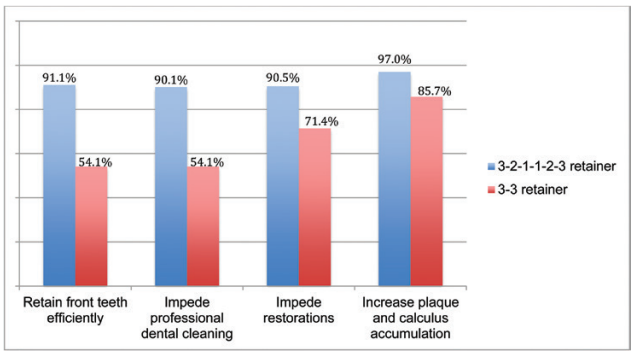

Figure 9. Proportion of respondents who agreed with the above statements concerning 3-2-1-1-2-3 and 3-3 retainers.

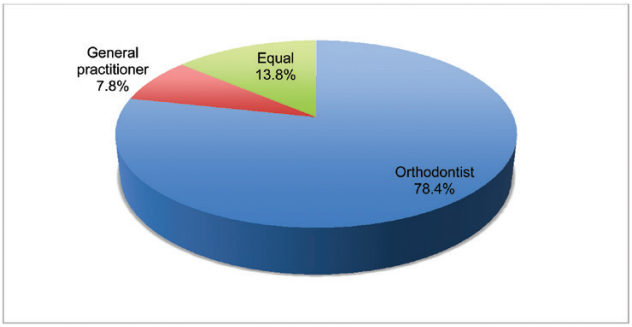

Figure 10. Who should be responsible for the follow up of fixed retainers in the first six month after bonding?

cent of general practitioners thought that the retainer should be controlled during the first 6 months after insertion by the orthodontist who had treated the patient. Thereafter, general practitioners saw themselves gradually taking over the monitoring and follow-up care of the retainer (66.4 per cent). A minority of dentists thought that orthodontists (18.1 per cent), or a dentist together with an orthodontist (15.5 per cent) should control bonded retention after the first 6 months.

In case of retainer failure, 74.1 per cent respondents felt sufficiently competent to repair the retainer themselves. Slightly fewer general practitioners (59 per cent) considered themselves competent enough to replace a bonded retainer.

The vast majority of survey participants (87.2 per cent) found the questionnaire exploring the know-how in the field of bonded orthodontic retainers useful or very useful. Similarly, most general practitioners (93.2 per cent) would value, or highly value, the existence of clinical guidelines for bonded orthodontic retainers.

Discussion

The aims of this survey was to evaluate how a randomly selected sample of Swiss general dentists manage patients wearing fixed orthodontic retention and to explore how practitioners deal with the occasional complications associated with their use. This knowledge is important because surveys carried out in other countries such as Australia and New Zealand (20), The Netherlands (21), UK (22), USA (23), and Norway (24) showed that bonded retention following orthodontic treatment has become more and more widespread. For example, about 50 per cent orthodontists practicing in Norway and 62 per cent of Dutch orthodontists recommend bonded retainers in the maxilla. This proportion is even higher for the mandibular arch—66.4 per cent was reported by Vandevska-Radunovic *et al.* (24). Also in Switzerland, bonded retainers are the most popular type of retention for the upper and lower dental arches. They are applied as sole retention appliances in many clinical situations but may also be supplemented with removable retention (9).

Most general practitioners are familiar with the routine control of fixed bonded retainers; they provide information regarding hygiene and perform repairs, if needed. We found that a significant proportion (20.3 per cent) of Swiss general practitioners offer also orthodontic treatment to their patients. In comparison to general dentists who do not offer orthodontic services general dentists providing orthodontic treatment seem to bond and/or replace significantly more retainers, detect more problematic bonding sites and perform more repairs. Moreover, in case of serious complications, general practitioners who practice orthodontics request advise from orthodontist specialists less frequently.

Bonded retainers sometimes fail. Failures range from a detachment of the retainer from one tooth to the complete loss of retainer due to detachment from all teeth. In a randomized clinical trial Pandis *et al.* (25) showed that retainer failures are relatively common, particularly the detachment from a single tooth. Furthermore, fixed retainers can cause severe side effects which require orthodontic retreatment. In particular, the FSW is known to cause unwanted side effects such as remarkable changes in torque when the retainer is bonded to all mandibular anterior teeth (18). Pazera *et al.* (19) described an extreme situation where the root of a tooth was moved completely out of the bone. About 40 per cent of survey participants were familiar with these severe complications. However, only around 33 per cent had observed such problems in their own patients. Although the frequency of torque change is not high (17, 18), potential consequences cannot be ignored. Early detection of this side-effect is therefore essential to reduce the potential negative impact on the involved tissues and to limit the need for retreatment (17). Due to the lack of knowledge about possible torque problems of FSW and the fact that inexperienced clinicians have difficulty detecting the effects in the early stages, 'active' retainers run the risk of being detected far too late. The wide variety of replies regarding occasional complications caused by fixed retainers provided by general dentists in this survey highlights the need for better information about possible side effects and their early detection: about 44 per cent of participants would even appreciate further training on this topic.

Several studies showed that the highest failure rates of bonded retainers are registered during the first few months after a retainer has been bonded (26, 27). In this period, teeth still show increased mobility (28, 29). Therefore, routine check-ups scheduled within 6 months after retainer placement increase early detection of possible failures and undesired tooth movement. An orthodontist usually performs these controls. In a survey of orthodontists and general dentists, Arnold et al. reported that 55.2 per cent of respondents perform the first check-up within 3 months after bonding o the retainers. The rate of patient recalls within 3 months of bonding was significantly higher for specialists (30).

In the long-term, bonded lingual retainers can cause higher accumulation of plaque, greater marginal recessions and increased probing depth. Pandis *et al.* therefore emphasize the importance of considering the personal anatomical characteristics as well as the patient's attitude to dental hygiene before selecting the retention protocol (25). The findings of our survey confirmed that general dentists consider the more pronounced accumulation of plaque, the higher impediment for calculus removal and more difficult insertion of new restorations for retainers bonded to each tooth to be challenging. As a result, the advantages and disadvantages of fixed retainers should be discussed together with the patient. As Iliadi *et al.* (31) demonstrated in their systematic review; although fixed orthodontic retainers have been used for years in clinical practice, selecting the best retention protocol is still highly subjective.

Ideally, follow-up control of orthodontic patients should be carried out by the orthodontist who provided the active orthodontic treatment. This would increase the orthodontist's experience in dealing with side-effects of retention and improve his knowledge of the long-term results of orthodontic treatment. However, the increasing length of recommended retention period—Lai *et al.* (9) found that 87 per cent of Swiss orthodontists recommended permanent retention—has created a new situation for dentists who will likely have to share the responsibility for management of patients in fixed retention. Our data demonstrate that general practitioners feel that the orthodontist and the patient should carry the responsibility for the retainers for the first 6 months

after completion of orthodontic treatment. Thereafter, general dentists are open to slowly taking over the task of retainer monitoring and maintenance—in collaboration with the orthodontist. The respondents in our survey also mentioned the responsibility the patient has during the retention phase. Mollov *et al.* (32) suggested that patients have a certain responsibility during the retention phase and that satisfaction with orthodontic results after treatment is related to patient perception of responsibility for retention and perceived stability of tooth position.

A recent audit in the UK by Kotecha *et al.* (33)—with a response rate slightly lower than ours (48 versus 61 per cent)—demonstrated that many general dentists are reluctant to take on the long-term control of retainers; <50 per cent felt it was their responsibility to monitor patients in retention. The main reasons listed were the lack of time in private practices and financial pressure due to the remuneration system by NHS. The concept of livetime retention was seen as problematic for general dentists. In contrast, general practitioners in Switzerland felt themselves more responsible (66.4 per cent) for the follow-up starting 6 months after termination of active treatment.

A smooth transfer from orthodontist to general dentist can only be achieved with good communication. As demonstrated in this survey, the vast majority of general practitioners would like to be informed about the end of orthodontic treatment, planned retention protocol, control of retainers and follow-up care for patients. Unfortunately, only less than half of the surveyed general dentists felt that they had been provided with this information. General dentists also felt that only a small percentage of the orthodontists communicate details such as type of retainer or expected retention length. Similar findings were reported in the UK (33). The statements of general dentists in the present study are in contrast with the data of Lai *et al.* (9), where 62 per cent of Swiss orthodontists stated that they were in contact with general dentists regarding monitoring and repair of fixed retainers. The discrepancy between the orthodontists' perception and general dentist's statements regarding mutual communication demonstrates the need for improvement.

The vast majority of respondents expressed the view that clinical guidelines for orthodontic retention are desired. Such guidelines could represent a tool for synthesis of current best available scientific and clinical information in order to optimize clinical practice and improve the quality of orthodontic retention services. However, evidence-based data regarding orthodontic retention is lacking, making the elaboration and implementation of standardized clinical guidelines a major challenge. Furthermore, depending on the remuneration system in the respective country, health care providers may take a key role under the aspect to approach lifelong retention. Undoubtedly, once such guidelines are ready for implementation in everyday clinical practice, they may represent a paradigm shift for numerous practitioners and patients. Gaining recognition and acceptance will probably only be achieved with time. The guidelines will also need periodic updating in order to integrate emerging scientific evidence.

Conclusions

The majority of Swiss general dentists are familiar with the routine control of fixed orthodontic retainers, the detection of failed bonding sites and their repair. They are also willing to take over the monitoring and maintenance of retainers after the first 6 months of the retention period. The survey highlights uncertainties regarding possible side effects of bonded retainers and the collaboration between general dentists and the orthodontists. Standardized clinical guidelines could be beneficial for orthodontists, general practitioners and their patients although they will not be easy to elaborate and implement.

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