PATIENTS' SELF-ASSESSMENT ON ORTHODONTIC RETAINERS – A QUALITATIVE RESEARCH

EUNICE SOH XINWEI

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EUNICE SOH XINWEI

RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ORTHODONTICS

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Matric No. : DGD150004

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PATIENTS' SELF-ASSESSMENT ON ORTHODONTIC RETAINERS

ABSTRACT

At the end of orthodontic treatment, a retention regimen is used to prevent relapse. Orthodontic retainers can be removable or bonded to teeth. Patients' satisfaction regarding orthodontic retainers affects their ability and willingness to comply with the prescribed retention regimen. This study is aimed to explore the effect of the prescribed orthodontic retainers on patients' everyday life and to explore the limitations in adhering to the prescribed orthodontic retention regimen. A qualitative study was carried out using the grounded theory approach. Purposive sampling was conducted, with subjects being orthodontic patients at the Faculty of Dentistry, University of Malaya. Individuals aged 18 years and older who were able to speak in Malay and/or English language and on a bonded or removable retention regimen for six months to two years were recruited. In-depth interviews (IDI) and three focus group discussions (FGD) – Hawley retainer group, thermoplastic retainer (VFR) group and a mixed group (removable and bonded retainers) were conducted. All responses were tape-recorded and transcribed. Framework analysis was undertaken to determine emerging themes. Six IDIs with three male and three female participants aged 18 to 24 years were conducted until a saturation point was reached. All three FGDs with participants aged 18 to 37 years had more female than male participants. Emerged themes on the effects of retainers on patients' everyday life were speech interference, eating disturbance, the appearance of the retainers, difficulty cleaning, uncertainty on storing removable retainers, the need to bring removable retainers when going away, and the need to get bonded retainers checked. Emerged themes on limitations in adhering to the retention regimen were remembering to take removable retainers when going away, lost removable retainers, interfered eating habit, retainer cleaning and cleanliness, and lack of incentive to wear removable retainers when already wearing bonded retainers. These

themes can form a conceptual framework for the future development of a validated questionnaire regarding patient satisfaction to orthodontic retention. Night-only removable retainer wear regimen eliminates the embarrassment of speaking, eating, and appearing with retainers in public. Personalised orthodontic retention prescription suiting the individual patient's lifestyle and needs may improve patient satisfaction and compliance to retention regimen.

Keywords: Orthodontic retainers, removable retainers, bonded retainers, patient satisfaction, qualitative research

PENILAIAN DIRI PESAKIT TERHADAP PENAHAN ORTODONTIK (*RETAINER*) – PENYELIDIKAN KUALITATIF

ABSTRAK

Pada akhir rawatan ortodontik, aturan pengekalan digunakan untuk mencegah pengembalian gigi ke kedudukan asal. Penahan ortodontik terdiri daripada jenis yang boleh tanggal atau terikat kepada gigi. Kepuasan pesakit mengenai penahan ortodontik mempengaruhi keupayaan dan kesanggupan mereka untuk mematuhi aturan pengekalan yang ditetapkan. Kajian ini bertujuan untuk meneroka kesan penahan ortodontik yang ditetapkan dalam kehidupan harian pesakit dan untuk meneroka batasan-batasan yang menghalang mereka daripada mematuhi aturan pengekalan ortodontik yang ditetapkan. Kajian kualitatif dijalankan menggunakan pendekatan teori berasas. Pensampelan bertujuan telah dijalankan, dengan subjek yang terdiri daripada pesakit ortodontik di Fakulti Pergigian, Universiti Malaya. Individu yang berumur 18 tahun dan ke atas yang dapat bertutur dalam bahasa Melayu dan / atau bahasa Inggeris dan mengikuti aturan pengekalan yang terikat atau boleh tanggal selama enam bulan hingga dua tahun telah diambil. Wawancara mendalam (IDI) dan tiga perbincangan kumpulan berfokus (FGD) - kumpulan penahan Hawley, kumpulan penahan termoplastik (VFR) dan kumpulan bercampur (penahan boleh tanggal dan penahan terikat) telah dijalankan. Semua jawapan direkod dan disalin. Analisis rangka kerja telah dijalankan untuk menentukan tema baru yang muncul. Enam IDI dengan tiga peserta lelaki dan tiga peserta wanita berusia 18 hingga 24 tahun telah dijalankan sehingga titik tepu tercapai. Ketiga-tiga FGD dengan peserta berusia 18 hingga 37 tahun mempunyai lebih banyak peserta perempuan berbanding peserta lelaki. Tema-tema yang muncul pada kesan penahan pada kehidupan harian pesakit ialah gangguan percakapan, gangguan pemakanan, penampilan penahan, kesusahan pembersihan, dan ketidakpastian dalam cara penyimpanan penahan boleh tanggal, keperluan untuk membawa penahan boleh tanggal

ke mana-mana, dan keperluan untuk penahan terikat diperiksa. Tema-tema yang dihadapi mengenai batasan-batasan dalam mematuhi aturan pengekalan ialah keterlupaan untuk membawa retainer boleh tanggal apabila keluar dari rumah, kehilangan penahan boleh tanggal, pengganggguan tabiat pemakanan, pembersihan dan kebersihan penahan, dan kekurangan dorongan untuk memakai penahan boleh tanggal apabila sudah memakai penahan terikat. Tema-tema ini boleh membentuk rangka kerja konseptual untuk perkembangan soal selidik bersah mengenai kepuasan pesakit terhadap pengekalan ortodontik pada masa depan. Aturan pemakaian penahan boleh tanggal pada waktu malam sahaja boleh mengelakkan rasa malu bercakap, gangguan pemakanan, dan penampilan dengan penahan di khalayak awam. Preskripsi penahan ortodontik secara peribadi yang sesuai dengan gaya hidup dan keperluan pesakit boleh meningkatkan kepuasan pesakit dan pematuhan terhadap aturan pengekalan.

Kata-kata kunci: Penahan ortodontik, penahan boleh tanggal, penahan terikat, kepuasan pesakit, kajian kualitatif.

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IDI	:	In-depth Interview
VFR	:	Thermoplastic retainer
FGD	:	Focus group discussion
SD	:	Standard deviation

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Public awareness of dental aesthetics and demand for orthodontic treatment has been increasing over the years in Malaysia. According to the Malaysian Health Informatics Centre (2016), there was a 9.9% increment of the number of new patients at the orthodontic specialist clinics run by the ministry from 46,226 people in 2015 to 51,139 people in 2016. The number of case completion increased by 17.5% from 3,971 cases in 2015 to 4,665 cases in 2016. On top of that, the workload per orthodontist in that ministry was one orthodontist to 4,055 patients seen in a year as of 2016, a 71.7% increase in workload.

At the end of orthodontic treatment, a retention regimen is used to prevent relapse, which is the return of teeth to their original position, and to resist unwanted tooth movements and disruptions in the occlusion due to ageing. The common types of orthodontic retainers are bonded retainers and removable retainers.

Bonded retainers are typically made of multi-strand stainless-steel twist flex wires bonded to each of the labial segment teeth or a single-stranded wire bonded to the canine teeth only. Less patient compliance is required as they are non-removable. However, the placement of bonded retainers is technique sensitive and time-consuming (Dahl & Zachrisson, 1991). On top of that, reported failure rates for the maxilla and mandible were as high as 36.7% and 50%, respectively, for the initial 12 months of retention (Forde *et al*., 2018). These bonding failures may not be noticed by the patient until localised relapse happens.

Hawley retainers, which are made of acrylic resin and stainless-steel wires, and transparent-looking thermoplastic retainers (VFRs) are common types of removable retainers. To date, it is still unclear which form of retention is the most clinically effective (Littlewood *et al*., 2016).

Relapse is unpredictable. Orthodontic retention regime has changed from a couple of years to a longer term due to this fact (Littlewood, 2017). When the number of patients having orthodontic treatment is increased, the number of patients who have completed orthodontic treatment and wearing retainers has also significantly increased. The patient's ability to, and willingness to comply with the retention plan are important considerations apart from clinical effectiveness when choosing the appropriate type of retainer (Zachrisson, 2007; Renkema *et al*., 2009). Therefore, patient satisfaction and opinions regarding orthodontic retainers and the wearing regimen is an important aspect in orthodontics.

1.2 Importance of Proposed Research

As far as post-treatment stability is concerned, the patient's responsibility in complying with the prescribed orthodontic retention regimen plays a major role. Various quantitative studies and randomised controlled trials have been conducted regarding patient's compliance to orthodontic retainers. However, no tool has been invented to provide reliable and valid assessments by patients regarding their prescribed orthodontic retainers. A qualitative study must be conducted to identify the key aspects which will then form the conceptual framework in the development of a measuring tool, such as a validated questionnaire, to gauge the level of patient satisfaction to the retention regimen.

Therefore, our study is intended to investigate how orthodontic retainers and retention regimen affect patients' everyday life and the factors hindering patients from complying with the retention regimen.

1.3 Aims

To explore patient self-assessment in terms of the effects of the prescribed orthodontic retainers on their everyday life and limitations in complying with the prescribed orthodontic retention regime, among adult orthodontic patients who have completed orthodontic treatment.

1.4 Objectives

i. To explore the effect of the prescribed orthodontic retainers on patients' everyday life.
ii. To explore the limitations in complying with the prescribed orthodontic retention regimen.

1.5 Rationale of the Study

Findings obtained from this qualitative study will be useful in serving as a conceptual framework for further quantitative studies, such as the development of a validated questionnaire to investigate patient satisfaction to different retention regimens. The use of an orthodontic retainer-specific measure will allow clinicians to better understand the effects of the orthodontic retainer and its wear regimen on adult orthodontic patients. It is hoped that this, in turn, will improve orthodontic patients' compliance towards orthodontic retention regimen and influence the orthodontists' choice of retention regimen.

CHAPTER 2:LITERATURE REVIEW

2.1 Research Methods for Assessing Patient's Perspective

Over the years, various methods have been employed to gather patients' opinion on orthodontic retainers. These methods can be categorised into two main domains – quantitative and qualitative methods.

2.1.1 Quantitative Study

Quantitative studies provide statistical, mathematical, or numerical results through systematic, rigorous, and empirical investigations. There are four main types of quantitative research designs: descriptive, co-relational, quasi-experimental and experimental. Most quantitative studies on healthcare are experimental or applied in nature, towards which specific practical problems or issues are geared (Pope & Mays, 2006). The objective is to measure and analyse the causal relationships between variables ideally free of confounding elements. Randomisation, blinding, highly structured protocols, and written or orally administered questionnaires with a limited range of predetermined responses are techniques to ensure this. The sample sizes are considerably larger than in qualitative research so that statistical methods can be used to ensure samples are representative (Carey, 1993) and data summary obtained can support a generalisation about the studied subject matter.

However, quantitative studies cannot be used to explain social phenomena (interactions, behaviours, etc.) and the individual experience attached to it, nor do they describe the contributing reason and mechanism (Pope & Mays, 2006). This is because of the complex and non-quantifiable nature of such aspects, which cannot be measured and pinpointed by using mathematical formulae.

2.1.2 Qualitative Study

The qualitative approach aims at producing in-depth and illustrative data to understand the different dimensions of the issue being examined. Techniques used in qualitative studies include in-depth and focus group interviews, and participant observation. The fundamental assumption of methodologies using qualitative techniques does not suppose one verifiable and replicable reality, but rather several similarly true facts (Williams *et al.*, 2019).

Small, purposeful samples of articulate participants are used because they can provide significant information, not because they represent a bigger community (Reid, 1996). The respondents' meanings and interpretations are the core of qualitative research (Liamputtong, 2019). It provides researchers with the opportunity to hear silenced voices, work with marginalised and disadvantaged individuals, tackle problems of social justice, and lead to person-centred healthcare and clinical trial design.

2.2 Orthodontic Retention

Orthodontic retention was defined as “the holding of teeth in the treated position for the period of time necessary for the maintenance of the result” (Moyers, 1973). When the treatment result changes via the return of the teeth to their original position, relapse has happened.

Retention after active orthodontic treatment is needed to resist relapse due to orthodontic factors and normal age changes (Littlewood *et al.*, 2017). Orthodontic factors are mainly pertaining to periodontal tissue reorganisation (Reitan, 1967) and teeth being moved beyond the neutral zone of soft tissue balance between the tongue and orofacial musculatures. Physiologically, growth continues throughout life (Behrents *et al*., 1989) causing minor changes in the relationship between the jaws and in the soft tissue pressures on the dentition. These can affect tooth alignment and occlusal relationships as a person ages. Therefore, it is impractical but essential to continue retaining orthodontically treated dentitions for as long as possible (Little *et al*., 1988), or at least until growth has reached adult levels to minimise relapse (Sadowsky & Sakols, 1982).

2.2.1 Orthodontic Retainers

There are generally two types of orthodontic retainers – removable retainers and bonded retainers.

2.2.1.1 Removable Retainers

Common forms of removable retainers are Hawley retainer, thermoplastic retainer (VFR), Begg retainer, Barrer retainer, etc.

VFRs and Hawley retainers are the most commonly used removable retainers in modern orthodontic practice. This is a trend observed in many countries such as New Zealand (Padmos *et al*., 2018), Italy (Manzon *et al*., 2018), United Kingdom, Netherlands, United States of America, etc. (Padmos *et al*., 2018). However, there is no data as such for our Malaysian population.

As they are removable, it is easier to maintain oral and retainer hygiene. However, patients have the sole responsibility in complying with the instructed duration of wear to prevent relapse occurrence. Therefore, patient satisfaction is important to ensure good compliance.

2.2.1.2 Bonded Retainers

Bonded retainers are typically bonded to the lingual surfaces of selected or all anterior teeth. The materials used can be made of multistrand stainless steel wire, sandblasted round stainless steel wire, orthoflex gold or stainless steel chain and reinforced fibres.

The indications for using bonded retainers are in cases needing prolonged retention such as patients with prior periodontal disease, diastema and generalised spacing, severely displaced teeth, proclined lower anterior teeth and altered inter-canine width.

As they are fixed to the teeth, patient compliance is not required for retainer wear but for meticulous oral hygiene as they are more prone to plaque and calculus accumulation (Millett *et al*., 2008). However, the placement of bonded retainers is technique sensitive and time-consuming (Dahl & Zachrisson, 1991). On top of that, reported failure rates for the maxilla and mandible were as high as 36.7% and 50%, respectively, for the initial 12 months of retention (Forde *et al*., 2018). These bonding failures may not be noticed by the patient until localised relapse happens. Therefore, regular follow-ups are important to detect any breakages as early as possible so that reparative measures can be taken promptly.

2.2.2 Orthodontic Retention Regimen

2.2.2.1 Removable Retainers

Many studies have compared full-time and part-time wear of various removable retainers. While most studies defined part-time wear as nights-only or twelve hours per day (Forde *et al*., 2018; Aslan *et al*., 2013; Kumar & Bansal, 2011; Rohaya *et al*., 2006; Rowland *et al*., 2007; Shawesh *et al*., 2010), Gill *et al*. (2007) defined it as eight hours per day, and Thickett & Power (2010) defined it as ten hours per day.

Some patients were instructed to wear their retainers full-time for six months then part-time for six months (Kumar & Bansal, 2011), some were asked to wear their retainers full-time for six months then nights only for three months (Aslan *et al.*, 2013), while some clinicians prescribed night-only retention regimen for every night right after fixed orthodontic appliance removal (Forde *et al*., 2018). To date, no surveys have been conducted in Malaysia regarding the preference of orthodontic retention regimen prescribed by our local orthodontists.

Due to the unpredictability of relapse, the orthodontic retention regimen has changed from a couple of years to a longer term (Littlewood, 2017). In a 2016 Cochrane review conducted by Littlewood and co-authors, retention procedures for stabilising tooth position after orthodontic treatment were looked into. The authors concluded that there was insufficient high-quality evidence to make recommendations on retention procedures to prevent relapse and that further high quality randomised controlled trials are needed. One of the suggestions by the authors was to investigate the levels of patient satisfaction to different retention regimens, including no retention. Littlewood and others (2017) studied on retention and relapse in clinical practice, and stated that the clinicians' approach to retention will be affected by personal clinical experience and expertise with different retainers, and also patient's expectations and circumstances.

Shawesh and colleagues (2010) in a randomised clinical trial compared full-time and night-time wear of Hawley retainers and found no difference between the two groups if the patients are not at high risk of relapse. Kaklamanos and co-reviewers (2017) did a systematic review on the performance of clear VFRs depending on retention protocol and concluded that full-time VFR wear was not superior to part-time, with potential implications for health burden, retainer longevity and cost-effectiveness, as well as patient satisfaction and compliance as other important issues to be considered. In terms of stability, it is sufficient to wear removable retainers only at night as reported in a randomised clinical trial by Forde *et al*. (2018).

Patient compliance with the prescribed retention regimen can be reinforced by the active participation of general dental practitioners in the management of patients who have completed orthodontic treatment (Johnston & Littlewood, 2015). At regular check-up appointments, the general dental practitioners can assess the compliance and provide necessary advice, repair or replacement.

2.2.2.2 Bonded Retainers

About bonded retainers, Rinchuse *et al*. (2007) believed that the combination of various removable and fixed retainers enhances the stability of treatment and patient compliance. There is added security as patients may not be aware of bonding failure of the bonded retainers until frank relapse has occurred. Until the failed bonded retainer has been repaired or replaced, the removable retainer can hold the teeth in place (Johnston & Littlewood, 2015).

Although patient compliance is not needed for bonded retainer wear, meticulous and proper cleaning of the retainer and teeth it is attached to require a high level of compliance and dexterity to prevent the build-up of plaque and calculus. Besides hindering interdental cleaning, it also carries the risk of caries developing under partially failed bonding material (Bearn, 1995). However, in a twenty-year follow-up of patients with mandibular canine-to-canine bonded retainers (Booth *et al.*, 2008), 75% of the sixty patients recalled still had their retainers in-situ after twenty to twenty-nine years, and there was no association with periodontal disease or caries. Variations such as wave retainers (Corbett *et al*., 2014) were introduced to ease interdental flossing. However, no clinical difference was found between the periodontal health of anterior teeth retained with a straight retainer or a wave retainer for a period of two to four years.

General dental practitioners play an important role in reviewing patients with bonded retainers at their regular check-up appointments, and if necessary, repairing or replacing the retainers (Johnston & Littlewood, 2015). When there is a relapse, referral to the orthodontist should be made for further management. This lessens the burden on orthodontists on the recall of patients with bonded retainers as these retainers are to be fixed in patients' mouth for a very long time.

2.3 Assessing Patient's Perspective on Orthodontic Retention

Whilst orthodontic treatment is provided by orthodontists, it is important that patients' perspective is taken into consideration to ensure the delivery of a holistic treatment approach. Unlike medical care, orthodontic treatment is considered less of a necessity but something sought after by patients who want to improve their aesthetics. Thus, patient satisfaction has to be taken seriously owing to the fact that orthodontic treatment is expensive. On top of that, patients' perspective on how treatment affects their life and compliance is an aspect which requires further exploration in depth.

2.3.1 Qualitative Studies

In 1999, Bennett and Tulloch conducted a qualitative study to explore orthodontic treatment satisfaction from the patients' perspective using four single-sexed focus groups consisting of two female groups of 6 and 8, ranging in age from 12 to 17 years, and two male groups of 2 and 6, ranging in age from 14 to 17 years. All the participants had completed their orthodontic treatment within the past 2 years at a dental teaching clinic and were guided to discuss any aspects throughout their entire orthodontic treatment which they liked or disliked. Almost all participants disliked their retainers, with some noting that it was more inconvenient to live with retainers than braces. The problems noted included speech problems, eating, losing retainers, and embarrassment over the retainer's appearance. Few participants voiced they expected to see their orthodontists regularly even after completion of orthodontic treatment.

Travess and co-researchers (2004) conducted four focus group meetings with participants aged ranging from 18 to 50 years and have undergone combined orthodontic-orthognathic surgical treatment. Regarding wearing retainers at the end of active treatment, some participants mentioned it was more difficult to speak and eat as the retainers were in the inner side of the mouth as compared to braces which only

covered the labial or buccal tooth surfaces. There was no mention of the type of retainer the participants used in the article.

2.3.2 Quantitative Studies

To date, many quantitative studies exploring patient satisfaction on orthodontic retention has been carried out. Questionnaires were the most commonly used tool in measuring satisfaction level among patients who have completed orthodontic treatment.

Hichens and colleagues (2007) in a randomised clinical trial comparing patients wearing Hawley retainers and VFRs had two-thirds of female and one-third of male subjects with a mean age of 15 years. It has been found that Hawley retainers caused more embarrassment particularly in terms of speech and aesthetics and had approximately three times more breakages. Frequent breakages lead to extra appointments incurring extra travel costs, childcare costs, patient fees, and lost income. As a result, VFRs were preferred over Hawley retainers in the majority of subjects in this study because they had less palatal coverage and were almost transparent as compared to the pinkish acrylic Hawley retainers with greater palatal coverage.

In 2012, Jäderberg *et al.* conducted a randomised prospective study comparing different wear regimens of VFRs; full-time wear for three months and thereafter at night, and full-time wear for a week and thereafter at night only. At the end of six months, all patients completed a questionnaire to evaluate their experience of wearing VFRs and compliance. Overall, the VFRs were well tolerated, easy to get used to, and most patients had no difficulty in remembering to wear them despite only using them part-time. However, 22% of the respondents reported a speech problem. The mean age of the recruited patients was 15.7 years. Although more females were included in this study, it is not unusual when recruiting orthodontic patients consecutively. While other researches have shown that females comply better with removable appliances, i.e.

headgear (Clemmer & Hayes, 1979; Cucalon & Smith, 1990), no gender differences were seen in this study.

An assessment of social perceptions on orthodontic retainer wear was done by Meade *et al*. (2014) by using questionnaires. A total of 402 college-going students aged 18 to 25 years who participated in the study were asked to look at a full-face smiling photograph of a young adult male or female wearing one of five maxillary retainers: VFR, Hawley retainer, acrylated Hawley retainer, and Begg retainer. They then indicated their scores on a Likert scale regarding the photographed subject's social competence, psychological adjustment, intellectual ability, and attractiveness. Subjects wearing bonded retainers were perceived to have higher intellectual ability compared to those wearing Hawley retainers and acrylated Hawley retainers. Also, those wearing bonded retainers were felt to be more attractive than people wearing all other retainer types. Interestingly, participants who had orthodontic treatment or wore braces before did not have different social perceptions regarding whether a retainer had been worn or not. The findings showed that retainer design and appearance influenced a young adult's social perceptions. This may adversely affect social interaction and consequent psychosocial well-being.

In China, a single-centre randomised controlled trial was carried out by Wan and co-researchers (2017) to analyse the effect of alterations in adult patient vocals and voiceless fricatives between Hawley retainers and VFRs by means of objective acoustic analysis. Twenty adults aged 19 to 29 years were recruited for speech assessment before wearing the retainers (T0), immediately after wearing (T1), and at 24 hours (T2), one week (T3), one month (T4), and three months (T5). While sound distortion could be found in both the Hawley retainer group and the vacuum-formed retainer group, changes in articulation in the Hawley retainer group were more evident. Therefore,

patients should be informed of the influence of orthodontic retainers on speech and should be encouraged to adapt to these changes.

In a multi-centre randomised controlled clinical trial, Forde *et al.* (2018) compared stability, retainer survival, and patient satisfaction outcomes after twelve months on patients wearing bonded retainers and VFRs. The mean ages for both groups were similar at 16 years and 17 years respectively. The questionnaire used to evaluate patient satisfaction was a modified version of Hichens and co-worker's in 2007. As opposed to findings from previous qualitative studies (Bennett & Tulloch, 1999; Travess *et al*., 2004) that patient felt retainers were less tolerable than fixed orthodontic appliances, patients from this study noted their retainers were better or no worse than their braces. It was statistically significant that VFRs were reported to be more uncomfortable and affecting speech, but easier to clean than bonded retainers.

The comparison between VFRs and Hawley retainers by Manzon *et al*. (2018) indicated that VFRs are the most accepted by patients for their higher aesthetic and oral comfort characteristics. The mean age of subjects recruited was 15 years and gender distribution was equal between the groups. VFR group subjects had better overall experience, self-perception and comfort compared to Hawley group subjects.

Almuqbil and Banabilh (2019) studied on patient compliance and reasons for non-compliance with VFRs and Hawley retainers. The participants recruited were 18 to 28 years old. Gender distribution was equal between the groups. For both retainers, among those participants who failed to comply, the majority agreed not to wear their retainer because it affects their eating (84.3%), speech (56.9%), comfort (47.1%), and odour of breath (43.1%). Eating was the major factor that contributed to noncompliance in the studied participants because of the need to remove the retainers before every meal made

it difficult for them. A statistically significant difference in compliance levels over time since debond was also discovered.

As of now, the way orthodontic retention regimen affects patients' daily life and factors that limit patients' adherence to retention regimens have not been explored in depth. It is not known why some patients could not comply with wearing their retainers as told. Perhaps there were confusions in the instructions given or certain types of lifestyle adjustments have caused the non-compliance. The knowledge gap in this aspect needs to be filled by comprehensive exploration. Qualitative methods are the most suitable means for this purpose. To the best of our knowledge, the present study is the first to explore extensively in these subject matters by using a qualitative approach. With a steadily increasing number of orthodontic population and patients in the retention phase, we hope to provide a thorough view of orthodontic retention regimen from the patients' perspective.

CHAPTER 3: MATERIALS AND METHODS

3.1 Study Design

This was a qualitative study carried out using the grounded theory approach.

3.1.1 Subject Selection

Purposive sampling was conducted, with subjects being orthodontic patients attending the postgraduate orthodontic clinic and specialist orthodontic clinic at the Faculty of Dentistry, University of Malaya. Prior to the commencement of subject recruitment, approval for the research was obtained from the Medical Ethics Committee, Faculty of Dentistry, University of Malaya (Ethics approval number: DF CD1711/0073(P)). This study was supported by the University of Malaya Dental Postgraduate Research Grant (grant number: DPRG/01/18) (Appendix A). All potential subjects who fitted the inclusion criteria were approached to participate in the study and were given an information sheet (Appendix B) regarding the research project. Those who wanted to participate were asked to sign a consent form (Appendix C). Participants had the right to withdraw at any time up to the point of analysis. No information will be used in an identifiable manner from the data collection.

3.1.2 Inclusion Criteria

i. Male and female adult patients aged 18 years and older
ii. Able to speak Malay and/ or English language
iii. On a fixed and/ or removable orthodontic retention regimen for 6 months to 2 years

3.2 Methodology

3.2.1 Data Collection

Focus group discussion (FGD) and in-depth interviews were conducted.

3.2.1.1 Focus Group Discussion

Three focus groups were formed with 8 participants per group. The three groups were – Hawley retainer group, VFR group, and a mixed group (removable and fixed retainers). The FGDs were conducted following the stages suggested by (Cresswell & Poth, 2017).

Conduct of the FGD

(a) ***Stage 1: Scene setting and ground rules***

The researcher introduced the outline of the research topic and background information on the purpose of the study to the group. An explanation was given of the need to record the discussion to provide a full account of everything that was said, what would happen to the data and of proposals for reporting.

(b) ***Stage 2: Individual introductions***

The group was asked to introduce themselves in turn.

(c) ***Stage 3: The opening topic***

The researcher started off the general discussion by introducing a general topic to break the ice, followed by a more conceptual issue regarding the research topic. Issues raised in this initial discussion that relate to key topics requiring full debate were identified. Main questions and probing questions were used (Appendix D).

(d) ***Stage 4: Discussion***

The issues mentioned were selected and discussed. The researcher probed both the group and individual members, using open-ended questions, directed the flow over other relevant topic areas if they were not raised spontaneously by the group, and kept the discussion broadly focused on the research subject. The discussion was audio recorded and transcribed.

3.2.1.2 In-depth Interview

Each subject was interviewed, tape-recorded and transcribed. Grounded theory approach, which involved the generation of analytical categories and their dimensions, and the identification of relationships between them, was used. The process of data collection continued until data saturation was reached. The total number of subjects was determined by saturation of data.

Conduct of in-depth interview

(a) ***Stage 1: Introducing the research***

The researcher introduced the research topic to the interviewee by providing a clear reiteration of the nature and purpose of the research. An explanation was given of the need to record the discussion to provide a full account of everything that was said, what would happen to the data and of proposals for reporting.

(b) ***Stage 2: Interview***

The interviewee's personal details and background information were obtained to help set the scene of an interview. The researcher guided the interviewee through key themes – both those anticipated by the researcher and those which emerged from the interview. Each subject was explored in depth with a series of follow-up questions and probes.

3.2.2 Data Analysis

NVivo 12 software was used for data analysis. Framework analysis was undertaken to determine emerging themes. It was a qualitative data analysis method used to organise and manage research through the process of summarisation. It allowed an analysis of the data by case and theme. It allowed for the identification of a typology, which described groups of respondents displaying different clusters of behaviours, attitudes or views of the world.

(a) ***Data labelling***

Sections of transcripts were labelled by the researcher to indicate which themes the data were related to.

(b) ***Sorting the data by theme***

Labelled data were sorted according to themes.

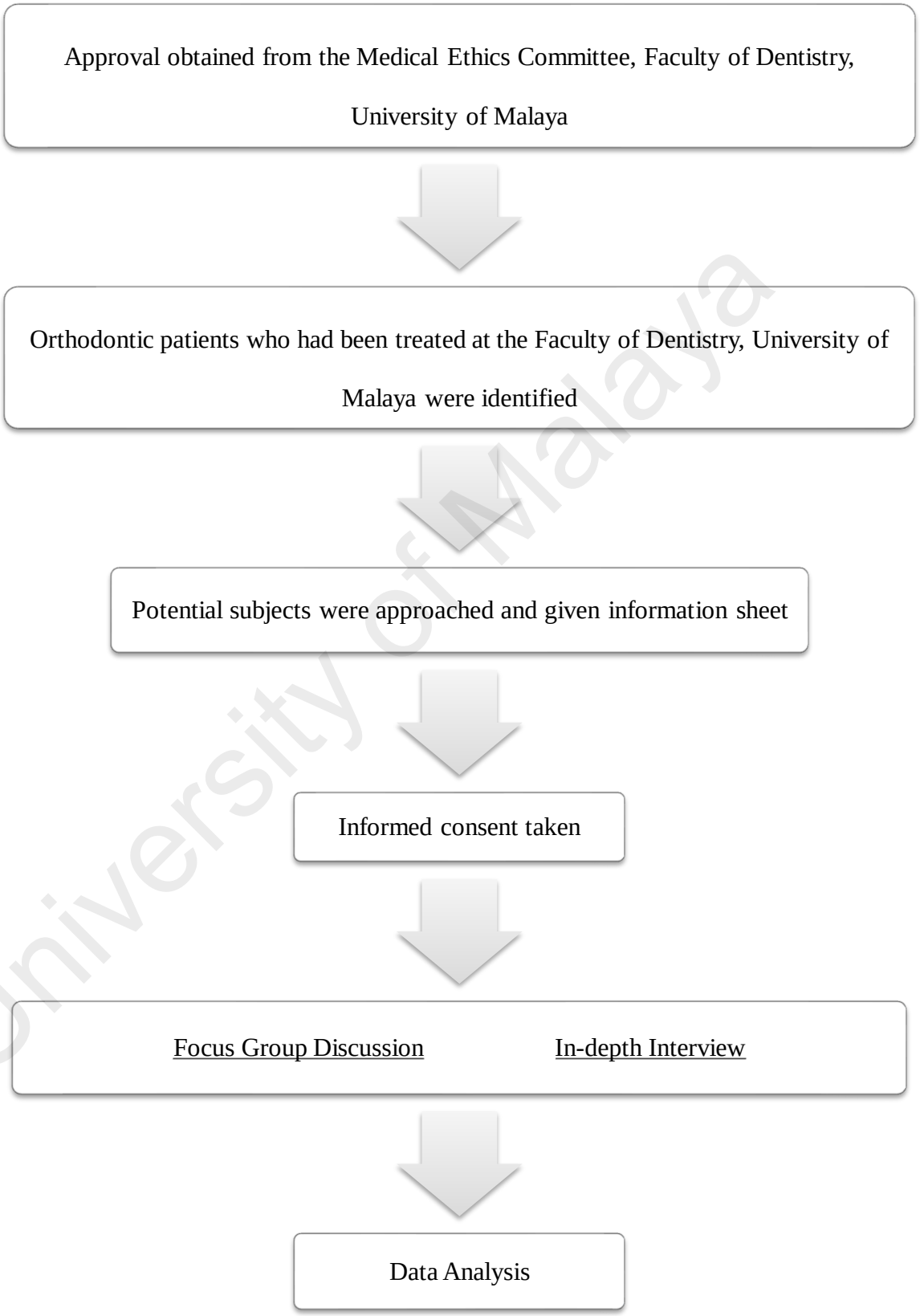
(c) ***Data synthesis***

Thematic charts were created for each of the main themes retaining the context used in the data.

(d) ***Descriptive accounts***

The nature and content of each theme were described, and the themes were discussed within the study team before the themes were finalised.

FLOWCHART OF THE METHOD



CHAPTER 4:RESULTS

4.1 Subject Recruitment

A total of 441 potential subjects who had had their fixed appliances removed within 2 years were identified, among which 397 of them had had the appliances removed for at least 6 months. The pool of potential subjects was narrowed down to 293 people who were at least 18 years old.

Among these 293 potential subjects, 58 of them had VFRs, 47 had Hawley retainers, and 43 were on dual retention (bonded and removable retention regimen). All of them had been contacted via phone calls, and the information sheet was provided via instant text messaging.

A total of 25 and 6 participants met the inclusion criteria and consented to take part in focus group discussions and in-depth interviews respectively.

4.1.1 Focus Group Discussions (FGD)

4.1.1.1 Hawley Retainer Group

13 potential subjects agreed to participate, among which 10 were randomly selected by drawing lots.

9 participants (7 females and 2 males) with ages ranged from 18 to 37 years old (mean, 24.22 years; SD 2.03 years) managed to join the study.

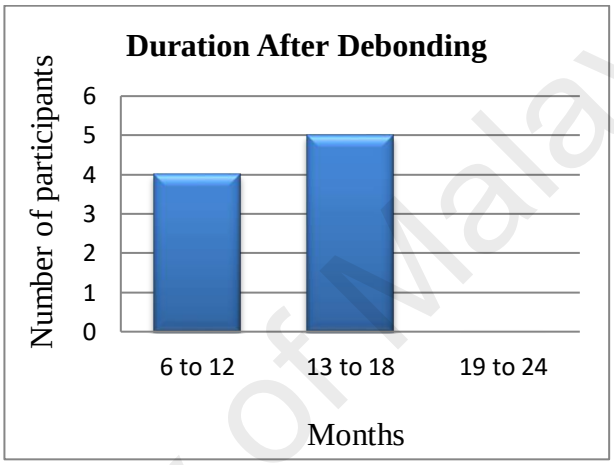


Figure 4.1: Duration after debonding (FGD – Hawley retainer group)

Figure 4.1 shows 44.44% (4 subjects) of the participants in this group had their orthodontic fixed appliances removed six to twelve months ago, while the other 55.56% (5 subjects) had the appliances removed thirteen to eighteen months ago. None of them was in their retention phase from 19 months to less than two years.

4.1.1.2 Thermoplastic Retainer (VFR) Group

12 potential subjects agreed to participate, among which 10 were randomly selected by drawing lots.

8 participants (6 females and 2 males) with ages ranged from 18 to 24 years old (mean, 20.88 years; SD 0.79 years) joined the study.

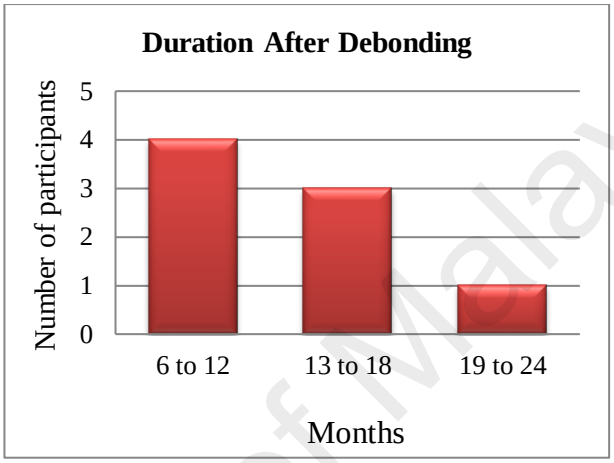


Figure 4.2: Duration after debonding (FGD – VFR group)

Figure 4.2 shows 50% (4 subjects) of the participants in this group had their orthodontic fixed appliances removed six to twelve months ago, 37.5% (3 subjects) had the appliances removed thirteen to eighteen months ago. 12.5% (2 subjects) of them were in their retention phase from 19 months to less than two years.

4.1.1.3 Mixed (Removable and Bonded) Retainer Group

11 potential subjects agreed to participate, among which 10 were randomly selected by drawing lots.

8 participants (6 females and 2 males) with ages ranged from 23 to 33 years old (mean, 26 years; SD 1.15 years) joined the study, of which 62% (5 subjects) had VFR and bonded retainers while the remaining 38% (3 subjects) had Hawley retainers and bonded retainers, as depicted in Figure 4.3.

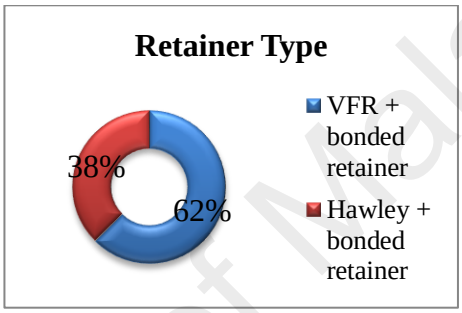


Figure 4.3: Retainer type in FGD – mixed retainer group

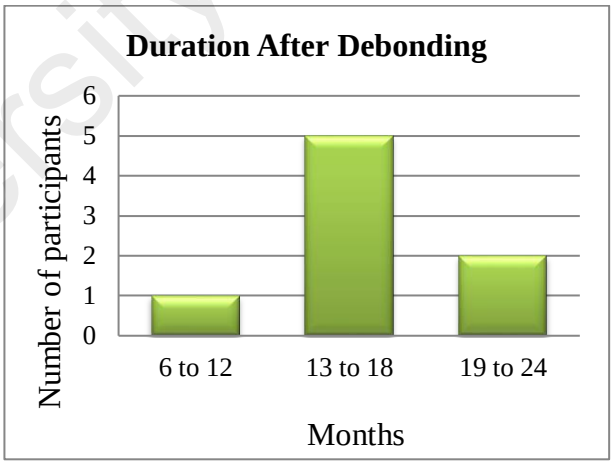


Figure 4.4: Duration after debonding (FGD – mixed retainer group)

Figure 4.4 shows 12.5% (1 subject) of the participants in this group had his or her orthodontic fixed appliances removed six to twelve months ago, 62.5% (5 subjects) had the appliances removed thirteen to eighteen months ago. 25% (2 subjects) were in their retention phase from 19 months to less than two years.

4.1.2 In-depth Interview

8 potential subjects agreed to participate, among which 6 participants (3 male and 3 females) with ages ranged from 18 to 24 years (mean, 20.83 years; SD, 1.01 years) were randomly selected by drawing lots and interviewed until data was saturated.

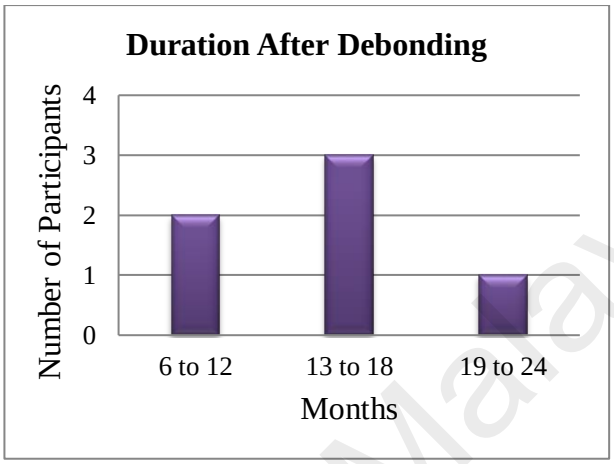
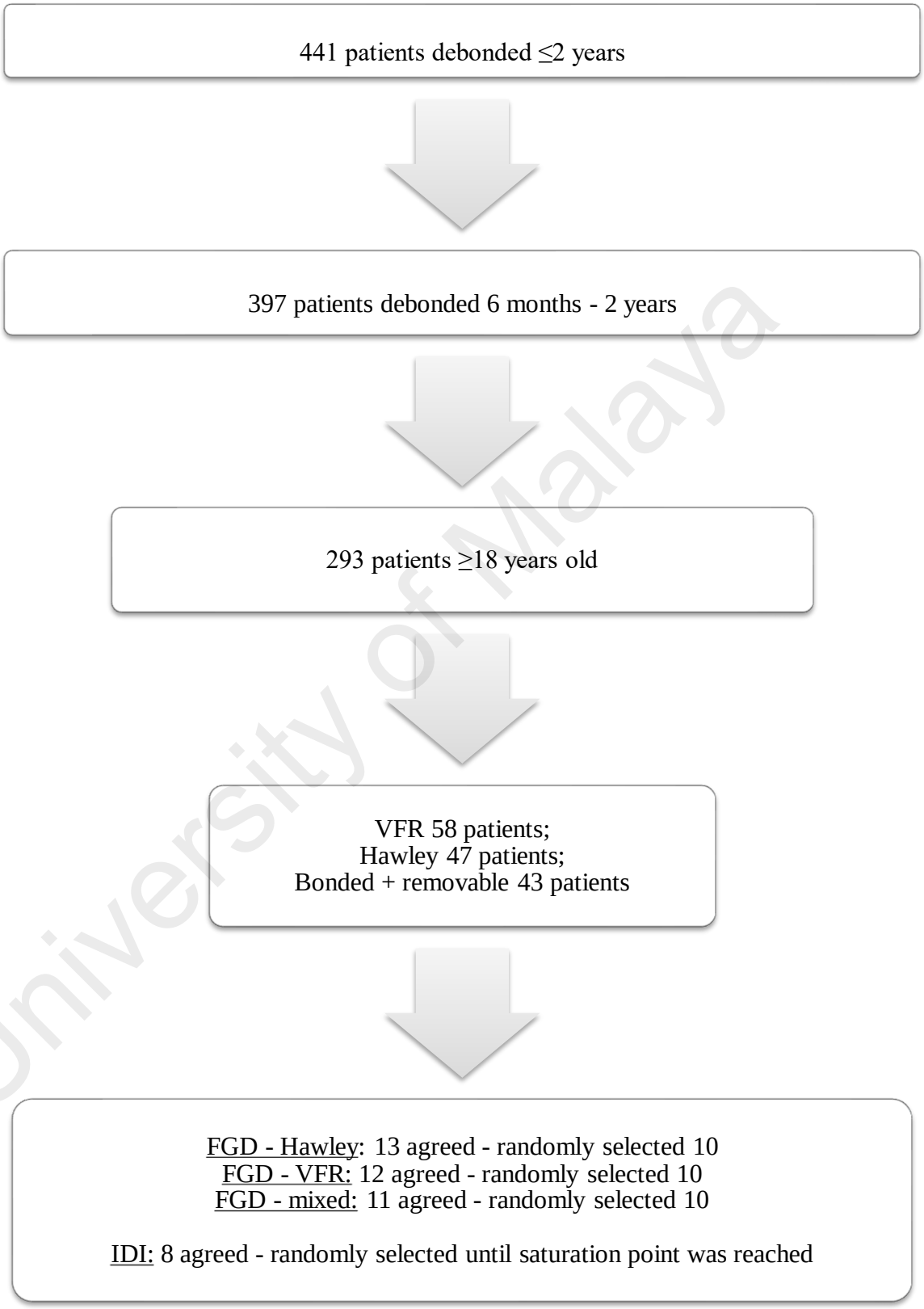


Figure 4.5: Duration after debonding (in-depth interview)

Figure 4.5 shows 33.33% (2 subjects) of the participants in this group had their orthodontic fixed appliances removed six to twelve months ago, 50% (3 subjects) had the appliances removed thirteen to eighteen months ago. 16.67% (1 subject) was in his or her retention phase from 19 months to less than two years.

SUBJECT RECRUITMENT



4.2 Emerged Themes

The emerged themes obtained from the FGDs and in-depth interviews conducted are categorised into effects of orthodontic retention regimen on patients' everyday life and limiting factors in adherence to the prescribed orthodontic retention regimen.

4.2.1 Effects of Orthodontic Retention Regimen on Patients' Daily Life

4.2.1.1 Removable Retainers

Generally, the emerged themes obtained for both types of removable retainers studied i.e. Hawley retainer and thermoplastic retainer (VFR) have many similarities. Table 4.1 summarises the list of themes for this group of retainers.

Table 4.1: Emerged themes on effects of removable retainers on daily life

Hawley retainers	VFR
Speech interference	Speech interference
Eating difficulty	Eating difficulty
The need to bring retainers when going away	The need to bring retainers when going away
Appearance	Appearance
Cleaning	Cleaning
	Uncertainty on storage

(a) ***Hawley Retainers***

i *Speech Interference*

Many participants reported speech interference when wearing their retainers.

> '*Siapa tak hendak pakai, bila pakai, macam saya berjumpa dengan student, hendak bercakap tersembur-sembur air liur* (Who does not want to wear, when wearing, like when I am meeting with students, saliva sprays) (laughs)*.'* (Female, FGD, age 22).

Some removed their retainers when they needed to speak to others.

> '*If I can speak and they can understand then I wear it. If not, I take it off*.' (Male, FGD, age 27).

A few mentioned that the maxillary retainer covers the palate, which was why articulation of words was not clear.

> '*Dia tutup lelangit, bila bercakap, orang tak faham*. (It covers the palate, when talking, others don't understand.).' (Female, in-depth interview, age 21).

ii Eating Difficulty

Most of the participants voiced that it was troublesome to remove the retainers every time during mealtime.

> 'It's very easily to forget that you're wearing the retainer. Especially when you're having meals.' (Male, FGD, age 27).

Some discussed on the need to clean their retainers before putting them back on again after eating.

> '*When I want to eat then I have to remove it, which is quite a trouble. And I like to snack on food sometimes. I have to actually take it out, then after that I have to clean it, then put it back, it's quite a trouble.*' (Female, in-depth interview, age 23).

Several participants even resorted to just have a drink to avoid the hassle of having to remove the retainers if they were to eat something.

> '*Like I'll avoid eating, I'll just have a drink*.' (Female, FGD, age 30).

iii The need to bring retainers when going away

Many of the participants talked about the need to bring their retainers when going away.

> '*I think when you travel, just say you're going for a vacation, so it's like a must to take your retainers 'cause if you're going for a long period of time then you're not… you're gonna skip wearing your retainers*.' (Male, FGD, age 27).

One participant recalled her incident of leaving her retainers at her workplace.

> '*Just afraid that if forgot to bring. Cause I left my retainers one in my office then I went back home. Then I just realised "Oh gosh". I thought I lost it. Then after thinking, I think I left it in the office. And then I took a bus back to my office just purposely to take back my retainers because prior to that incident I left it again once in the office and I did wait the whole night. The next day when in the morning when I rush to the office and put it back in it's really tight. And then I regretted it so this time I just rush back to the office just to take the retainers then I go back home again.* (laughs)' (Female, FGD, age 30).

Another participant mentioned she forgot to bring her retainers to work or school.

Interviewer: '*Have you ever lost your retainer like you forgot to bring to school or to work?*'

Female: '*Yeah.*'

Interviewer: '*So how did you overcome that?*'

Female: '*I just waited until the end of the day when I was home*.'

(Female, in-depth interview, age 23)

iv Appearance

Some participants commented on the appearance of their denture-looking Hawley retainers.

> '*I would prefer another type of retainer which is the transparent one. Because uh, this pink colour one is actually not very looking like, you know…*' (Female, FGD, age 21).

> '*Sebab malas nak kena bukak depan orang kan… "Kau ni pakai gigi palsu ke apa?"* (Because I'm lazy to remove them in front of people… "Are you wearing dentures?" ' (Male, FGD, age 23).

One participant reported that others thought he was still having orthodontic treatment as the labial bow was visible.

> '*Just appearance because during like meeting other people, people will be like "ah, how come you still having the treatment?"*' (Male, FGD, age 27).

v Cleaning

Many participants acknowledged the difficulty to keep the retainers clean.

> '*So, whether you brush it every day, using toothpaste, or using the mouthwash mouth rinse, everything that you try it is not easy to remove. Whether on the side of the teeth, I mean the retainer, or on the bottom of it*.' (Female, FGD, age 21).

Some explained about food getting stuck on the wire components of the retainers.

> '*Ya the wire part. So, every time after eating I have to clean it up. It's just four corners, every time it's the upper two and the lower two I had to clean it up properly*.' (Male, FGD, age 27).

One participant shared her view on using diluted vinegar to help in removing stubborn dirt on her retainers.

> '*Hmm... I soak it for 15 minutes in diluted vinegar then I brush it with the* (unclear) *toothbrush. Usually, it actually like, after soaking for 15 minutes the white stain can actually come off. Just you have to soak that for, yeah diluted 50:50, 1-to-1*.' (Female, FGD, age 30).

A few found it cumbersome having to brush the retainers clean.

> '*It's like having an extra pair of teeth. Ya, so how you brush your teeth every day you got to brush your retainer*.' (Female, FGD, age 18).

(b) ***VFR***

i *Speech Interference*

Many participants would remove their retainers when they needed to speak.

'*...especially when for example presentation, (most participants nod in unison), I have to actually take it out, do my presentation, and put it back on.*' (Female, FGD, age 19).

'…*tak pakai masa study tu sebab nak cakap senang.* (…did not wear when studying because it's easier to speak)'

'…*ganggu sebab dia ada kat lingual surface*. (…disturbing because it's at the lingual surface.' (Male, in-depth interview, age 21).

ii Eating difficulty

Almost all participants reported that it was very troublesome for them to remove their retainers every time before eating or drinking sweetened beverages.

> '*…so bila doktor dah suggest jangan pakai bila minum air manis so macam agak susah sikit. Sebab bila kat luar kan nak buka macam take time sikit la*. (…so, when the doctor suggested not to wear them when drinking sweetened drinks, it's quite difficult. Because when eating out, it takes time to remove them.)' (Female, FGD, age 25).

> '*Sambil study saya suka makan juga. So bila ada retainer itu, nak study dan makan itu tak boleh sebab dia get in the way*. (I like to eat when studying. So, when there are retainers in place, I cannot study and eat because they get in the way.)' (Male, in-depth interview, age 21).

iii The need to bring retainers when going away

Some participants indicated that they had to bring along their retainers when going away from home.

> '*I don't take to trip because I had one time I almost forgot to bring back my retainers, so that's why I keep them safe, don't want to bring around. If not I have to come here and then I have to make another one. It's very troublesome*." (Male, FGD, age 21).

> '*I feel like I have to really bring a really big bag, just for… because I have a lot of things, so if I have to bring one more container then I feel like very leceh* (troublesome)." (Female, FGD, age 21).

iv Appearance

Few participants commented that people were aware of them wearing retainers although VFRs are translucent.

> '*My doctor said the first month need to wear 24 hours. I only did that for the first 3 days, and then it was like, I went to college and it was like I can't eat with this, then I had to go to toilet to take out, and then someone saw me, very embarrassing*.' (Female, FGD, age 19).

One of the participants pointed out VFRs propped her bite open.

> 'It's harder to close the mouth when you wear your retainer. So, there's like a gap in your mouth every time you want to talk. Like even if you're not talking your mouth is just like (opened).' (Female, FGD, age 18).

v Cleaning

Almost all the participants mentioned the difficulty in keeping their retainers clean.

> '*It's a bit hard to clean because certain area because it follows your gum and your tooth, so I think there's a bit of dent inside because it follows, and then there are certain areas where my toothbrush cannot reach*.' (Female, in-depth interview, age 23).

> '*I feel like very hard to clean it. ...I'm just going to use my brush and clean it but it's so hard. There're small gaps*.' (Female, FGD, age 19).

One participant voiced her experience of letting the retainers dry first to ease the removal of dirt on her retainers.

> Female (age 19): '*But then it'll get white stains*.'
> Female (age 21): '*Actually that white thing, you can actually remove it, when your retainers are dry. Just use a toothpick and scrap it.*'

On the other hand, some noted on the hassle to clean their retainers besides cleaning their teeth.

> '*'Cause you have to brush your own teeth and then you have to brush your retainer. Nak rendam lagi, basuh. It's like that la macam dua benda you kena jaga*. (I needed to soak and wash them. It's like that *lah* like there are two things you have to look after.)' (Female, FGD, age 23).

Several participants expressed their uncertainty in the correct way to clean their retainers.

Female (age 25): '*Hmm… because my doctor said kalau pakai toothpaste sahaja akan menghakis your retainer, macam itu (laughs), so I pakai sabun mandi sahaja.* (Hmm… because my doctor said if toothpaste was used, it would corrode your retainers, like that (laughs), so I used only body shampoo.)'

Interviewer: '*Sabun mandi? Ada siapa-siapa pakai sabun lain ke?* (Body shampoo? Anybody uses other types of soap?)'

Female (age 23): '*Tiada*. (No.)'

Female (age 26): '*What are we supposed to use?*'

vi Uncertainty on storage

A few participants were unsure of how to store their retainers.

'*I don't know where to store it, don't know whether to put it in an empty container or container with water*.' (Female, in-depth interview, age 23)

'*I don't know whether you're supposed to do this, but sometimes you know Listerine the mouthwash? I put it in a cup then I soak it in. But it smells nice afterwards, and it cleans, I think. I'm not sure whether it will harm the plastic or not*.' (Female, FGD, age 19).

'*After you wash, you put inside the container, it's very smelly when you take it out, I don't know why. So normally now I just open it*.' (Male, FGD, age 21).

4.2.1.2 Bonded Retainers

The emerged themes for bonded retainer were slightly different from those for removable retainers. Table 4.2 listed the emerged themes for bonded retainers.

Table 4.2: Emerged themes on the effects of bonded retainers on daily life

Bonded Retainers
Cleaning
The need to get bonded retainers checked

i Cleaning

Some participants talked about food impaction.

> '*Sometimes makanan melekat juga*. (Sometimes food will get stuck.)' (Male, FGD, age 25).

A couple of them commented on the importance of having toothpicks.

> Female, age 26: '*And use that stick.*'
>
> Female, age 33: '*Yang tu memang kena sentiasa ada. Sebab kalau takde dia rasa macam tak boleh survive*. (That is a must-have all the time. Because if there isn't any, it feels like it's unsurvivable.)'

Another participant said she could not properly brush the tooth surfaces with bonded retainers attached.

> '*Bila nak berus gigi tu macam tak kena dekat tempat tu*. (When brushing my teeth, it felt like it did not touch those places.)' (Female, FGD, 25).

ii The need to get bonded retainers checked

Several participants felt that it was important to get their bonded retainers checked regularly.

> '*Kena selalu buat check up to ensure yang belakang tu bersih* (Have to go for regular check-ups to ensure the one at the back is clean).' (Female, FGD, age 33).

> '*I went through two scalings already. So far it's quite okay*." (Male, in-depth interview, age 24).

4.2.2 Limiting Factors in Compliance with Retention Regimen

4.2.2.1 Removable Retainers

Generally, the emerged themes obtained for both types of removable retainers studied i.e. Hawley retainer and thermoplastic retainer (VFR) had some similarities. Table 4.3 summarises the list of themes for this group of retainers.

Table 4.3: Emerged themes on limitations in compliance with removable retention regimen

Hawley retainers	VFR
Instructed duration of wear	Instructed duration of wear
Lost retainer	Lost retainer
	Interfered eating habit
	Going away from home
	Retainer cleaning and cleanliness

(a) ***Hawley Retainers***

i Instructed duration of wear

Some patients had been instructed to wear their retainers full-time during the first month after fixed orthodontic appliance removal.

> '*Dr xxx kata saya kena pakai 24 jam. Tapi, saya try lah pakai 24 jam. Saya tengah mengajar sekarang ni. Jadi mengajar, saya pakai. Bila pakai, anak murid, bila saya cakap, tanya banyak kali banyak kali banyak kali.* (Dr xxx said I must wear for 24 hours. But, I tried to wear for 24 hours. I am currently teaching. So, when I am teaching, I wear [the retainers]. When I wear them, my students, when I speak, asked many many times.)' (Female, FGD, age 22).

One participant said he felt stressful when wearing his retainers all the time and he needed a break at times.

> Male: '*So far, I'm wearing 24 hours and then most of the time I took out like 3 to 4 hours, depends. Because sometimes I will take out longer time because I feel like, a bit stressed inside. So I take out for longer time. But most of the time I try to wear it for 24 hours*.'
>
> Interviewer: '*Ok. Can you elaborate a bit, when you say "stressed"?*'
>
> Male: '*It's like feeling that, there's something in your mouth, that like normal person when you like working for like five days, of course, weekend is your relax day right. So, it's the same, applicable for your mouth as well.*'
>
> (Male, FGD, age 27).

Most participants commented that they had been instructed to wear their retainers for at least twelve hours a day during the first year after fixed orthodontic appliance removal. But many confessed that they did not comply with the twelve-hour wear duration.

Interviewer: '*Oh okay, so jujur eh (jokingly). Ada pakai tak dua belas jam?* (Oh okay, so, be frank yeah (jokingly). Have you been wearing them for twelve hours?)'

(Collectively): '*Tidak*. (No.)'

Female (age 37): 'Weekend (sahaja) ah dekat rumah. Kita mula-mula memang kita pakai (dua belas jam) lama-lama kita tak pakai lah waktu tidur je kita pakai. ([Only on] weekends, at home. Initially, I really wore [for twelve hours], as time passed by I did not, I only wore when I was sleeping.)'

ii Lost retainer

One participant reported that she had lost her retainers when dining out and had difficulties in getting a new pair of retainers as she was busy studying.

> '*Almost six months. Tengah-tengah makan tiba-tiba pergi toilet sekejap. Barang memang tinggal. Tau-tau je pinggan dah angkat, my retainer lost macam tu je. Nak buat, tengah study. So macam susah nak buat.* (Almost six months. I went to the toilet in the middle of having a meal. I did not bring my belongings along. When I realised it, my plate had been taken away, and my retainers were lost just like that. I wanted to have it re-made, but I am currently studying.)' (Female, FGD, age 21).

Another participant shared a similar situation in which she could not find time to get a new pair of retainers since she was frequently out of town.

> '*Masa je la, sebab saya banyak outstation kan, ar so memang sebenarnya memang kalau boleh buat terus tapi the thing is saya selalu takde kat KL. Masa yang lepas hilang tu la.* (It's just time because I am frequently outstation, so actually, it is best to have it done right away but the thing is, I am not always in KL.)' (Female, FGD, age 23).

(b) ***VFR***

i *Instructed duration of wear*

Some participants had been instructed to wear their retainers the whole day.

(When asked regarding the instructed duration of wear)

Female (age 19): '*Twenty-four hours.*'

Most participants: '*Twelve hours.*'

Female (age 24): '*For me, the doctor said you wear them when you sleep, no specific time.*'

Female (age 19): '*I know mine said wear it as long as possible, but I was like, I'm just going to wear it when I sleep.*'

Male (age 18): '*Twenty-four hours, except for brushing and eating. For the first month, twenty-four hours, but after that, only night time.*'

Female (age 21): '*My doctor actually told me to wear it twelve hours, but I heard quite a number of other doctors said, some need to wear whenever you're not eating, but some said that you can wear it for just like specific hours. Different doctors say different things.*'

When asked regarding whether the instructed duration of wear was adhered to, some participants commented that they only wore their retainers when they were sleeping, which was less than the duration instructed.

'*Only when I sleep, but sometimes I sleep late, so it's like less than 8 hours*.' (Female, FGD, age 19).

Female: '*Waktu tidur sahaja.* (Only when I am sleeping.)'

Interviewer: '*Tapi tidur berapa jam?* (But how many hours do you sleep?)'

Female: '*Enam jam macam itu.* (About six hours.)'

(Female, FGD, age 21).

One participant had to work at night, therefore she did not wear her retainers whenever she was working.

'When I sleep, but then not regularly, sometimes when I have work then I don't really wear it.' (Female, FGD, age 24).

ii Lost retainer

One of the participants reported that since losing one of her retainers, she only wore the remaining one.

> '*I lost it. Saya hilang yang atas sahaja, bawah ada lagi*. (I lost the top one, I'm still having the bottom one)." (Female, FGD, age 21).

Another lady participant lost both her retainers when she left them on the office toilet sink.

> '*Saya pergi toilet, office toilet, and then saya letak dia atas sink. Maybe cleaner tu tak tahu benda tu apa then she just throw*. (I went to the toilet, office toilet, and then I put them on the sink. Maybe the cleaner did not know what they were then she just threw them away.)' (Female, FGD, age 33).

iii Interfered eating habit

Some participants reported that wearing retainers interfered their eating habit, and they would opt not to wear their retainers to avoid the hassle of having to remove them before eating.

> '*Kalau hendak stay up, tak sure lepas itu hendak keluar makan dengan kawan ke... So kalau macam itu better saya siap-siap tidak pakai retainer, daripada kena buka*. (If I want to stay up, I'm unsure of whether I'll eat out with friends afterwards, so if that's the case, it'd be better for me not to wear them than having to remove them afterwards.)" (Male, FGD, age 21).

> '*Because I like to eat, every time I have to eat then I have to remove them, basically, I just eat all the time, I just keep on eating, and so I just removed them whenever it's daytime*.' (Female, FGD, age 21).

iv Going away from home

One of the participants purposely left his retainers at home when going away as he wanted to prevent losing them.

> '*I don't take to trip because I had one time I almost forgot to bring back my retainers, so that's why I keep them safe, don't want to bring around*." (Male, FGD, age 21).

v Retainer cleaning and cleanliness

One of the participants mentioned that they did not wear their retainers because they were too lazy to clean the retainers.

> '*You feel difficult when you wake up you want to clean this again, and then ok la next day also forget to wear, then lama-lama (in the long run) you are not going to wear this*.' (Male, FGD, age 28).

Another lady participant stopped wearing her retainers as they become dirty.

> '*I noticed that they have like those white white thing on it, which I'm not quite sure what it is but I thought maybe it's some material growing so I didn't wear it*.' (Female, FGD, age 26).

4.2.2.2 Bonded Retainers

Only one theme emerged under this category for bonded retainers.

i *Lack of incentive to wear removable retainers when already wearing bonded retainers*

Some participants felt that by having their bonded retainers, it was sufficient to prevent relapse hence they did not wear the removable retainers according to the duration of wear instructed to them.

> '*Memang dia kata retainer tu kena pakai selalu. …tapi I still ada yang the apa ni yang lekat kat gigi tu.* (Indeed she said the retainers have to be worn always… but I still have this which is glued to the teeth.)" (Female, FGD, age 33).

> '*Because kalau dekat kat bawah tu ada, barulah dia straight, kan? So kat atas pun dia ikut dia punya barisan. Kalau dia takde, so dia lari. So atas pun macam lari, kan?* (Because if the one at the bottom is there, then it's straight, right? So, the top teeth will follow the alignment. If it's not there, so the teeth will move. So, the top teeth will also move, right?' (Female, FGD, age 23).

CHAPTER 5:DISCUSSION

5.1 Study Design

Patient satisfaction is complex and subjective in nature. Existing measuring tools such as questionnaires crudely measure patient satisfaction level limited to the domains present in the questionnaires. Subtle details and especially the reason for dissatisfaction may not be revealed using quantitative scales. Therefore, a qualitative study has been chosen to explore and investigate the source of content and discontent, and their effects on patients' everyday life and subsequently retention regimen compliance.

5.2 Subject Recruitment

The mean ages of subjects in all three focus groups and in-depth interviews in the present study were ranged from 20 to 26 years, similar to mean age of participants in Travess *et al*. (2004)'s focus group discussions and a quantitative study conducted by Almuqbil and Banabilh (2019). Travess *et al*. (2004) investigated patients who had orthodontic-orthognathic surgical treatment hence the higher age group as surgical treatment has a longer duration. Almuqbil and Banabilh (2019) had participants who were undergraduate dental students; hence they were more than 18 years old. Another previous qualitative study using focus group meetings (Bennett & Tulloch, 1999) recruited participants aged 11 to 17 years, and most previous quantitative studies recruited teenagers (Forde *et al*., 2018; Hichens *et al*., 2007; Jäderberg *et al*., 2012; Manzon *et al*., 2018). Generally, teenage individuals in the mixed dentition stage seek orthodontic treatment as most malocclusion start to develop then. The present study included individuals who were at least 18 years old as most people in Malaysia completes basic formal education at the age of 18, thus able to converse clearly in either one of the two common languages in the country i.e. Malay and English. This is to ease communication, especially in focus group discussions. Furthermore, we are interested in how orthodontic retention regimen affects one's daily life, especially working adults.

This is because retention is meant to be life-long, and most patients wearing retainers are working adults.

In this study, the majority of subjects in the focus groups comprised of females, similar to previous studies (Hichens *et al*., 2007; Jäderberg *et al*., 2012). This is not unusual when recruiting orthodontic patients consecutively as reported by Jäderberg *et al*. (2012) as more orthodontic patients are females. However, it would be more ideal if single-sexed focus groups were conducted as in Bennett and Tulloch's (1999) study to eliminate gender dimorphism.

5.3 Effects of Orthodontic Retention Regimen on Patients' Daily Life

5.3.1 Removable Retainers

From the present study, the themes emerged for both Hawley retainer and VFR were similar in terms of speech interference, eating difficulty, the need to bring retainers when going away, appearance and cleaning. Uncertainty on storage was the only different theme emerged for VFR.

In this study, speech interference was the most mentioned negative effect of removable retainers on patients' everyday life. This was because removable retainers cover the palate and encroach on tongue space. This is in agreement with findings from previous studies (Almuqbil & Banabilh, 2019; Bennett & Tulloch, 1999; Forde *et al*., 2018; Hichens *et al*., 2007; Jäderberg *et al*., 2012; Travess *et al*., 2004), and speech problem was found to be more prevalent in patients wearing Hawley retainers (Hichens *et al*., 2007; Wan *et al*., 2017). However, the exact reason as to how speech has been disturbed by the removable retainers has not been pinpointed in previous studies. The present study has identified the reason to be to the greater coverage area of Hawley retainers as the design incorporates palatal and lingual acrylic flanges, as compared to the design of conventional VFRs which covers up to the gingival at most. This has also

been pointed out by participants wearing maxillary Hawley retainers. Therefore, patients have to be warned of speech disturbance when wearing removable retainers and urged to adapt to it (Wan *et al*., 2017).

Previous studies (Almuqbil & Banabilh, 2019; Bennett & Tulloch, 1999) reported that patients who had retainers experienced difficulties in eating. However, the exact reason as to how eating is disturbed by the removable retainers has not been explored. The present study found that it is the inconvenience of having to remove removable retainers every time before eating that disturbed the patients, especially during the day. Some college students noted that late night supper with friends after studying together was a common impromptu activity and it was a nuisance for them to remove their removable retainers every time before going out for supper.

While none of the previous studies found bringing the removable retainers when leaving home was a problem to patients, the present study has some patients who reported diligently bringing their removable retainers when going to work or on holidays and then to experience forgetting their retainers there. Some related that they had to purposely bring a bag to carry the container with the retainers in it, and it was troublesome. Having a designated container for the removable retainers is a protective measure, especially when the retainers have to be brought away from home. This is because of the fragile nature of the removable retainers, more so of the brittle acrylic base plate of the Hawley retainers, which can break easily if accidentally knocked against a hard object.

Reports from previous studies concluded that VFRs were perceived to be more aesthetic than Hawley retainers and bonded retainers (Hichens *et al*., 2007; Manzon *et al*., 2018), and people wearing bonded retainers were more attractive than those wearing removable retainers (Meade *et al*., 2014). Social perceptions were found to be

influenced by retainer design and appearance (Meade *et al*., 2014). This problem affects patients who are wearing Hawley retainers as the denture-looking retainers and their visible labial bow component increased self-consciousness among patients and prevented them from wearing the retainers in public. Although VFRs are translucent, a few participants in this study commented that others were aware of them wearing the retainers, especially when they removed the retainers before a meal, and that was embarrassing to them. Another interesting finding which has not been highlighted in previous studies is the appearance of a patient's mouth propped open by the VFRs. This is because VFRs cover the occlusal surface of the teeth, preventing the maxillary and mandibular teeth from meeting each other, hence the open-bite appearance.

Forde *et al.* (2018) reported that VFRs were statistically significantly easier to clean than bonded retainers. While the present study did not conduct a measurable comparison between cleaning removable retainers and bonded retainers, most participants in the present study related their negative experiences in removing stubborn whitish dirt on the removable retainers. All of them who commented on this agreed that mere brushing was unable to get rid of the whitish dirt. VFR wearers commented that the design of the retainer which mimicked the exact morphology of the teeth made it harder for them to brush the deep curvatures and grooves on the retainers. To solve the problem, some of them shared their creative ways of using a diluted vinegar solution to soften the dirt first for easier brushing of the retainers. A few mentioned about letting the retainers dry beforehand so that it became easier for the dirt to be scraped off. The unhygienic appearance may put the patient off from wearing their retainers. The stubborn whitish dirt mentioned was most probably calculus deposits from inadequate cleaning.

On the other hand, another recent finding from this study is the uncertainty of some participants wearing VFRs on the storage method of their retainers. They were unsure of whether to store their VFRs in water or not and whether the VFRs could be soaked in commercial mouth rinses or not. VFRs are made of thermoplastic materials which will not undergo dimensional changes when desiccated like the acrylic base plate of Hawley retainers. Therefore, it is not necessary to soak VFRs in the water when they are not in use. The abovementioned confused participants had probably not received clear and comprehensive instructions from their orthodontists when they were given the retainers. Otherwise, they could have forgotten about the details of the instructions. Also, there is no scientific investigation on the effect of commercial mouth rinses on VFRs. Logically, many mouth rinses contain alcohol. As a solvent, alcohol can alter the properties of VFRs which are made of thermoplastic materials. Hence, soaking VFRs in mouth rinses for an extensive period of time is not recommended. In a nutshell, proper and detailed instructions must be given to the patients when issuing the retainers.

5.3.2 Bonded Retainers

Bonded retainers are attached on the lingual surfaces of anterior teeth. They may not be visible unless the patient opens his or her mouth widely. As they are small in dimension and have little coverage on the tooth surface, speech interference is not a problem with none of the participants in past and present studies mentioning it. Cleaning and the need to get the bonded retainers checked were themes emerged for this category.

As bonded retainers are attached on teeth and conventionally cover the contact points, food impaction is unavoidable and it is difficult for patients to clean the interdental surfaces without using supplementary oral hygiene aids such as super flosses. In this study, some participants stressed the importance of having toothpicks all

the time to clean their teeth every time after a meal. This has not been stated in previous studies. Corbett *et al.* (2014) introduced a variation of bonded retainers such as wave retainers to facilitate interdental flossing. However, no clinical difference was found between the periodontal health of anterior teeth retained with a straight retainer or a wave retainer for a period of two to four years. In this study, information on the type and design of bonded retainers worn by patients has not been gathered.

While some of our participants knew the importance of having regular dental scalings to maintain the cleanliness of their teeth and bonded retainers, several of them felt that it was important to get their bonded retainers checked regularly. This has not been described by previous studies and the reason could be non-inclusion of this aspect in the questionnaires used. Clinicians have to ensure that patients have the dexterity and willingness to perform additional steps in their regular oral hygiene practice before prescribing bonded retainers. On top of that, proper oral hygiene instructions, especially on bonded retainer cleaning, are essential.

5.4 Limiting Factors in Adherence to Retention Regimen

5.4.1 Removable Retainers

In the present study, the emerged themes regarding the factors limiting patients from adhering to their prescribed retention regimen were similar for both Hawley retainer and VFR. Instructed duration of wear, lost retainer, interfered eating habit, going away from home, retainer cleaning and cleanliness were listed.

Different duration of removable retainer wear has been prescribed by clinicians at the Faculty of Dentistry, University of Malaya. It has been reported to be ranged from full-time, twelve hours a day, only at night, to only when sleeping. While the accumulative impression from previous studies shows that no solid existing evidence has proven the optimum duration of retainer wear to prevent relapse, it is shown that with potential

implications for health burden, retainer longevity and cost-effectiveness, as well as patient satisfaction and compliance as other important issues considered, part-time removable retainer wear is sufficient and more practical than full-time retainer wear. However, many of our participants reported only wearing their removable retainers when they were asleep, and most of them admitted having less than 6 hours of sleep. While no studies have been conducted to look into the minimum hours of retainer wear needed for retention to be effective, the fact that most young adults do not sleep much could have affected the efficacy of retainers in maintaining their teeth straight, to some extent. According to projections, around 35% of American adults reported sleeping less than 7 hours per night (Centers for Disease Control and Prevention, 2014). Although no survey has been conducted to estimate the average duration of sleep our general population gets, the local scenario may be similar to the American's.

Apart from that, the issue of lost retainers has not been discussed in previous studies, most probably because experiences as such will only be revealed when probed in depth. A few of the participants in this study reported losing their retainers hence unable to wear them. Most of them commented on their difficulties in getting replacements due to their busy schedules. Interestingly, one of them related her experience of losing her Hawley retainers when she was dining at a restaurant. She left the retainers on a plate and the waiter collected the plate together with her retainers. Another participant accidentally left her translucent VFRs on a toilet sink at work and a toilet cleaner threw them away not knowing what they were. Incidents and experiences as such may be disclosed to patients when the removable retainers are issued as a precautionary warning. This may increase the awareness and alertness among patients on trivial matters that may cause them to lose their retainers.

Quite a number of participants in this study noted that they resorted not to wear their retainers at all when going out to avoid the trouble of removing their retainers every time before a meal, more so if they have to do it in public because it was embarrassing to them. Some did not wear their retainers at all during the daytime as they had a habit of eating frequently. This noncompliance due to disturbed eating habits has been reported by Almuqbil and Banabilh (2019) in their quantitative study using questionnaires as the measuring tool.

A couple of findings which have not been explored by previous studies are the need to carry a container and the worry of misplacing the removable retainers when going away from home which has dissuaded patients from bringing the retainers out. Many participants in the present study commented that they often did not bring their retainers when going away for vacation. As a result, the removable retainers were not worn for the duration of time the patients were away from home. This is more worrying when patients need to leave home for more than a couple of days as relapse may occur readily. And when the patients get home after a long period of time, some relapse may have happened which then cause the retainers to be too tight fitting. This discomfort may possibly further discourage the patients from wearing their retainers again, hence causing further relapse until the retainers cannot fit at all.

Removable retainer cleaning and cleanliness, and their effects on retainer wear compliance have not been investigated by previous studies. One of the participants in this study opted not to wear his retainers because he was too lazy to clean them. Although this may seem to be a one-off discovery pertaining to an individual's behaviour, its significance should not be neglected. This is because the prevalence of such behaviour could be under-reported as it takes great courage for one to admit his or her negligence. On another note, a lady participant in this study stopped wearing her

retainers when they became dirty. This raises the alarm that proper cleaning instructions should be given to patients when the retainers are issued to prevent noncompliance due to such preventable matters.

Most of the negative effects removable retainers have on patients' everyday life and their impact on retainer wear compliance found in this study will be eliminated once clinicians prescribe night-only retainer wear regimen. Several studies have shown that removable retainers need only to be worn at night to maintain the stability of the orthodontically correction dentition (Forde *et al*., 2018; Kaklamanos *et al.*, 2017; Shawesh *et al.*, 2010), and that full-time retainer wear may affect patient satisfaction and compliance (Kaklamanos *et al*., 2017).

On the other hand, patients with restorative needs for tooth build-up and replacements are often prescribed orthodontic retainers with variations such as acrylic denture tooth for space maintenance prior to definitive restorative treatment. These patients are required to wear their retainers all the time to preserve the space planned for restorative work. Therefore, the aforementioned effects of orthodontic retainers on patients' life during the day will be faced by this group of patients until they receive definitive restorative treatment. From then onward, night-only retainer wear should be recommended.

5.4.2 Bonded Retainers

All the participants in this study who wore bonded retainers were also prescribed removable retainers. The only theme emerged for this group of patients regarding the factors limiting them from complying with their orthodontic retention regimen was the lack of incentive to wear removable retainers when already wearing bonded retainers. This practice of dual-retention is in agreement with the opinion of Rinchuse *et al.* (2007) that the combination of different removable and fixed retainers increases

treatment stability and patient compliance, and that the removable retainer can hold the teeth in place until the failed bonded retainer is repaired or replaced (Johnston & Littlewood, 2015). Several participants were confident that their bonded retainers alone were sufficient to prevent relapse, and although the maxillary teeth did not have bonded retainers, they should follow the alignment of the mandibular teeth which were bonded using retainers. Fortunately, none of them reported having had broken or lost bonded retainers. As patients may not be able to tell when there is a breakage in their bonded retainers until obvious unwanted tooth movement has occurred, a proper review appointment system has to be set up. More so when bonded retainers are shown to be prone to breakages (Forde *et al*., 2018), subsequently resulting in unwanted tooth movement and increased risk of caries and demineralisation (Bearn, 1995). Therefore, patients must be informed of the importance of wearing removable retainers over their fixed retainers in preventing relapse should their fixed retainers break.

5.5 Limitations

Due to convenience sampling, the pool of participants recruited were those residing in the city (Klang Valley). Urban lifestyle can be more hectic with long hours spent on the daily commute to work and school, and a faster pace of living. Therefore, the findings obtained from this study may not be an insight for rural people.

Gender distribution was unequal as there were more female orthodontic patients at the Faculty of Dentistry, University of Malaya. We suggest that further focus group discussions are conducted with participants from the same sex to eliminate gender dimorphism in the aspects of compliance to retainer wear, way of living, and even openness to express one's own thoughts.

Our participants were mainly young adults who were either college students or working adults. Hence results obtained may not be applicable to teenagers and mature adults. Lifestyle, mind frame and social background differences may also have influenced experiences and perceptions among the participants.

CHAPTER 6:CONCLUSION

6.1 Conclusions

Within the limitations of the study, the following can be concluded:

1. Speech, appearance, eating, cleaning, storing, the need to bring removable retainers when going away, and the need to get bonded retainers checked are the main effects of orthodontic retainers on patients' everyday life.
2. Forgetting to bring retainers when going away, lost retainers, interfered eating habit, retainer cleaning and cleanliness and not wearing removable retainers over fixed retainers prevents patients from adhering to the retention regimen.
3. Night-only removable retainer wear regimen eliminates the embarrassment of speaking, eating, and appearing with retainers in public.

In conclusion, themes identified in this study can form a conceptual framework for the future development of a validated questionnaire regarding patient satisfaction to orthodontic retention.

6.2 Recommendations

6.2.1 Recommendations for clinical practice

With solid scientific evidence indicating night-only orthodontic retainer wear is sufficient in maintaining the stability of orthodontic treatment results, clinicians should prescribe removable orthodontic retention regimen based on current evidence.

Personalised orthodontic retention prescription suiting the individual patient's lifestyle and needs may improve patient satisfaction and compliance to retention regimen. Individuals with a busy lifestyle and inconsistent sleeping hours, such as those who work in jobs that require shift schedules or going outstation, police and military personnel, and parents with infants may be more suited to wear bonded retainers. Patients with poor manual dexterity should not be issued bonded retainers as they may not be able to clean their retainers and teeth thoroughly, possibly resulting in tooth demineralisation and retainer failure.

Essentially, clinicians must provide proper hygiene instructions and demonstration on ways to clean the removable and bonded retainers, and also teeth bonded with retainers. Advice on what to expect living with retainers and how to cope with adhering to the prescribed orthodontic retention regimen should also be given. Patients who will be given bonded retainers must be informed of the importance of having their retainers reviewed regularly as they are at risk of tooth relapse.

Although review appointments, especially for bonded retainers, are important, orthodontists may be overburdened as the number of patients with bonded retainers increases with time. General dental practitioners (GDPs) can be empowered to take over the role of orthodontists for retainer maintenance during the patients' regular dental check-up appointments. If any arising issue is beyond the GDP's ability to manage, the

patient has to be referred to an orthodontist. By doing this, it may be a win-win situation for the orthodontists, GDPs, and patients.

6.2.2 Recommendations for future studies

Single-sexed focus groups are desired to exclude any bias due to gender differences. Furthermore, whether gender influences the effects of orthodontic retention regimen on patients' everyday life should also be investigated.

The inclusion of patients wearing orthodontic retainers with restorative variations full-time can also be included for comparison and exploration on their satisfaction and problem faced when living with retainers.

Participants in our study were young adults. Patients of different age groups, namely teenagers and older adults may have different perception and lifestyle compared to young adults. Therefore, further research is needed.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

Soh, E. X., Radzi, Z., Saub, R., & Littlewood, S. J. (2019). Patients' Self-assessment on Orthodontic Retainers - A Qualitative Research. In *The 25th Malaysian Association of Orthodontics International Scientific Conference and Trade Exhibition*. Kuala Lumpur: Malaysian Association of Orthodontists.

Patients' Self-assessment on Orthodontic Retainers – a Qualitative Study

E.X. SOH[1]*, Z. RADZI[1], R. SAUB[1], S.J. LITTLEWOOD[2]. ([1]Universiti of Malaya; [2]St. Luke's Hospital, Bradford, U.K.)

Objectives: To explore the effect of the prescribed orthodontic retainers on patients' everyday life and to explore the limitations in adhering to the prescribed orthodontic retention regimen.

Methods: A qualitative study was carried out using the grounded theory approach. Individuals on a fixed or removable retention regimen were recruited. In-depth interviews (IDI) and three focus group discussion (FGD) – Hawley retainer group, thermoplastic retainer (VFR) group and a mixed group (removable and fixed retainers) were conducted. All responses were tape-recorded and transcribed. Framework analysis was undertaken to determine emerging themes.

Results: Six IDIs with three male and three female participants aged 18 to 24 years were conducted until a saturation point was reached. All three FGDs had more female than male participants aged 18 to 37 years. Emerged themes on the effects of retainers on patients' everyday life were speech interference, the appearance of the retainers, difficulty cleaning, and uncertainty on storing removable retainers. Emerged themes on limitations in adhering to the retention regimen were remembering to take removable retainers when going away, lost removable retainers and lack of incentive to wear removable retainers when already wearing fixed retainers.

Conclusions: Speech, appearance, cleaning and storing are the main effects of orthodontic retainers on patients' everyday life. Forgetting to bring retainers when going away, lost retainers, and not wearing removable retainers over fixed retainers prevents patients from adhering to the retention regimen. These themes can form a conceptual framework for the future development of a validated questionnaire regarding patient satisfaction to orthodontic retention.

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