IMPACTS OF SELF-PERCEIVED MALOCCLUSION ON THE ORAL HEALTH-RELATED QUALITY OF LIFE OF YOUNG ADULTS IN MALAYSIA

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IMPACTS OF SELF-PERCEIVED MALOCCLUSION ON THE ORAL HEALTH-RELATED QUALITY OF LIFE OF YOUNG ADULTS IN MALAYSIA

ABSTRACT

Objectives: To assess the prevalence, severity and extent of impacts of self-perceived malocclusion on the oral health-related quality of life (OHRQoL) related to dental aesthetics among young Malaysian adults, to compare between those with and without self-perceived malocclusion and to investigate the influence of demographics on the outcome. Methods: Multi-stage random sampling method was used to recruit 589 subjects from tertiary institutions in Malaysia. Study instruments comprised the Aesthetic Component of the Index of Orthodontic Treatment Need (AC-IOTN) and Malaysian version of the Psychosocial Impact of Dental Aesthetics (PIDA) to measure self-perceived malocclusion and its impacts. Analyses included multifactorial ANOVA and Pearson correlation. Results: The response rate was 83.5%. Data analysis included complete data on 524 subjects. 92.6% of subjects with self-perceived malocclusion reported impacts on their OHRQoL. Psychological Impact was the most prevalent domain affected (75.8%), followed by Dental Self Confidence (59.4%), Social Impact (48.9%) and Aesthetic Concern (22.1%) domains. 28.6% subjects with self-perceived malocclusion reported significant impact on all domains while their mean severity PIDA scores were 43.9 (±16.1). Females had higher PIDA scores than males while Malays had higher PIDA scores than Indians ($p>0.05$) but the effect sizes were small. There was small yet significant interaction effect between gender and place of residence. Females in sub-urban and rural areas had significantly higher PIDA scores than their male counterparts. Conclusion: The study provided baseline data to demonstrate that Malaysian young adults were highly impacted by their perception of their malocclusion. Gender, race and residence influenced this effect.

Keywords: psychosocial impacts of dental aesthetics, self-perceived malocclusion

IMPAK MALOKULUSI TANGGAPAN KENDIRI TERHADAP KUALITI HIDUP BERKAITAN KESIHATAN GIGI BAGI BELIA DI MALAYSIA

ABSTRAK

Objektif kajian: Tujuan kajian adalah untuk menyelidik prevalens, keterukan dan tahap impak malokulusi tanggapan kendiri terhadap kualiti hidup berkaitan kesihatan gigi (OHRQoL) secara estetik dalam kalangan belia Malaysia, membandingkan antara golongan yang mempunyai dengan tidak mempunyai malokulusi tanggapan kendiri, serta pengaruh demografi yang terlibat. Metodologi: Seramai 589 peserta daripada institusi pendidikan tinggi di Malaysia telah terpilih melalui pensampelan rawak pelbagai peringkat. Soal-selidik "Aesthetic Component of the Index of Orthodontic Treatment Need (AC-IOTN)" dan "Psychosocial Impact of Dental Aesthetics (PIDA)" versi Malaysia digunakan untuk mengukur malokulusi tanggapan kendiri dan kesannya terhadap OHRQoL. Analisis terlibat ialah ANOVA pelbagai faktor dan korelasi Pearson. Dapatan kajian: Kadar respons adalah 83.5%. Analisis data menggunakan data penuh daripada 524 peserta. Terdapat 92.6% peserta dengan malokulusi tanggapan kendiri dengan impak terhadap OHRQoL mereka. "Psychological Impact" merupakan domain yang paling terkesan dalam kalangan belia (75.8%), diikuti "Dental Self Confidence" (59.4%), "Social Impact" (48.9%) dan "Aesthetic Concern" (22.1%). Terdapat 28.6% peserta dengan malokulusi tanggapan kendiri dengan impak signifikan dalam kesemua domain, manakala purata tahap keseriusan PIDA adalah 43.9(±16.1). Perempuan mempunyai skor PIDA lebih tinggi daripada lelaki, manakala Melayu mempunyai skor PIDA lebih tinggi daripada India ($p>0.05$), namun ukuran kesan adalah kecil. Terdapat kesan interaksi yang kecil tetapi signifikan di antara jantina dan kawasan tempat tinggal. Perempuan di sub-urban dan pedalaman mempunyai skor PIDA lebih tinggi daripada lelaki di kawasan sama. Kesimpulan: Kajian ini telah menyediakan data asas untuk menunjukkan bahawa malokulusi tanggapan kendiri mempunyai kesan yang tinggi terhadap belia Malaysia. Jantina, bangsa dan kawasan tempat tinggal mempengaruhi kesan ini.

Kata kunci: impak psikososial berkaitan estetik gigi, malokulusi tanggapan kendiri

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df : Degrees of freedom

F : F-statistic

Sig.: significance probability

α : Alpha

ηp^2 : partial eta squared

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CHAPTER 1: CHAPTER 1: INTRODUCTION

1.1 Background of study

In the world where everything about us can be shown on social media, appearance plays an important role in making our first impression. Not only our family, relative, friends or acquaintances able to observe on our daily life, strangers are also developing their own opinions by just observing our images through social media without getting to know us.

Adaptation into social standards is one of the reasons we placed our looks as one of the essential aspects in our life. Some people did put a higher value in their appearance esteem as the door for social acceptance. They keep on checking their own looks in any time, and their self-worth relies on the perfectness of their appearance on that day.

Young adults typically fall victims of over-comparing their self-image. During adolescent stage, we started learning about body image and its impact on our social well-being.

Appearance esteem is branching out from body esteem, which is traced back into a concept of self-esteem (Park & Ko, 2011). Experiencing lower self-esteem does bring negative effects on our life satisfaction (Kang et al., 2003) and quality of life (QoL) (Agou et al., 2008). One of the key attributes of QoL, oral health-related quality of life (OHRQoL), in another hand, is still a less prominent concept that still being explored theoretically and empirically.

One of the main issues in OHRQoL is the impact of aesthetic concern of the teeth. Facial features in particular are uniquely individual, and the dentition are one of the prominent structures that are vital in refining it. Due to its nature as one of the prominent features of the face, people are willing to get treatment for their dental appearance despite the only reason being aesthetic issue and not physical pain.

The negative effects of having concerns over dental aesthetic issues might contributed for such phenomenon. It had been related to lower level of general well-being, namely the social life (Marques et al., 2006; Traebert et al., 2005), self-awareness (Klages et al., 2004) and daily performances (Peres et al., 2009).

Increasing demands for orthodontic treatments had shown the attempts to improve the affected OHRQoL. This signify the importance of having nicely aligned teeth, with the young adults are one of the most popular groups who request orthodontic care (Meai et al., 2009).

1.2 Problem statement

The dental aesthetics concern mainly originating from a dental condition known as malocclusion. Malocclusion is “the misalignment of the teeth when the jaws are closed” ("Malocclusion," 2019). Generally, malocclusion is diagnosed clinically by the dentist or orthodontist, however it also can be done by self-assessment. The term “self-perceived malocclusion” defines the malocclusion rating based on the individual perspective of his or her own teeth.

It is common practice to refer for clinical diagnosis of malocclusion before proceeding into orthodontic treatment. The orthodontic treatment had been based mostly on improving the appearance of teeth, as well as normative need assessment. However, the impact of the malocclusion towards their daily life had been overlooked. Therefore, considering the patient’s feedback in determining the psychosocial impacts of the dental appearance is one of the crucial steps (Siddiqui et al., 2014). Furthermore, understanding the impacts of self-perceived malocclusion on the OHRQoL is important while practicing a holistic approach in anticipation of meeting patients’ expectation while pursuing better clinical outcomes.

OHRQoL, simply put is the understanding of the individual as whether their oral health condition is within their own expectation. This term is derived from the World Health Organization (2018) term Quality of Life (QoL), generally means one’s viewpoint of their desired outcome as compared to his/her life in the aspects of their society and value system.

On the other hand, malocclusion related OHRQoL is rarely being discussed particularly in the Malaysian general population. Malaysian past studies of OHRQoL had been focused on treatment-seeking population (Masood et al., 2013; Tin-Oo et al., 2011). In Malaysia, the subsidized orthodontic treatment had been limited towards Malaysians

aged below eighteen years old with exceptions depending on their treatment needs such as multidisciplinary cases. It is also important to understand the concerns of potential orthodontic patients particularly among the young adults, since children and adolescents were given priority of access in getting orthodontic treatment.

Young adults, which is the focus group of this study is currently being defined globally as person aged from 15 to 24 (UNESCO, n.d.). However, UNESCO will follow the local definition of youth at national level. Previously, Malaysian youth had been classified as person aged from 15 until 40 years old in Malaysia (Ministry of Youth and Sports Malaysia, 1997). Recently, the redefinition had been done to 15 until 30 years old under the Youth Societies and Youth Development Act 2007 (Act 668) (Rahman, 2019).

As mentioned before, young adults are one of the age groups that is gullible with appearance concern and lack of self-esteem. Thus, some of the them may not only seeking the treatments only due to physical concern (teeth appearance), but other reasons such as psychological impact or affected daily life due to malocclusion. It is also essential to understand their concerns of the teeth appearance in psychosocial aspect.

Therefore, there is a need for a baseline epidemiological data on the nation's young adults who perceived themselves with poor dental aesthetics. The outcome of this study may provide information on the need for treatment based on the impacts on their OHRQoL. The evidence may aid government policy makers to consider extending the provision of orthodontic treatment to this group.

1.3 Significance of the study

Current provision to prioritize orthodontic treatment is based on normative need using clinical indices, such as the Index of Orthodontic Treatment Need, and assessed by clinicians. Thus, national treatment need estimation is currently based on the normative need. Such method may not reflect the impacts on the OHRQoL as experienced by the individuals from their perception of their own malocclusion.

This study would provide evidence on the orthodontic treatment need based on impact related need as reported by individuals, especially those with self-perceived malocclusion. Understanding the public's viewpoint towards the psychosocial impacts of self-perceived malocclusion will improve the orthodontic practice in serving better patient care.

Unlike past studies that using instruments like Oral Health Impact Profile (OHIP) and the Oral Impacts on Daily Performances (OIDP), which were developed for assessing impacts related to general oral health, the instrument used in this study was developed specifically for the assessment of impacts on the OHRQoL related to malocclusion. Thus, the findings may reflect the national impact related need for orthodontic treatment among Malaysian young adults. The findings of this study may also aid clinicians, health policy makers and researchers to understand the way malocclusion affects the ORHQoL of young adults.

Other than that, the data from this study may assist in enhancing the treatment policy in Malaysia such as considering better options of subsidized orthodontic treatments for Malaysian young adults as well as improving the oral health financing in government-based hospitals and clinics.

1.4 Research objective

Purposes of this study is divided into two, general aim and specific objectives. The aim of study is a wider perspective of the desired outcomes that will be accomplished in this study. The specific objectives, however; are in-depth description of the research aim. In this study, there will be three specific objectives branching out from the general objective. Further details are shown below.

1.4.1 Aim of study

a) To assess the psychosocial impact of dental aesthetic in Malaysian young adults

1.4.2 Specific Objectives

a) To assess the prevalence, severity and extent of the psychosocial impact of dental aesthetics in Malaysian young adults

b) To compare the prevalence, severity and extent of psychosocial impact of dental aesthetics in Malaysian young adults with and without self-perceived malocclusion

c) To identify factors associated with psychosocial impact of dental aesthetic in Malaysian young adults

1.5 Research Hypothesis

There are two different hypotheses for this study. The first hypothesis, the null hypothesis (H_0) will be stated that there is no significant difference in between variables of the study. This hypothesis will be accepted if the results of the study did show that there is no relationship or association between variables.

Meanwhile, alternate hypothesis (H_A) was offered aside H_o, and defined that there is indeed significant difference in between study variables. The acceptance of H_A indicated that the study results shown association between variables in the study. Both of the hypotheses were stated below.

1.5.1 Null hypothesis (H_0)

There is no significant difference in OHRQoL impacts between young adults with or without self-perceived malocclusion.

1.5.2 Alternative hypothesis (H_A)

The young adults with self-perceived malocclusion will have higher impacts of OHRQoL compared with those with no self-perceived malocclusion.

1.6 Conceptual framework of study

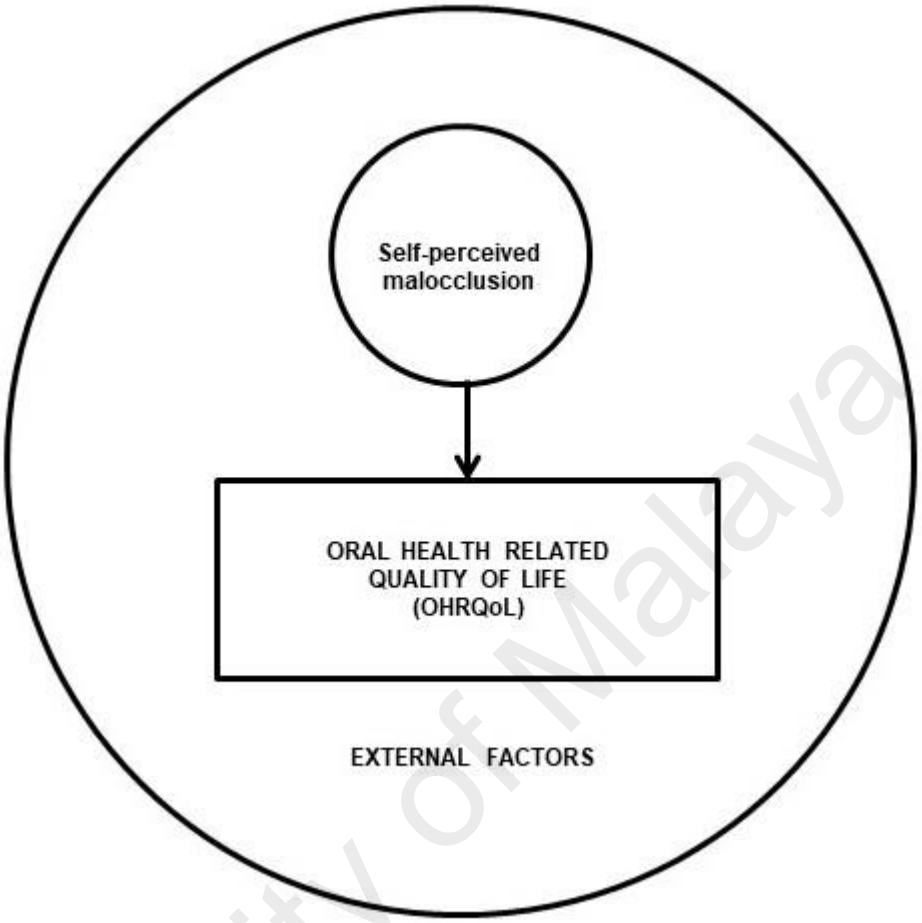

Figure 1.1 The conceptual framework of this study

This study is focusing on the psychosocial impacts of the self-perceived malocclusion on the OHRQoL (represented by the arrow). The psychosocial impacts were measured through prevalence, severity and extent of the impacts. Both self-perceived malocclusion and OHRQoL were impacted by external factors encircling them. The factors related to the psychosocial impacts of self-perceived malocclusion studied in this research are age, gender, ethnicity, household income and place of residence.

CHAPTER 2: LITERATURE REVIEW

2.1 Malocclusion and related studies

2.1.1 Definition and factors related to malocclusion

In the early years, Angle (1899) is the pioneer in describing the word “malocclusion”. Malocclusion is derived from the word “occlusion”, which generally means the facing teeth’s facets being into contact with each other ("Occlusion [Def. 1b]," 2018). Nelson and Ash (2010) however criticized the typical definition of occlusion by excluding the masticatory system and the performance of oral motor aspects.

Malocclusion, on another hand, is a “deviation or a malrelationship of the dental arches outside the accepted range of normal” (Ireland, 2010). It is quite different with other teeth conditions that only affects the physical parts, as World Health Organization (WHO) stated in their World Oral Health Report (Petersen, 2003), that it is classified as in different context with disease. In more specific, malocclusion is a group of teeth misalignment that can affect quality of life in certain situations (Petersen, 2003). During developmental age, it is mainly caused by the disruption of typical growth processes of occlusion (Nelson & Ash, 2010).

There were several types for classification of malocclusion (Table 2.1), namely Angle’s classification, British Standards Institute classification, Summers occlusion index, Index of Treatment Need (IOTN), Peer Assessment Rating (PAR) and Index of Complexity Outcome and Need (ICON) (Mitchell, 2007), and the Angle’s Class I malocclusion is the most common type found in various settings (Jafari et al., 2008; Lew et al., 1993; Soh et al., 2005).

Table 2.1 The summary of malocclusion classification

Malocclusion Classification Type	Classification

Angle's classification	• Class I
	• Class II
	  • Division 1
	  • Division 2
	  • Sub-division
	• Class III
	  • Pseudo-class
	  • Sub-division

British Standards Institute classification	• Class I
	• Class II,
	  • Division 1
	  • Division 2
	  • Class III

Summers occlusion index	• Based on the scoring

Index of Treatment Need (IOTN)	• Dental Health Component (DHC)
	  • Grade 1-5
	• Aesthetic Component (AC)
	  • Rating 1-10

Peer Assessment Rating (PAR)	• Based on PAR score
Index of Complexity Outcome and Need (ICON)	• Based on ICON score - Easy to Very Difficult treatment

2.1.2 Psychosocial impacts of malocclusion

In adolescents and young adults, malocclusion had proved to affect them in several psychosocial aspects, such as bullying (DiBiase & Sandler, 2001; Seehra et al., 2011; Seehra et al., 2012), self-esteem (Agou et al., 2008; DiBiase & Sandler, 2001), and aesthetic concerns (Gardezi et al., 2015; Tin-Oo et al., 2011).

It is shown that dental aesthetic issue is one of the popular reasons that stimulates bullying, especially because of teeth loss or gap, dental appearance, and maxillary frontal teeth that are noticeable (Al-Bitar et al., 2013).

There are conflicted opinions about impacts of malocclusion towards one's self-esteem. Agou et al. (2008) and DiBiase and Sandler (2001) had supported that malocclusion does have negative impact on self-esteem.

However, several studies had objected that self-esteem did not have any impact towards orthodontic issues, or vice versa (De Baets et al., 2011; Foster Page et al., 2013; Huang, 2010; Seehra et al., 2012). In explaining these, self-esteem is agreed upon that it only serves as an individual coping strategy in negative situations (De Baets et al., 2011), thus makes it harder to be influenced by other components, indicating its consistency (Huang, 2010).

Moving to aesthetic concerns, females are the ones typically associated with teeth appearance concerns (Tin-Oo et al., 2011). Differences in genders are also noted in Rusanen et al. (2011) study, where low level of malocclusion-related Oral Health Related Quality of Life (OHRQoL) are evident in women. Thus, authors urged that the genders difference need to be considered while studying relationship between malocclusion and OHRQoL (Rusanen et al., 2011).

Other than that, the personal worry about own mental and social aspects as well as the problems with teeth precedes the orthodontic treatment (Gardezi et al., 2015).

2.2 Malocclusion and Oral Health Related Quality of Life (OHRQoL)

2.2.1 Malocclusion and OHRQoL

Sheiham (2005) had made a remark in WHO bulletin, mentioning that oral health is contributing to overall health spectrum, insisting on its importance on human's life. He further elaborates on the effects that oral health issues may bring in daily life since it correlates in essential human productivity such as eating, talking, quality of life as well as well-being (Sheiham, 2005).

Malocclusion is one of the oral health issues that has a negative relationship with quality of life (QoL) as shown in several studies (Gardezi et al., 2015; Liu et al., 2009; Masood et al., 2013).

Thus, it is crucial to know the extent of undesirable impacts of malocclusion will bring so that we can have better productivity level throughout our lifespan and achieve better life.

2.2.2 Orthodontic treatment and OHRQoL

The orthodontic treatments had shown contribution towards better levels of OHRQoL. (Seehra et al., 2012; Silvola et al., 2016).

There is a noteworthy discovery in 2015 study among adult subjects (18 to 64 years old), mentioning that OHRQoL of patients with severe malocclusion had been improved along with treatment due to reduction in facial pain (Silvola et al., 2016). Apart from that, majority (78%) of bullied adolescents in UK research that attended orthodontic treatment had experienced a decrease in bullying occurrence afterwards (Seehra et al., 2012).

Most of the malocclusion treatment aims towards non-functional issues, specifically to improve the teeth appearance, which is the main aim of majority of patients since their quality of life were affected by the aesthetic issues (Abdullah et al., 2001; Raescu et al., 2014).

2.3 Instruments in measuring OHRQoL

2.3.1 OHRQoL Models

There are few models related to OHRQoL were established. Earlier noteworthy model is the adaptation of World Health Organization's (WHO) International Classification of Impairments, Disabilities and Handicaps model (WHO,1980) for dentistry field by Locker (1988). The model comprises of three levels, which is “impairment” (level one), “intermediate impacts” (level two) and “ultimate impacts” (level three) (Locker, 1988).

As for current models, one of the recent OHRQoL models was done by Sischo and Broder (2011) (Figure 2.1).

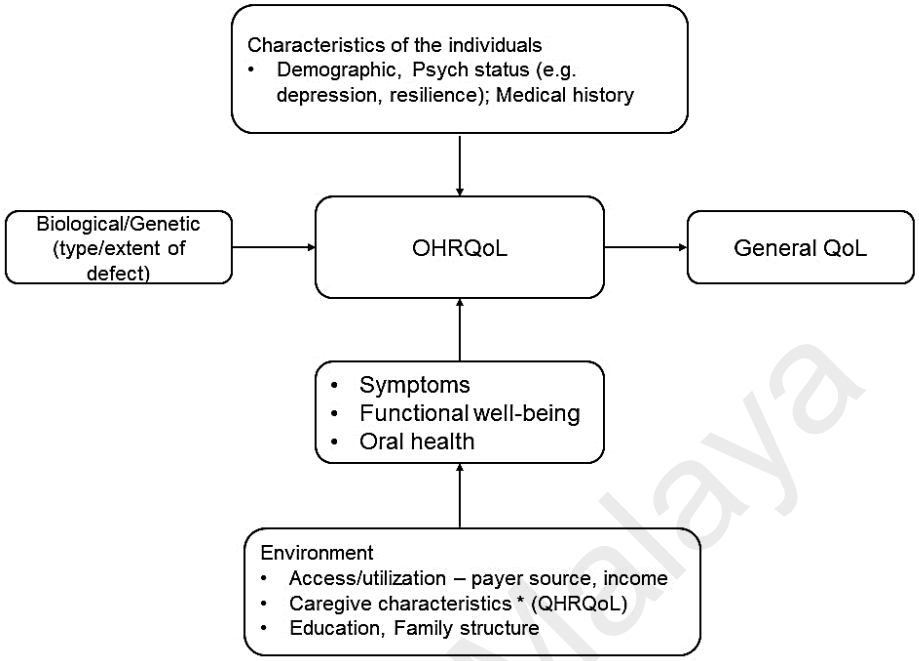

Figure 2.1 OHRQoL model for children

Adapted [reprinted] from "Oral health-related quality of life: what, why, how, and future implications," by Sischo and Broder, 2011, Journal of dental research, 11, p.1265. Copyright (2011) by Hillary Broder". Reprinted with permission.

The model discussed oral health as a multifaceted construct where it combines "clinical variables, functional status, oral-facial appearance, psychological status, OHRQoL and overall QoL" (Sischo & Broder, 2011). They were also enlightened on the significance of OHRQoL in their article (Sischo & Broder, 2011). Other research involving younger generations also discover the psychosocial effects in dental problems, further strengthen the findings by them (Foster Page et al., 2013; Rodd et al., 2011).

2.3.2 General OHRQoL Instruments

OHRQoL is mostly measured by self-assessed questionnaires in order to gain the patient's perspective and feedback regarding condition of their own teeth as well as the effects on their quality of life. Table 2.2 had summarized the oral health measures available into before and after year of 1997 (Locker & Allen, 2007) with additional malocclusion-specific measures noted in asterisk.

Table 2.2 Oral health measures list

		Author (Year)
Pre-1997	Social Impacts of Dental Disease	Cushing et al. (1986)
	General (Geriatric) Oral Health Assessment Index (GOHAI)	Atchison and Dolan (1990)
	Dental Impact Profile (DIP)	Strauss and Hunt (1993)
	Oral Health Impact Profile (OHIP)	Slade and Spencer (1994)
	Oral Impacts on Daily Performance (OIDP)	Adulyanon and Sheiham (1997)
	Subjective Oral Health Status Indicators (SOHSI)	Locker and Miller (1994)
	Oral Health-Related Quality of Life Measure	Kressin (1997)
	Dental Impact on Daily Living (DIDLS)	Leao and Sheiham (1996)
	Oral Health Quality of Life Inventory	Cornell et al. (1997)
	Rand Dental Questions	Dolan and Gooch (1997)
Post-1997	OHQoL-UK	McGrath and Bedi (2001)
	Child Oral Health Quality of Life Questionnaire (COHQoL)	Jokovic et al. (2002)
	Child OIDP	Gherunpong et al. (2004a)
	OHRQOL for Dental Hygiene	Gadbury-Amyot et al. (1999)
	Orthognathic QOL Questionnaire	Cunningham et al. (2000)
	Surgical Orthodontic Outcome Questionnaire (SOOQ)	Locker et al. (2007)
	Psychosocial Impact of Dental Aesthetics Questionnaire*	Klages, Claus, et al. (2005)
	Orthognathic Quality of life questionnaire (OQLQ)*	Cunningham et al. (2002)
	Malocclusion Impact Questionnaire (first part) *	Patel et al. (2016)
	Malocclusion Impact Questionnaire (second part) *	Benson et al. (2016)

Oral Health Impact Profile (OHIP) is one of the popular OHRQoL instruments used in cross-sectional research especially in adult setting (Elmahgoub & Abuaffan, 2015; Gardezi et al., 2015; Hassan & Amin, 2010; Masood et al., 2013; Rusanen et al., 2009; Rusanen et al., 2011; Zucoloto et al., 2016). Slade and Spencer (1994) had developed OHIP in reference to David Locker's oral health model (1988).

Another measure that is developed based on the similar model is Oral Impacts on Daily Performances (OIDP) by Adulyanon and Sheiham (1997). Unlike OHIP, OIDP measures the frequency and severity of dental issues experiences in eight major activities in daily life ("eating and enjoying food", "speaking and pronouncing clearly", "cleaning teeth, sleeping and relaxing", "smiling, laughing and showing teeth without embarrassment", "maintain usual emotional state without being irritable", "carrying out major work or social role" and "enjoying contact with people") (Adulyanon & Sheiham, 1997).

2.3.3 OHRQoL instruments that are condition-specific to malocclusion

There are only few questionnaires focused on the malocclusion. One of the currently developing malocclusion-related measures is Malocclusion Impact Questionnaire (Patel et al., 2016). The researchers had completed their first part of developing, in terms of searching the themes related, which are: "appearance of their teeth", "effect on social interactions" and "oral health and function".

Meanwhile, the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) was developed by Klages, Claus, et al. (2005). The PIDAQ consists of 4 domains, Dental Self-Confidence (DSC) domain measures positive dental concept that assess dental appearance; the Social Impact (SI) domain assesses inter- personal sensitivity that measure anxiety levels towards other people's reaction to the appearance of the subject's teeth; the Psychological Impact domain (PI) assess negative emotions towards one's dental appearance; and the Aesthetic Concern (AC) domain assess disapproval of the image of one's exposed dentition (Wan Hassan et al., 2017a).

PIDAQ recently had been cross-culturally translated and adapted in Malay and Malaysian English (Wan Hassan et al., 2017a; Wan Hassan et al., 2017b), making it as the only malocclusion-specific self-assessed instrument that has been validated for the use of Malaysian for now. The use of PIDAQ is significant in assessing the motivation of prospective patients in getting orthodontics treatment (Wan Hassan et al., 2017a).

2.4 Significance of Patient Reported Outcome Measures (PROMs)

In conventional dental practice, usually the patient's feedback is deemed less important as compared to clinical measure (Hassan & Amin, 2010).

However nowadays, input by the patients themselves are also being considered in developing treatment plan. WHO's oral health strategies in prevention and promotion had stressed on quick response by dentists towards legitimate request by patients. (World Health Organization).

The significance of including the patient's perspective in cosmetic dentistry is emphasized since similar opinions from both parties (dentist and patient) is needed prior to treatment (Siddiqui et al., 2014), as well having common agreement on the final outcome of the treatment (Abdullah et al., 2001). The obvious reason would be that the patient needs to be satisfied with current teeth appearance in order to meet their own expectation in before attending the treatment session (Sischo & Broder, 2011).

The dental practitioners in practice should not ignore the patients' suggestions and opinion while making their treatment plan. A few studies had discovered the patients' perspectives can be reliable. In a research done in Pakistan, there is shown weak similarities in patient perspective and normative need measures in using IOTN (Siddiqui et al., 2014).

Furthermore, there is also a latest study done among 9 to 18 years old Indians whom never attending any orthodontic interventions, corroborating that they have accurate

capability in subjective analysing of their teeth (Athira et al., 2016). Researchers further particularized in their article that this discovery had shown that in ensuring overall satisfaction, emphasis should be put on considering the patients' view prior to any treatments (Athira et al., 2016). Thus, in the concerns of analysing malocclusion and OHRQoL, it is essential to include the patients' self-perceived malocclusion in order to understand the dental aesthetics impacts towards their oral well-being.

2.5 OHRQoL of Young Adults related to Malocclusion

2.5.1 Malocclusion and young adults

Most of OHRQoL studies concentrating on malocclusion are aiming towards adolescents with mostly their ages ranging from 11 to 14 years old, rather than focusing on young adults such as the study in Saudi adolescents (Dawoodbhoy et al., 2013), Brazil adolescents (Scapini et al., 2013) and Canadian adolescents (Agou et al., 2008). These studies had found that malocclusion indeed affected the OHRQoL to certain extent.

Yet, young adult generation should not be left out in discovering OHRQoL related to malocclusion. WHO had targeted adolescents within 10 to 19 years old as significant age group for oral health intervention programs (World Health Organization). The continuation of oral health concerns should be done in efforts to keep their OHRQoL in check.

On the other hand, there are several demographic factors found related to self-perceived malocclusion impacts on OHRQoL of young adults, such as age (Masood et al., 2013), genders (Gardezi et al., 2015; Rusanen et al., 2011) and race (Soh et al., 2005). In these studies, the OHRQoL of the younger age group (15-18 years old) was more affected (Masood et al., 2013) and females were impacted more than males (Gardezi et al., 2015; Rusanen et al., 2011). Ethnicity was the significant factor in the malocclusion related OHRQoL (Soh et al., 2005).

2.5.2 Local studies regarding malocclusion in young adults and OHRQoL

There are few Malaysian studies done in establishing relationship between malocclusion and OHRQoL in young adults. A structured survey conducted in four dental clinics in Kuala Lumpur involving 250 Malaysian patients from 10 to 35 years old had indicated that there are 54% of participants believed that they are having malocclusion problem, whilst two out of five pursuing orthodontic treatment due to aesthetic purpose, specifically in straightening out their teeth (Bailwad et al., 2015).

This prevalence corroborated with the earlier findings from 2009 study that used clinical measures (Meai et al., 2009). Half of the Malaysian participants in the study did not need orthodontic treatment based on the Index of Treatment Need – Dental Health Component (IOTN-DHC) (Meai et al., 2009). However, they also noted extremely high percentage (96%) indicated similarly in Index of Treatment Need – Aesthetic Component (IOTN-AC) (Meai et al., 2009). Yet the generalization cannot be done due to small sample size (Meai et al., 2009). Since there are gap in differences between perceived need and treatment need in both studies, further studies need to be done to clarify the facts.

2.5.3 Young adults and issues in getting orthodontic treatment

Financial issue is one of the highlighted concerns related to delayed and unattended orthodontic treatment in adolescents as well as young adults.

Zreaqat et al. (2013) had suggested that financial factor plays a role in preventing majority of the Malaysian teens in the study from receiving appropriate oral intervention, causing alarming concern towards excess treatment need despite less demands from them.

In Malaysia, extensive orthodontic treatments are currently unavailable in general public healthcare (Meai et al., 2009) due to the restricted age limit. Only children and teenagers aged 18 years and below are provided with subsidized orthodontic care in government dental clinics. For orthodontic patients aged above 18 years old, private

clinics are the available option. The exception applied only if they are present with very great treatment need, have functional problems or require complex multidisciplinary management.

Young adults are one of the most popular groups in requesting orthodontic care (Meai et al., 2009) and yet, most of them are still under tight financial budget to proceed with the treatment. Other than that, orthodontic treatment is also known with its time-consuming treatments, which also contributed for decision-making among prospective patients.

2.5.4 Comparison of malocclusion between young adults and children

Studies that had participants ranging from adolescents to young adults had noticed similarities and differences in OHRQoL for both ages.

A Brazil study involving kindergarten children suggested that malocclusion had not yet affecting them adversely since it occurs progressively in slow manner, thus the impending complications had not yet been seen through (Aldrigui et al., 2011).

In addition to this matter, a local research reported that they found out a situation they likely termed as “response shift”, by means the older a person becomes, the lesser will malocclusion affecting the QoL, suggesting that they may have adapted themselves with the condition over time (Masood et al., 2013). However, a study by Tin-Oo et al. (2011) had found that age is not a significant factor as compared to Masood et al. (2013) findings

2.6 Summary

The psychosocial impacts of the malocclusion are one of the important area that still needs more exploration, especially towards young adults group. Developing more understanding in their dental aesthetics concern may resulted in better orthodontic treatments while improving their daily life, since OHRQoL studies tend to focus more on children and adolescent as the frequent orthodontic patients.

CHAPTER 3: METHODOLOGY

3.1 Study design

This study used a cross-sectional study design. It was funded by the Ministry of Higher Education Fundamental Research Grant Scheme (FP033-2015A). The duration of this study was fifteen months, starting from March 2017 until May 2018.

3.2 Sample population

The study population was Malaysian young adults in tertiary education institutions (matriculation, polytechnic, public university and community college) aged 18 to 30 years old. In order to develop a systematic and efficient sampling method, there was a need to seek the distribution of Malaysian young adults. Population Projections based on the adjusted Population and Housing Census of Malaysia 2010 (Department of Statistics, 2016b) estimated that there are about 5,086,200 Malaysian youths aged from 18 to 25 in 2015.

In 2015, there were about 14,067,700 persons employed in Malaysia by which 50.2% of citizens aged from 15 to 24 years old had been employed (Department of Statistics, 2016a). The rate of unemployment for 20 to 24 years old in 2015 was about 9.3%, which made up the highest percentage (42.1%) of total unemployed persons (Department of Statistics, 2016a).

Assuming that majority of the higher institutions' students were between 18 to 25 years old, the related statistics were referred (Ministry of Higher Education, 2016). The total bachelor's degrees' intake and enrolments in public and private universities as well as polytechnics and community colleges (where applicable) in 2015 were 781,897, diplomas were 591,004, certificates were 130,114, and public universities' matriculations/foundations were 29,706. About 30.13% (1,532,721) of the Malaysian

young adults were under Ministry of Higher Education (MoHE) jurisdiction under the initial assumption.

The tremendous value of young adults in higher educations is undeniable, since the data from Ministry of Education (Form 6 and matriculation) and other Malaysians studying abroad had not yet been included in the statistics.

Meanwhile, the outputs from all education levels (bachelor's degree, diploma, certificate and matriculation/foundations) at the same year from the institutions mentioned above are 261,733 (Ministry of Higher Education, 2016). In consideration for students aged 25 until 30 years old, the intake, enrolment and output statistics for master level at public and private universities are 140,119 (Ministry of Higher Education, 2016).

These numbers had shown that the most of young adults aged 18 to 30 are probably still in tertiary educations aside from working.

Due to the above reasons, students from the tertiary education institution were invited to contribute to the sampling of Malaysian young adult population aged 18 to 30 years old in this study (Figure 3.2).

The academic institutions were chosen due to its mass number of younger young adults and easier randomization process as there were complete lists and proper statistics available.

3.3 Sample size calculation

Due to the need to calculate the sample size, a pretest study was done as there was no existing local data on the topic.

Students undertaking foundation studies, Form 6 (upper and lower classes) students, and community college students were recruited in the pre-test in order to represent the research samples as close as possible. The total participants obtained for the pretest was

41 students. All participants gave their consent to participate in the pretest. The list of participants is shown in Table 3.1 below.

Table 3.1 Participants involved in the pretest

Participants	Total (n)
Form 6 students	17
Foundation students	10
Community college students	14

The sampling method was done by convenience sampling. The pretest was performed in a similar manner with the main study. A brief explanation was given before the participants completed the questionnaire which consisted of demographic information and the Psychosocial Impact of Dental Aesthetics (PIDA). After answering the questionnaire, the participants were interviewed as a group.

A focus group discussion was conducted to seek their opinions on how to improve the questionnaire. The researcher asked on the participants' comprehension and comments over the questionnaire including the aim, instructions, items, answer options, flow of the questionnaire, and other related aspects. At the end of the discussion, all participants understood the questionnaire well and had no complaints over the content. Thus, no content changes was made. At the end, a toothbrush was given out to the participants as a token of gratitude.

3.3.1 Results of the pre-test

The number of students involved was 41, i.e. 17 form 6 students, 10 foundation students and 14 community college students.

However, since the design effect (D_{eff}) calculation required a similar number of counts from each group, some students were randomly removed, i.e. 7 from the form 6 group,

and 4 from the community college group. The final number of sample (n) for each group was 10.

Analysis of variance (ANOVA) was used to calculate the mean square of between and within groups. The result of ANOVA is shown in Table 3.2 below.

Table 3.2 ANOVA Test Result

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	605.400	2	302.700	5.163	.013
Within Groups	1582.900	27	58.626		
Total	2188.300	29			

The formula for the **design effect** calculation (Kerry & Bland, 1998) is:

D_{eff} = 1 + p (n-1),

where;

p: intraclass correlation, n: number of samples

The *intraclass correlation* (*p*) is calculated as:

$$p = \frac{\text{(Mean Square Between Groups – Mean Square Within Groups)}}{\text{[Mean Square Between Groups + (n-1) x Mean Square Within Groups]}}$$

$$p = \frac{(302.7–58.626)}{[302.7+ (10-1) \times 58.63]}$$

$$= 0.29$$

Therefore, D_{eff} = 1 + 0.29 (10-1) = **3.61**

The actual sample size needed for this study is:

N = n x D_{eff}

where **n** = minimum sample size, which the calculation differed according to the objectives:

For Objective 1: To assess the prevalence, severity and extent of the psychosocial impact of dental aesthetics in Malaysian young adults;

$$n = \frac{z^2 \mathbf{p(1-p)}}{\mathbf{d^2}}$$ (Cochran, 1963);

z: z statistics for a level of confidence,

p: expected prevalence or proportion

d: precision

The sample size (*n*) from previous study on the prevalence of psychosocial impact of dental aesthetics among Malaysian adolescents was referred (Wan Hassan et al., 2019). This study was chosen because it had the demographic information that reflected the Malaysian population. The present study will investigate the epidemiological data of the young Malaysian adults. The prevalence of psychosocial impact of dental aesthetics on adolescents based on that study was 90.2% (Wan Hassan et al., 2019) thus this prevalence was used as the value for *p* in this formula for prevalence calculation as mentioned.

The level of confidence (CI) was set at 95%, thus the z statistics at 95% CI was 1.96. The precision set (*d)* was 0.05.

Therefore, $n = \frac{1.96^2 \times 0.902 \times 0.098}{0.05^2} = 136$

Thus, the total sample size needed for Objective 1 was N = 136 x 3.61 = 491 students (rounded to nearest digit). In consideration of 20% non-response rate, the final sample size for objective 1 was set as **589** subjects (rounded to nearest digit).

For Objective 2, to compare the prevalence and severity of psychosocial impact of dental aesthetics in Malaysian young adults with and without self-perceived malocclusion;

$$n = \frac{z^2 [p_1(1-p_1) + p_2 (1-p_2)}{d^2}$$ (Cochran, 1963);

z: z statistics for a level of confidence,

p_1: expected prevalence or proportion (larger)

p_2: expected prevalence or proportion (smaller)

d: precision

The aforementioned study was referred (Wan Hassan et al., 2019). The prevalence of Malaysian adolescents with self–perceived malocclusion was 53.27% (p_1), meanwhile the proportion without self-perceived malocclusion was 46.73%(p_2).

Similar level of confidence (CI) was set at 95%, thus the z statistics was 1.96. The precision set (d) was 0.05.

Therefore, $n = \frac{1.96^2 \times 0.5327 \times 0.4673 \times 0.4673 \times 0.5327}{0.05^2} = 95$;

The sample size needed according to hypothesis testing of comparing between two groups was N = 95 x 3.61 = 343 students (rounded to nearest digit). Considering 20% dropout, the final sample size needed as **412** participants.

Since the calculation from Objective 1 required more participants, **589** participants were the final sample size used for this study.

3.4 Sampling method

3.4.1 Screening and selection of subjects

This study was conducted in Malaysia's tertiary educational institutions (matriculations, community colleges and public university), where the sample was anticipated to represent Malaysian's young adult in higher education.

3.4.1.2 Inclusion and exclusion criteria

- Inclusion criteria
  i. The age range was from 18 to 30 years. The range of age of participants was taken in relation to the year of the study. As an example, if the birthdate is 31st January 1998, and the participant answered the questionnaire on 3rd December 2017, then he or she will be regarded as 19 years old in this study. Refer variable table in subchapter **3.5.1**.
- Exclusion criteria
  i. Those who were non-Malaysian citizens
  ii. Those who were undergoing or have had orthodontic treatment
  iii. Those with cleft lip and/or palate, or other craniofacial deformities
  iv. Those with learning difficulties
  v. Those who cannot read and/or comprehend English or Malay languages

3.4.2 Selection of study participants

Multi-staged sampling method was used to recruit the participants. It is the method of dividing the population into smaller clusters following to the stages. There should be homogeneity among the clusters, with the heterogeneity observed within each of the clusters. This sampling method was chosen with the assumption that the Malaysian young adults in different regions were homogenous.

3.4.2.1 Assumption of homogeneity of samples

Preliminary data from previous study involving Malaysian adolescents in different regions was referred (Wan Hassan et al., 2019). In the study, the sample was taken from school children in Melaka (representing the Southern region), Kuala Lumpur (representing the Central region), Kedah (representing the Northern region), Sabah (representing the Borneo region) and Pahang (representing the Eastern region).

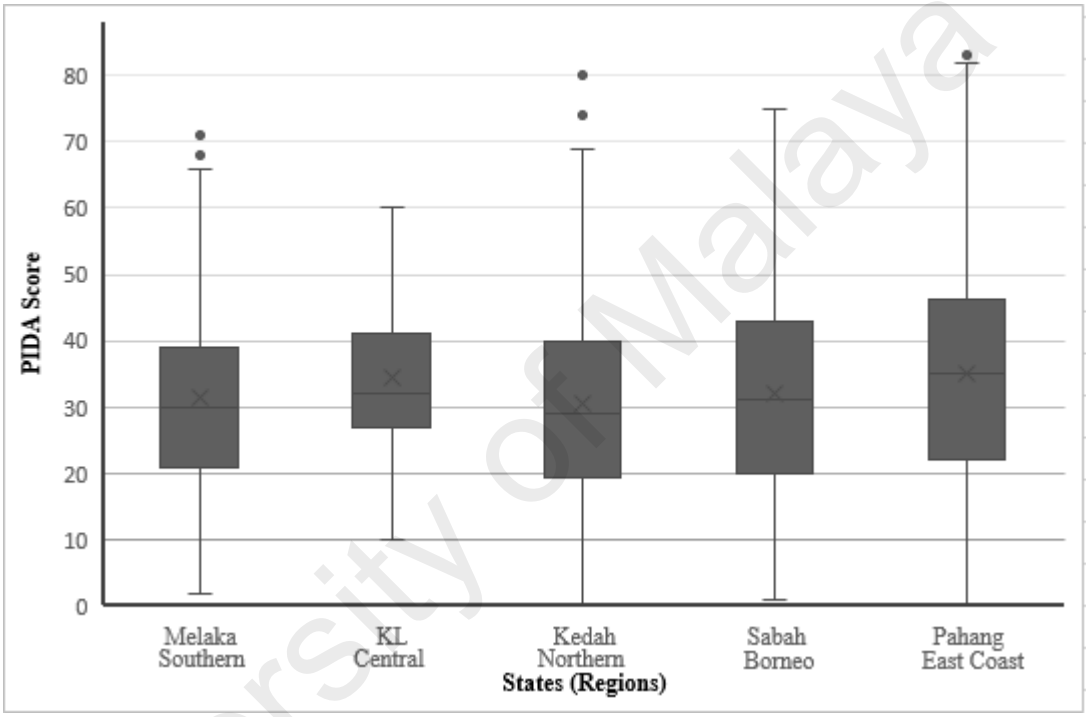

Figure 3.1 Boxplot of Malaysian school children PIDA scores by states/regions

Figure 3.1 shows the boxplot of the unpublished results of the study. The interquartile range (the boxplot size) and the median (center line in the box) among the states representing each region were almost similar. Thus, there was also no obvious difference in the range of the data (shown by the whiskers or the vertical line) between each state (representing each region).

Levene's test of homogeneity of variances was then done in attempt to further confirm the homogeneity assumption. These differences of distributions between the regions, represented by the states, were then analysed.

Table 3.3 Levene's test of homogeneity of variances for PIDA scores by states/region

	Levene statistic	df1	df2	Sig.
Based on mean	1.229	4	896	0.297
Based on median	1.076	4	896	0.367
Based on median and adjusted df	1.076	4	883.783	0.367
Based on trimmed mean	1.150	4	896	0.332

With the significance (α) was put at 0.05, the Levene's test p-value for all conditions were more than α. Thus, the null hypothesis (equal variances among the regions) was accepted.

Results from the preliminary data showing the boxplot and test of homogeneity of variances supports that the PIDA across the regions in Malaysia are homogenous. This evidence was thus used to support the assumption that the population in the clusters of the multistage random sampling were homogenous to each other.

3.4.2.2 Sampling Frame

The sampling procedures done for respondents were shown in Figure 3.2.

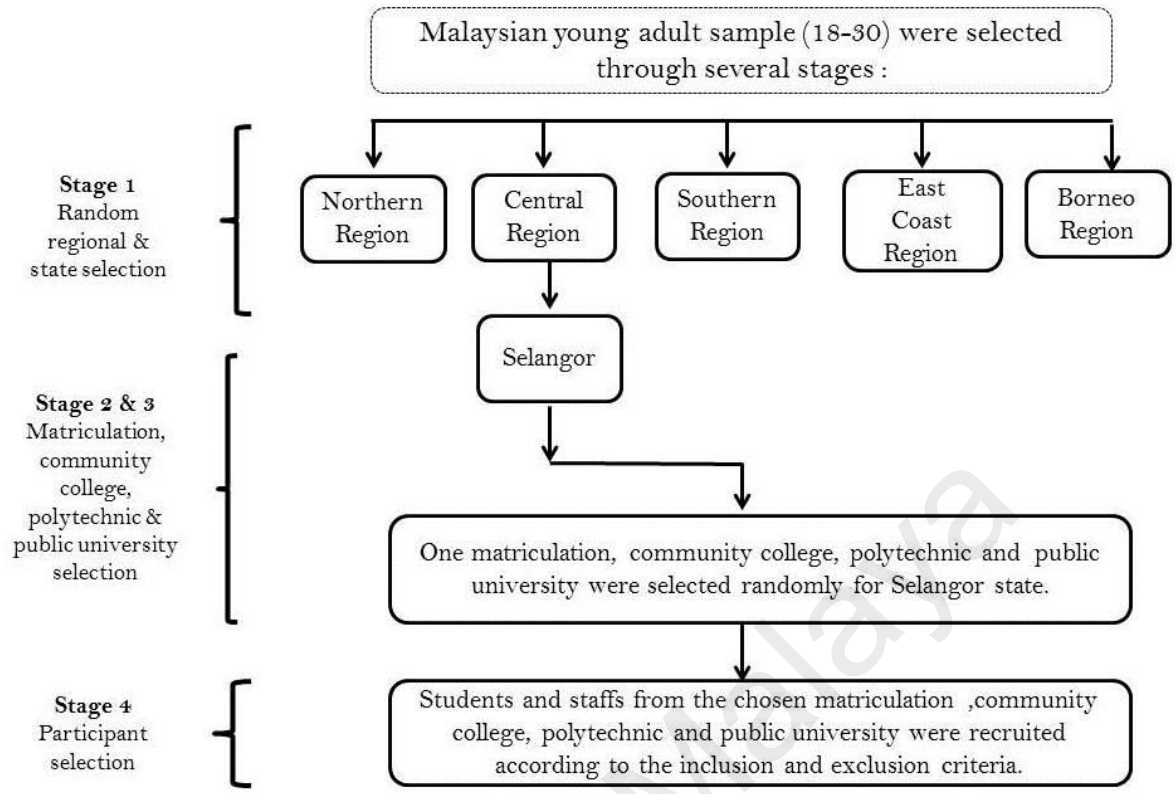

Figure 3.2 Multi-stage sampling frame for this study

This study used a multistage sampling method. In Stage 1, the country was divided into five major regions (Northern, Central, Southern, East Coast and Borneo).

The states included in each region were:

i. Perlis, Kedah, Penang and Perak (Northern)
ii. Selangor, WP Kuala Lumpur and Negeri Sembilan (Central)
iii. Melaka and Johor (Southern)
iv. Pahang, Kelantan and Terengganu (East Coast); and
v. Sabah and Sarawak (Borneo).

Then, a region was randomly selected, and the selected region was the central region.

In Stage 2, Selangor state was randomly selected among the three states in the central region. Next, the sampling frame in Selangor was created as shown in Table 3.4 below. With regards to public universities in Selangor, the main campus of Universiti

Kebangsaan Malaysia (UKM) had been randomly selected as the representative of public universities in Selangor. The sampling frame is shown in Figure 3.3.

In Stage 3, stratified sampling proportionate to size was conducted. Figure 3.3 shows the stratification and the proportionate number of samples required for each type of the institutions. Based on the proportionate sampling calculations, 30 participants were required from matriculation, 55 participants from community college, 161 participants from polytechnic, and 343 participants from UKM main campus. In this stage, a matriculation, a community college, a polytechnic, and a faculty from the main campus. UKM were randomly selected through the sampling frame in Table 3.4. The list of matriculation, community college, polytechnic and faculty included in Stage 3 were:

a) Selangor Matriculation College (Kolej Matrikulasi Selangor)
b) Hulu Langat Community College (Kolej Komuniti Hulu Langat (KKHL))
c) Sultan Salahuddin Abdul Aziz Shah Polytechnic (Politeknik Sultan Salahuddin Abdul Aziz Shah)
d) Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM).

Throughout this sampling method from stage one to stage three, the randomization was done using online software (Urbaniak & Plous, 2013). Each region (stage one), states (stage two), tertiary institutions (stage three) were labelled with numbers and randomly selected using the software.

In Stage 4, the questionnaires were distributed to the students in the respective institutions within the limited access given by the respective institutions. Those who agreed to participate were included in the study.

Table 3.4 Lists of institutions in Selangor

Institutions			Number of faculties	Number of students (n)
Matriculation	1.	Kolej Matrikulasi Selangor		**1,999**
Community College	1.	Kolej Komuniti Sabak Bernam		580
	2.	Kolej Komuniti Tanjong Karang		90
	3.	Kolej Komuniti Hulu Selangor		360
	4.	Kolej Komuniti Selayang		740
	5.	Kolej Komuniti Kuala Langat		920
	6.	Kolej Komuniti Klang		90
	7.	Kolej Komuniti Hulu Langat		380
	8.	Kolej Komuniti Shah Alam		45
	9.	Kolej Komuniti Ampang		360
	10.	Kolej Komuniti Kelana Jaya		110
		TOTAL		**3,675**
Polytechnic	1.	Politeknik Sultan Salahuddin Abdul Aziz Shah (PSSAAS)		3,600
	2.	Politeknik Sultan Idris Shah (PSIS)		4,655
	3.	Politeknik Banting Selangor (PBS)		2,400
		TOTAL		**10,644**
Public University	1.	Universiti Putra Malaysia (UPM) (Main Campus)	15	
	2.	Universiti Islam Antarabangsa Malaysia (UIA) (Gombak campus)	7	
	3.	Universiti Teknologi MARA (UiTM)		
		1. Main Campus	11	
		2. Puncak Alam Campus	7	
		3. Puncak Perdana Campus	2	
		4. Selayang Campus	1	
		5. Sungai Buloh Campus	2	
	4.	**Universiti Kebangsaan Malaysia (UKM) (Main campus)**	8	
		i. Economics & Management		3,400
		ii. Engineering & Built Environment		2,485
		iii. Education		3,889
		iv. Islamic Studies		2,816
		v. Science & Technology		3,503
		vi. Social Sciences and Humanities		4,139
		vii. Information Science and Technology		1,549
		viii. Law		772
		TOTAL		**22,553**

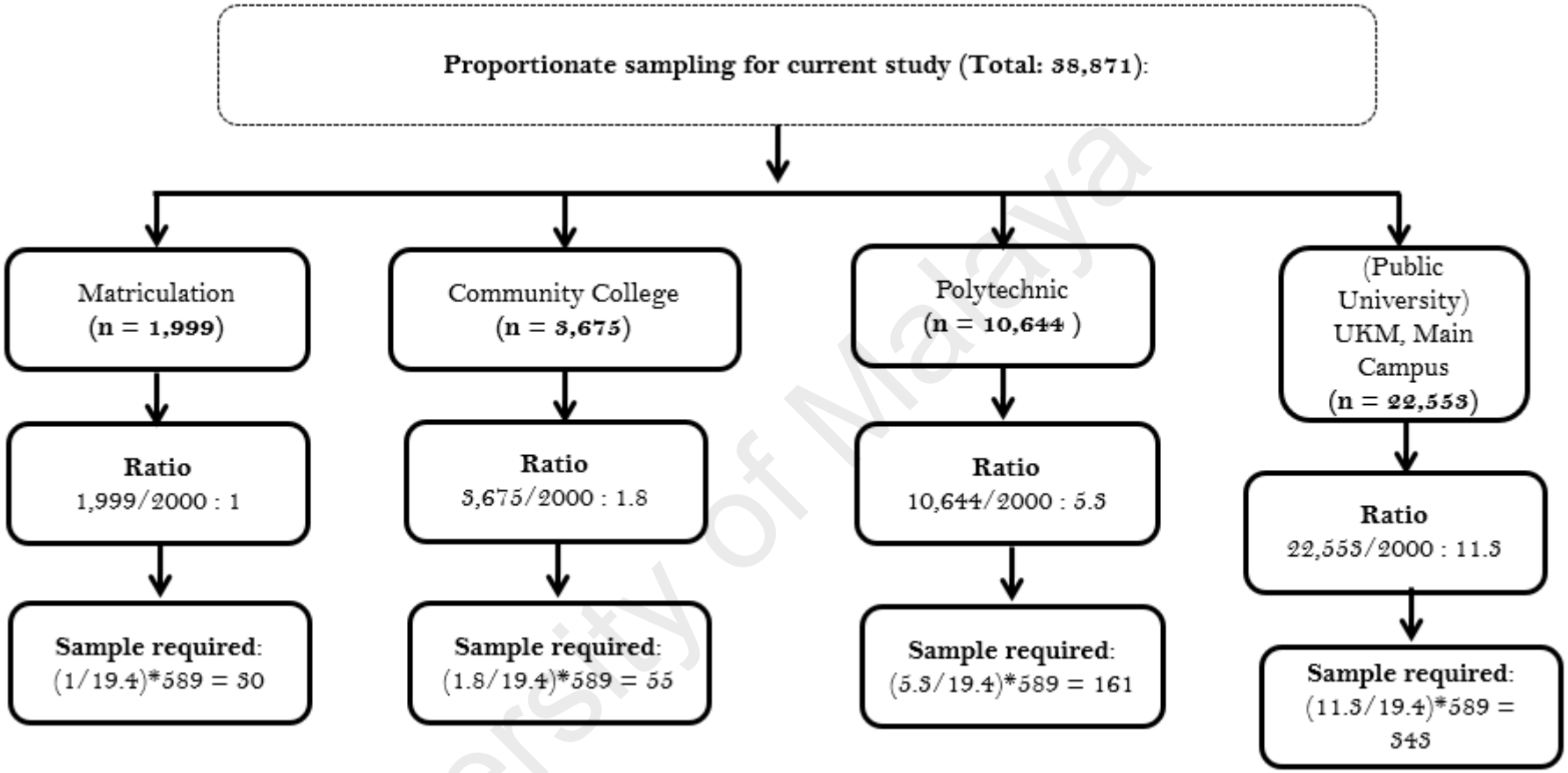

Figure 3.3 Proportionate sampling of the study participants

3.5 Study Variables

There were three variables measured in this study as listed below:

1. Independent variable: Self-perceived malocclusion and demographic background
2. Dependent variable: Oral health related quality of life (OHRQoL) related to dental aesthetics

3.5.1 Demographic factors

The demographic factors were one of the independent variables in this study. There were five factors considered (age, gender, race, household income and place of residence). Further details are shown in variable table (Table 3.5).

Table 3.5 Variable table for demographic data

No	Conceptual Definition	Operational Definition	Scale of measurement	Unit
1	Age	Age according to year of data collection	Ordinal	1. to 14. (18-30 years old and others)
2	Gender	Participants' sex orientation	Nominal	1. Male 2. Female
3	Race	The participant's ethnic group	Nominal	1. Malay 2. Chinese 3. Indian 4. Others
4	Household Income (RM)	• If he/she a student, mark the sum of parents'/caregiver's income • If he/she already working, mark their own income	Ordinal	1. 499 and below 2. 500-999 3. 1,000-1,499 4. 1,500-1,999 5. 2,000-2,499 6. 2,500-2,999 7. 3,000-3,499 8. 3,500-3,999 9. 4,000-4,999 10. 5,000 and above
5	Place of residence	Place where the participant's live	Nominal	1. Urban 2. Sub-urban 3. Rural
6	Orthodontic treatment experience	The status of ever receiving orthodontic Treatment or not	Nominal	1. Currently wearing 2. Yes 3. No
7	Name	The set of word that the participant is addressed to		Alphabetical
8	Course/Job	The study program/ occupation of the participant	-	Alphabetical
9	Birthdate	The day the participant's born	-	Numerical

3.5.2 Self-perceived malocclusion

The Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) was used to measure the self-perceived malocclusion status, which is also independent variable. Table 3.6 shown the variable table for IOTN-AC.

Table 3.6 Variable table for self-perceived malocclusion

No	Conceptual Definition	Operational Definition	Scale of measurement	Unit
1	Aesthetic Component of Index of Treatment Need	The self-perceived rating of malocclusion by the participant	Ordinal	1 (very good) to 10 (very severe) a) 1-2 no self-perceived malocclusion b) 3-10 self-perceived malocclusion

3.5.3 Oral health related quality of life (OHRQoL) related to dental aesthetics

The oral health related quality of life (OHRQoL) related to dental aesthetics was defined by using Psychosocial Impact of Dental Aesthetics (PIDA) questionnaire in this study. It is the dependent variable. Refer Table 3.7.

Table 3.7 Variable table for OHRQoL related to aesthetics

No	Conceptual Definition	Operational Definition	Scale of measurement	Unit
1	PIDA Items	22 items score of PIDA	Ordinal	0. Not at all 1. A little 2. Somewhat 3. Strongly 4. Very Strongly

The PIDA questionnaire was further analysed into three variables in order to answer the study objectives. The operational definitions were referred from Tsakos et al. (2012) Refer Table 3.8. Further information ensued in subchapter **3.8.2.1.**

Table 3.8 Variable table for OHRQoL (related to study objectives)

No	Conceptual Definition	Operational Definition (Tsakos et al., 2012)	Scale of measurement	Unit
1	Prevalence of PIDA	Percentage of participants that reported at least one item of PIDA with significant impact	Ordinal	0% - 100%
2.	Extent of PIDA	Percentage of participants with at least one significant impact on any one item of PIDA domains.	Ordinal	0% - 100%
3.	Severity of PIDA	The mean and standard variation (SD) of total PIDA score	Ordinal	0-88

3.6 Study instruments

The questionnaire used in this study comprised of three sections (Section A until C). Section A consisted of items to assess demographic background, Section B consisted of items on the Psychosocial Impact of Dental Aesthetics (PIDA), and Section C was the Index of Orthodontic Treatment Need – Aesthetic Component (IOTN-AC).

3.6.1 Section A: Demographics data

The related demographic factors that were studied in this research were age, gender, ethnicity, household income and place of residence. The household income classification was based on the table of Percentage Distribution of Households by Income Class, Malaysia, from 1970 to 2017 (Economic Planning Unit, 2017).

The definition of place of residence was derived from the online Oxford Dictionary ("Lexico.com," 2019) as listed below:

a) Urban: town or city

b) Suburban: outside from city, mostly residential areas

c) Rural: countryside

3.6.2 Section B: Psychosocial Impact of Dental Aesthetics (PIDA) questionnaire

The development of this questionnaire was done based on feedback from 194 German young adults aged 18 to 30 years (Klages, Claus, et al., 2005). It consists of 23 items measuring four domains; (a) Dental Self-confidence (DSC, 6 items), Social Impact (SI, 8 items), Psychological Impact (PI, 6 items), and Aesthetic Concern (AC, 3 items).

1. The DSC domain deals with the effect of perceived teeth attractiveness towards one's psychological level.
2. The SI domain asks about the obstacles faced in public situations due to negative personal evaluation of own teeth.
3. The PI domain asks about the sad feeling and inferiority complex which arise as the result of comparing own teeth arrangement with other people with better quality of dental aesthetics.
4. The AC assesses the feeling of dissatisfaction when looking at one's own teeth through a mirror, picture or video image.

The PIDAQ demonstrated high construct validity with Cronbach's α value of between 0.85 and 0.91 (Klages, Claus, et al., 2005).

The instrument has been cross-culturally adapted for use by Malaysian adolescents (Wan Hassan et al., 2017a; Wan Hassan et al., 2017b). The Malaysian version has 22 items instead of 23 items. The item "don't like own teeth own video'" was removed from the AC domain because a large proportion of adolescents did not find this item relevant (Wan Hassan et al., 2017a; Wan Hassan et al., 2017b). Thus, in the Malaysian version, the AC domain has 2 instead of 3 items.

This current study used the Malaysian version of PIDAQ in view that it is the only malocclusion-specific OHRQoL instrument that has been adapted for Malaysians and to

allow for comparisons with studies that involved the use of the Malaysian PIDAQ on Malaysian adolescents.

3.6.3 Section C: Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC)

The aesthetic component of the index of orthodontic treatment need (IOTN-AC) was rated using a black and white photographic 10-point-scale showing teeth with increasing severity of malocclusion (Albarakati, 2007; Brook & Shaw, 1989; Bellot-Arcís et al., 2015; Grzywacz, 2003) . It can be used to measure malocclusion based on professional rating or by self-rating (Albarakati, 2007; Bellot-Arcís et al., 2015; Grzywacz, 2003). For this study, participants were asked to rate their self-perceived malocclusion to indicate their perception of their own dental aesthetics (Wan Hassan et al., 2019).

3.7 Conduct of study

3.7.1 Ethical approval

Since this is a human study, an ethical approval was needed before data collection stage. The ethical approval from the Medical Ethics Committee, Faculty of Dentistry, University of Malaya was obtained on 29th September 2017 (Reference number: **DF CD1708/0057(P)**) (Refer Appendix B).

3.7.2 Permissions to conduct the study

Permissions to conduct the study were obtained from all authorities in the four tertiary institutions involved.

At Kolej Komuniti Hulu Langat (KKHL), the staff had confirmed the permission on 7th November 2017 through a phone call and later released an official letter by KKHL director on 10th November 2017 (Refer Appendix C).

For second permission, it was obtained from Politeknik Sultan Salahuddin Abdul Aziz Shah (PSSASS) staff on 23rd October 2017, and the original letter was stamped by staff on behalf on the head of research and innovation unit on the data collection day (Refer Appendix D).

For Universiti Kebangsaan Malaysia (UKM), permission from the authorities of Faculty of Science and Technology, UKM was obtained through an official letter dated on 26th October 2017 (Refer Appendix E).

There were several stages to obtain permission for Kolej Matrikulasi Selangor (KMS). Firstly, Malaysia's Ministry of Education had given their permission through an official letter dated on 30th November 2017 (Refer Appendix F). Then, the KMS authorities had noted the ministry's permission and the researcher's official letter (Refer Appendix G). The staff had contacted and noted the permission on 2nd January through phone call. A subsequent official letter dated 19th January from Matriculation Division (Refer Appendix H) also had later stated their approval for data collection.

3.7.3 Approaching the institutions

3.7.3.1 Kolej Komuniti Hulu Langat (KKHL)/ Hulu Langat Community College

According to proportionate sampling in Figure 3.4, the supposed sample size for community college is 55 participants. However, the questionnaires were distributed to the maximum participants available during the day of data collection in order to prepare for lack of dropout from other institutions.

The data collection was done with assistance of one KKHL staff and lecturer-in-charge of every lecture room or workshop involved. The consent forms and questionnaires were distributed in classroom setting to 161 students. The investigator explained briefly on the process and the tokens were given after each class done with answering.

3.7.3.2 Politeknik Sultan Salahuddin Abdul Aziz Shah (PSSASS)/ Sultan Salahuddin Abdul Aziz Shah Polytechnic

The questionnaires were distributed to students who volunteered to answer due limited access and assistance provided from the managements. The investigator needed to approach participants as much as she can on that day. All participants filled the consent form and questionnaire after quick explanation. Toothbrushes were also given as token. Total participants from PSSAAS were 120 participants, which was a little bit short from the supposed sampling size (161).

3.7.3.3 Faculty of Science and Technology, Universiti Kebangsaan Malaysia (UKM)

Since the faculty staff did not assist with the data collection, the students' representative leader (undergraduate) voluntarily helped with the distribution of questionnaire. However, there were lack of voluntary participants observed due to examination week and semester break especially for undergraduates. Less postgraduates were participated even though the online questionnaire were posted in their community for months.

About 35 questionnaires were distributed by face to face method, and 102 were obtained through online. All of the participants (both online and offline) read and accept the terms in consent form and received toothbrushes as token. Lower number of participants from Faculty of Science & Technology, UKM were observed (137 participants) compared to the supposed sampling size (343 participants).

3.7.3.4 Kolej Matrikulasi Selangor (KMS)/ Selangor Matriculation College

The questionnaires were distributed through classroom setting to the maximum number of participants available from required sample (30 participants) to cater for possible dropout from other institutions. The students were briefed and assisted during

the session. All of 151 participants gave their consent to be involved in this study. Tokens were given as expression of gratitude to the participants.

3.7.4 Distribution of questionnaire

In summary, the participants recruited in this study answered the questionnaire booklet given by the researcher herself in mainly a classroom setting (55.23%), where the researcher went to each classroom to distribute and explain the questionnaires and consent form to the participants, with the assistance from the staff of the related institutions. The researcher also had done field data collection (27%), by approaching any students and staffs who volunteered to answer the questionnaire at one of the educational institutions involved. Online platform (17.77%) is also used in this study. Tokens were given to all of the participants of the study in the form of toothbrush.

The procedures done while conducting this research were then summarized in flowchart (Figure 3.4).

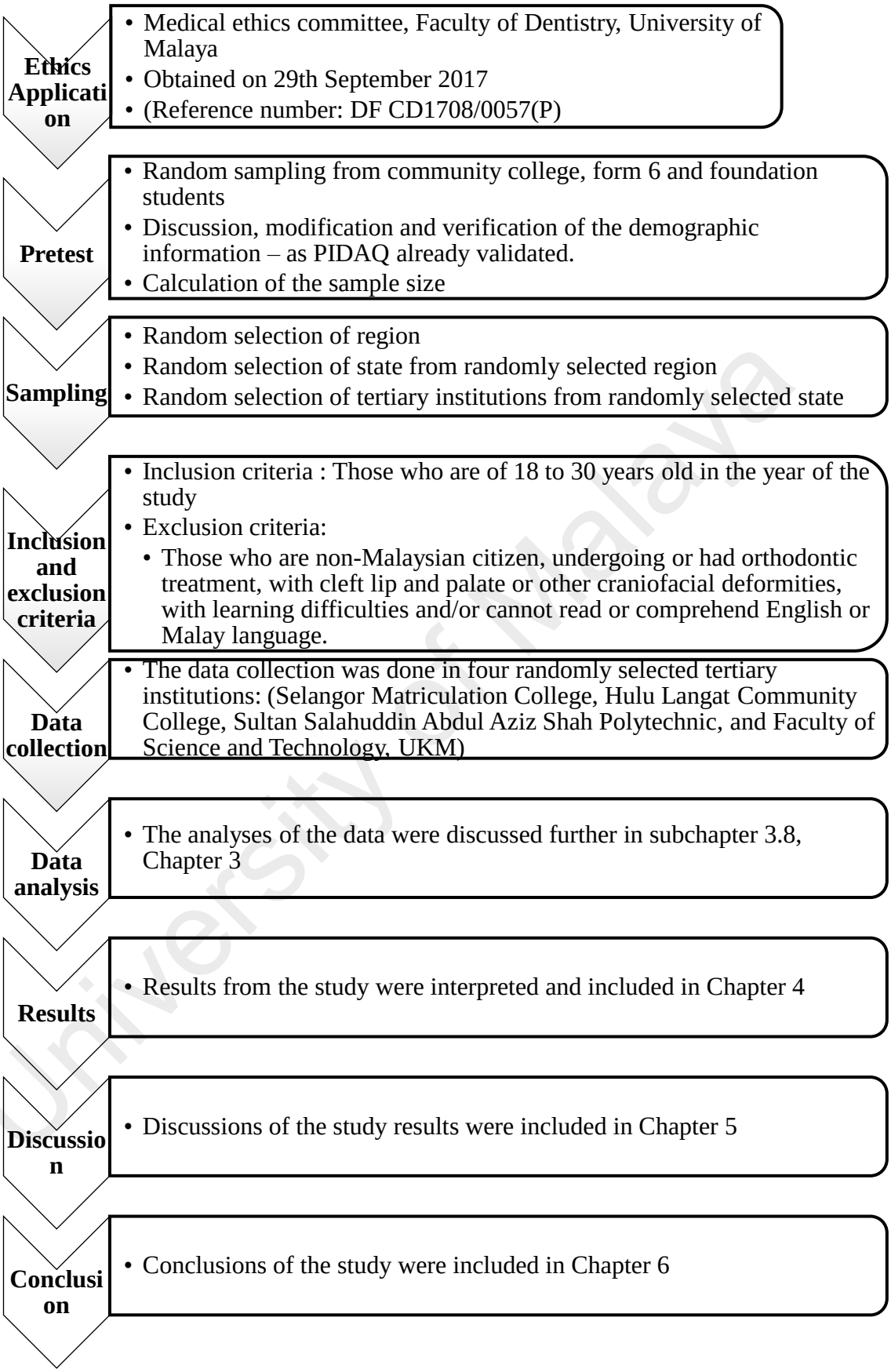

Figure 3.4 Flowchart of the conduct of study

3.8 Data management and analysis

3.8.1 Data cleaning and management of missing data

Total of 37 subjects out of collected 574 subjects (6.4%) were excluded from the study due to their experience as orthodontic patients. Then, 6 students (1.0%) with unfilled demographic data were also removed from the total count. Finally, the management of incomplete data PIDA and IOTN-AC ensued with the 531 participants' data left.

Data were classified as missing if 20% or more items in each of the PIDA domains were left unanswered (Downey & King, 1998). Therefore, up to only one missing item was allowed for the DSC, PI and SI domains and no missing item was allowed for the AC domain.

Meanwhile, participants with permissible empty scores (had less than 20% missing items in each domains) were inputted with the item mean score (IMS) of the domain. IMS is the method use to replace the missing score by the mean total score for the particular item (Downey & King, 1998) . As an example, the mean score of total non-missing data in item 9 is 1.39. Therefore 1.39 will be imputed into missing data of item 9.

3.8.2 Data analysis

After dealing with data cleaning and missing data, the final data were then analysed according to the aim and objectives of this study. Statistical Package for Social Sciences (SPSS) (IBM Corp, 2015) was used to analyse the data.

3.8.2.1.1 Descriptive analysis

The descriptive analysis in the present study were done with all the datasets available; the demographic data as well as the PIDAQ and IOTN-AC scores.

(a) Demographic data

All five of the demographic data (gender, age, race, household income and place of residence) were presented in the numbers and percentages of participants according to the classifications of the demographic (refer Table 3.4). The genders were divided into male and female, meanwhile for age were classified individually from 18 to 30 years old. Race were divided into Malays, Chinese, Indians and other races. Household income were divided into ten levels as mentioned in subchapter 3.6.1. The place of residence was categorized into urban, sub-urban and rural.

(b) Status of self-perceived malocclusion

Self-perceived malocclusion was based on the self-rated IOTN-AC rating. The ratings of 1 to 2 is classed as no need for orthodontic treatment, 3 to 4 as slight need for treatment, 5 to 7 as moderate need for treatment and 8 to 10 as severe need for treatment (Grzywacz, 2003). Thus, the ratings of 1 and 2 were considered as no self-perceived malocclusion while ratings of 3 and higher were considered as having self-perceived malocclusion. The black and white photographs of IOTN-AC were shown in Figure 3.5.

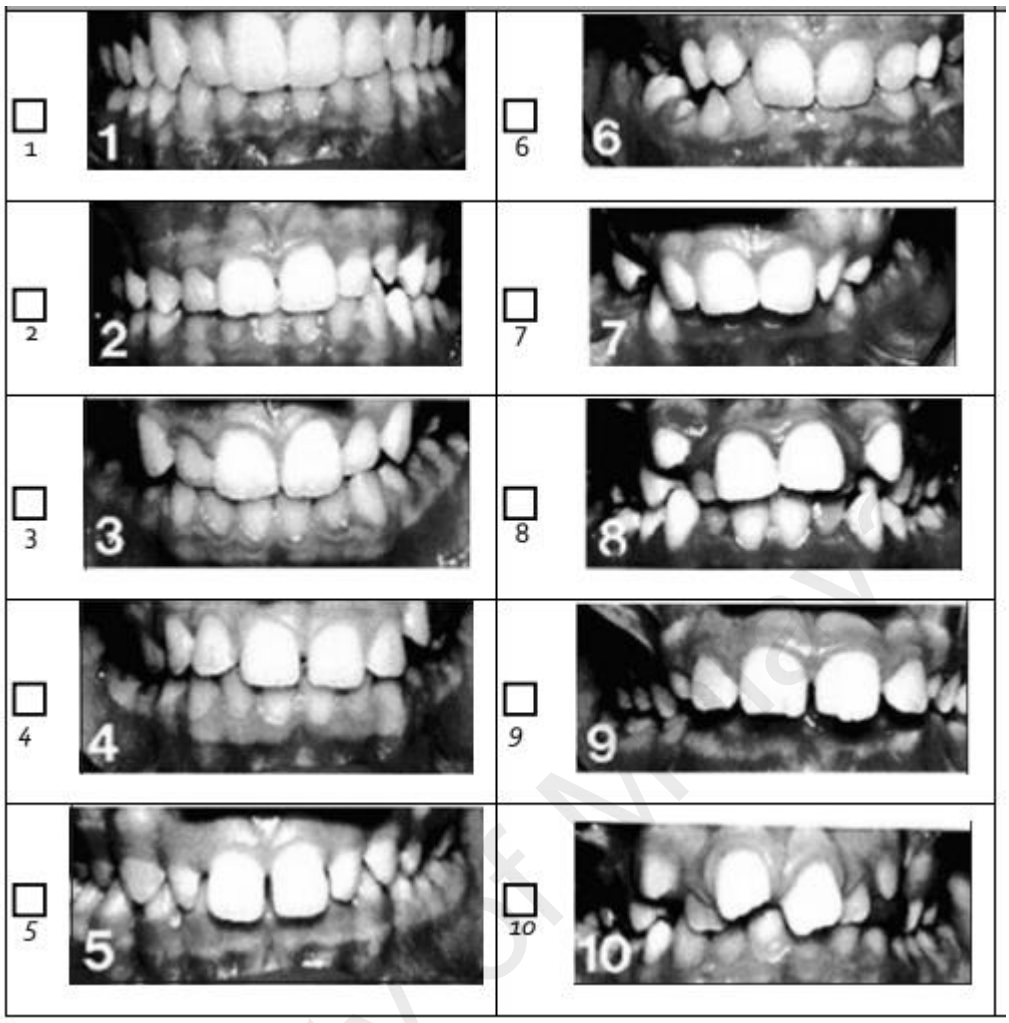

Figure 3.5: The black-and-white IOTN-AC scale

(c) Psychosocial impact of dental aesthetics (PIDA)

The descriptive analyses of PIDA were done according to the first and second objectives of this study. The first objective was to assess the prevalence, extent and severity of the psychosocial impact of dental aesthetics in Malaysian young adults, and the second objective was to compare the prevalence, extent and severity of psychosocial impact of dental aesthetics in Malaysian young adults with and without self-perceived malocclusion. Therefore, it is crucial to understand the scoring method of PIDA before proceeding to answer the objectives.

The total score of PIDA was calculated by summing up the scores from all the four domains. The items related with each domain are included in the Appendix A. The response for each of the 22 items was based on a five-point Likert scale. It is shown in Figure 3.6.

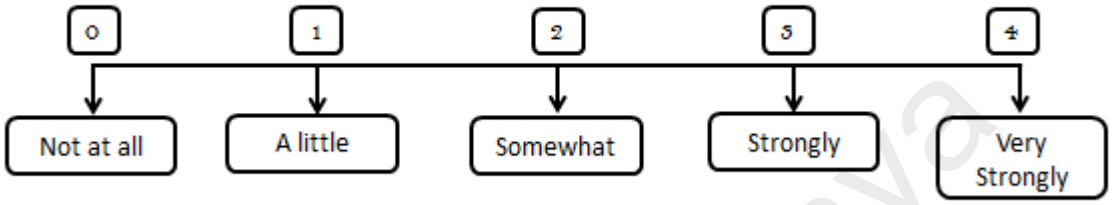

Figure 3.6: Five-point Likert scale used in PIDAQ

Table 3.9 shows the calculation of total score of PIDAQ. Only DSC domain will be reverse scored before summing up with other domains to calculate the total score of PIDA. For reverse scoring, the response from participants were reversed as:

a) Response 4 – Final score 0

b) Response 3 – Final score 1

c) Response 2 – Final score 2 (not changed)

d) Response 1 – Final score 3

e) Response 0 – Final score 4

Table 3.9 Calculation of PIDA Score

Domain	Total Item	Maximum Total Score	PIDAQ Maximum Total Score
Dental Self-Confidence (reverse-score)	6	24	88
Social Impact	8	32	
Psychological Impact	6	24	
Aesthetic Concerns	2	8	

The prevalence, extent and severity of PIDA

An item with a significant impact defined as the final two highest ratings (Tsakos et al., 2012) in PI, SI and AC domains (3 and 4) as well as the two lowest point in DSC domain (0 and 1). Previous Malaysian adult study by Saub and Locker (2006) had also used the two highest rating in OHIP as the cut-off point.

The prevalence of PIDA was calculated by the percentage of participants who reported at least one item of PIDA with a significant impact. Chi-square was used to test the relationship of prevalence of impact among those with and without self-perceived malocclusion.

As for severity of PIDA, the mean, standard deviation, median and interquartile range (IQR) of total PIDA score was used. The total score of PIDA was calculated by the sum of scores in PI, SI, AC and reverse-scored DSC. Meanwhile, the total score of the domains were calculated by adding on the scores from the items related to the domain. For DSC domain, the reverse scores from six items will be totaled (item 4,7,12,17,21 and 23), SI with total of eight items (2,5,9,13,14,15,19 and 22), PI with total of six items (3,6,10,11,16 and 20) and AC with total of two items (1 and 8). Independent t-test was used to analyse the relationship of prevalence of impact among those with and without self-perceived malocclusion.

The extent of PIDA is the percentage of participants with at least one significant impact on any one item of the PIDA domains. All of four PIDA domains from each of the participants were noted to either having significant impacts or not, then the total domains with the significant impacts were summed up. The percentages of participants according to one until four domains with significant impacts were then recorded. Chi-square was used to test the relationship of extent of impact among those with and without self-perceived malocclusion.

3.8.2.2 Univariate analysis

There were several univariate analyses done in this study which were the Pearson correlation test, independent t-test and one-way ANOVA. These tests were involving demographic data and self-perceived malocclusion status as the independent variable and total score of PIDA as the dependent variable. It was also done to answer part of final objective which was to identify factors associated with the psychosocial impact of dental aesthetics in Malaysian young adults.

Pearson correlation test was done in order to identify the relationship between age factor and total PIDA score. The other two tests (independent t-test and one-way ANOVA) were preceded the multivariate test that will be explained in next subchapter. Independent t-test was done with the gender factor and self-perceived malocclusion status with the total score of PIDA separately. Then, one-way ANOVA was performed individually towards ethnic, household income and place of residence factors with the PIDA total score.

3.8.2.3 Multivariate analysis

In order to answer the final objective of this study, the analysis of the demographic factors except age (gender, ethnic, household income and place of residence) along with self-perceived malocclusion status with total PIDA scores were done by multifactorial

ANOVA. The test was chosen since ANOVA is typically chosen as the best way in handling data with similar sample size in each group in independent variables, as well as a notably powerful test (Landsheer & van den Wittenboer, 2015).

The other optional test such as multiple linear regression will need to dichotomize the several levels of each of the categorical data before proceeding into the test – as in developing the dummy variables through dummy coding (Cohen & Cohen, 1983) which may bring the power loss and biased test (Royston et al., 2006; Winship & Mare, 1984). As a matter of fact, the categorical data in this study were indeed divided into several levels, especially the household income factor with ten classifications. In addition, there were also five factors in this study that needed to be dichotomized.

The assumptions for the multifactorial ANOVA (normality of residuals, equality of variances and fit of the model) (Naing & Wan Arfah, 2011) were examined before proceeding to the final model.

The normality of residuals was checked using histogram and box and whisker plot of the residuals of the dependent variable (Naing & Wan Arfah, 2011). See Figure 3.7 and 3.8 below.

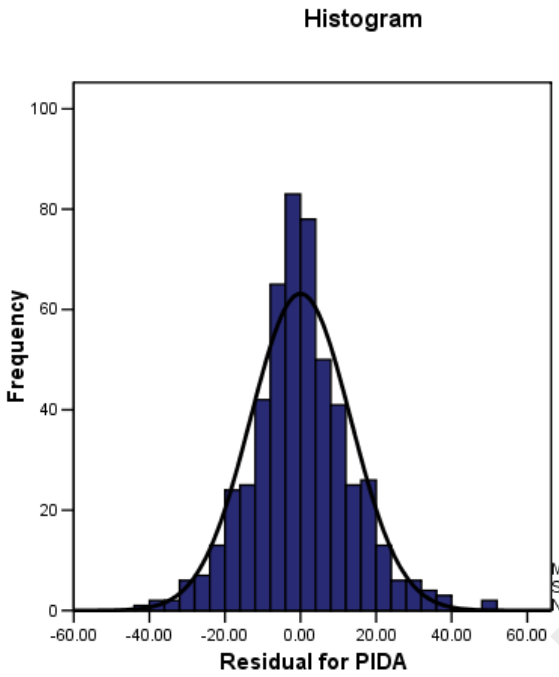

Figure 3.7 Histogram with overlaid normal curve for residuals of PIDA

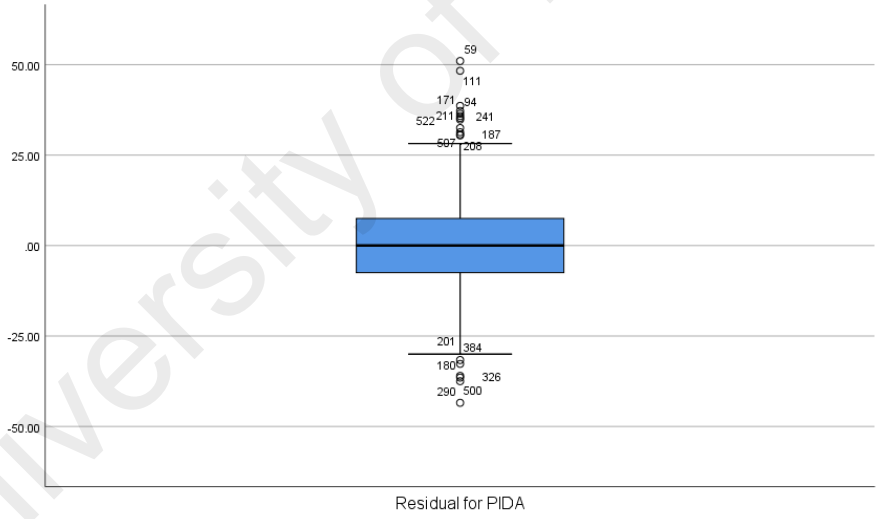

Figure 3.8 Box and whisker plot for residuals of PIDA

Based on both Figure 3.7 and 3.8, the assumption for normality of residuals is met. Then the equality of variance assumption was proved by using the Levene's test.

Refer Table 3.10.

Table 3.10 Levene's test for equality of variances for PIDA

F	df1	df2	p-value
1.02	157	366	.445

The Levene's test showed that the variances for PIDA total score were equal; *F (157,366) = 1.02, p = 0.445*. Thus, the assumption is met. For final assumption, the fit of the model, it was confirmed by using the lack of fit test. See Table 3.11 below.

Table 3.11 Lack of fit test for PIDA

Source	Sum of squares	df	Mean Square	F	p-value
Lack of fit	30007.611	139	215.882	.862	.847
Pure Error	91710.627	366	250.575		

The p-value is more than 0.05 (p = 0.847), thus the model is fit. Assumption is met. The effect size for the multifactorial ANOVA (partial eta squared) was based on small (0.01), medium (0.06) and large (0.14) (Draper, 2019).

CHAPTER 4: RESULTS

4.1 Response rate

Overall, there were 574 participants in the study out of 680 distributed questionnaires. See Table 4.1 below, based on information from subchapter **3.7.3.**

Table 4.1 List of participants in the study

Institutions	Number of participants
Kolej Matrikulasi Selangor	151
Kolej Komuniti Hulu Langat	166
Politeknik Sultan Salahuddin Abdul Aziz Shah	120
Faculty of Science & Technology, UKM	137

There were thirty-seven participants excluded from the study because they reported previous orthodontic treatment experiences (n=37/574; 6.4%). Thus, the actual recruited sample was n = 680 – 37 = 643 participants. Therefore, the number of responses was n = 574 – 37 = 537. The response rate of the study was 83.5% (n=537/643).

Then, six participants were further excluded due to incomplete demographic data (n=6; 1.1%). Seven participants (1.3%) were removed from data analysis due to unacceptable missing PIDA scores. Among the response from these seven participants, there was one item with four missing data in DSC domain, and one item with one missing data for the SI and PI domains, respectively. The final number of participants included in the analysis was 524 with the completion rate of 81.5% (n = 524/643).

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4.2 Demographic data

Table 4.2 shows the demographic information of the participants.

Table 4.2: Demographic data of the participants (N = 643)

		Number of participants	%
Gender	Male	240	45.8
	Female	284	54.2
Age/year	18	146	27.9
	19	132	25.2
	20	157	30.0
	21	60	11.5
	22	18	3.4
	23	5	1.0
	24	2	0.4
	27	1	0.2
	30	3	1.0
Race	Malay	465	88.7
	Chinese	21	4.0
	Indian	30	5.7
	Others	8	1.5
Household Income (RM)	≤499	38	7.3
	500-999	33	6.3
	1,000-1,499	79	15.1
	1,500-1,999	74	14.1
	2,000-2,499	66	12.6
	2,500-2,999	47	9.0
	3,000-3,499	57	10.9
	3,500-3,999	18	3.4
	4,000-4,999	27	5.2
	≥5,000	85	16.2
Place of residence	Urban	299	57.1
	Sub-urban	122	23.3
	Rural	103	19.7

4.2.1 Age

The minimum age of the participants was 18 years old while the maximum age was 30 years old. The mean age was 19.49±1.47 years and the median age was 19 years.

The 20-year-old participants made up 30.0% of the participants followed with 18 years old (27.9%) and 19 years old (25.2%). There were 11.5% of participants aged 21 years and the 22 years old comprised 3.4% of the participants. The minority of participants

were 23 years old and older. The 23 years old comprised 1.0% of the participants and the 30 years old comprised only 0.6% from total number of participants. Two age groups, 24 and 27-year-olds, comprised 0.4% and 0.2%, respectively.

4.2.2 Gender

The total number of female participants was slightly higher compared to male participants. About 54.2% (n = 284) participants were females, while 45.8% (n = 240) were male participants.

4.2.3 Ethnicity

Malay ethnicity had the highest number of participants among the major races at 88.7%, followed by Indian (5.7%) and Chinese (4%). Only 1.5% of participants were from other ethnicity. The other races who also participated in this study were Sikhs, Bumiputra Sabah and aborigines *(orang asli)*.

4.2.4 Household income

There were 16.2% (n=85) participants whose household income were more than RM 5,000. This was followed by the following household income classes: RM 1,000 to RM1,499 (15.1%), RM 1,500 to RM 1,999 (14.1%), RM2,000 to RM 2,499 (12.6%) and RM 3,000 to RM 3,499 (10.9%). Household income groups with less than ten percent of participants were: the RM 2,500 to RM 2,999 (9.0%), income less than RM 499 (7.3%), RM 500 to RM 999 (6.3%), RM 4,000 to RM 4,999 (5.2%) and RM 3,500 to RM 3,999 (3.4%) groups.

4.2.5 Place of Residence

The number of participants decreased from urban, suburban and rural areas. Urban area had the most participants with 57.1% (n=299) while the rural area had the lowest number with 19.7% (n=103). Suburban area had 23.3% (n=122) participants.

4.2.6 Status of the self-perceived malocclusion

Table 4.3 shows the perceived need for orthodontic treatment based on the IOTN-AC ratings.

Table 4.3: The number of participants according to the self-rated IOTN-AC rating (N = 524)

Self-perceived need status	IOTN-AC Severity (Rating Scores)	Number of participants n (%)
No perceived need	**None (1,2)**	307 (58.6)
Perceived need	**Slight (3,4)**	171 (32.6)
	Moderate (5-7)	29 (5.5)
	Severe (8-10)	17 (3.2)

From Table 4.3, there were higher number of participants with no perceived need for orthodontic treatment compared to those with perceived need for treatment (i.e. total number of participants with slight, moderate and severe perceived need for treatment). There were 307 participants (58.6%) with no perceived need for treatment, while for slight perceived need, there were 171 participants (32.6%), moderate perceived need was reported by 29 participants (5.5%) and 17 participants (3.2%) had severe perceived need.

Self-perceived malocclusion status was classified in this study as the ones rated 3 and above. This had indicated that those with no self-perceived malocclusion (no perceived need for treatment) comprised of 58.6% of participants, while those with self-perceived malocclusion comprised 41.4% (217) of participants.

4.3 Prevalence of psychosocial impact of dental aesthetics among the participants by self-perceived malocclusion [Objectives (a) and (b)]

Table 4.4 shows the prevalence of the PIDA and its domains by self-perceived malocclusion among the study participants.

Table 4.4: Prevalence of PIDA and its domains amongst the study participants and by self-perceived malocclusion (N=524)

	Overall n (%)	Self-perceived malocclusion (n = 217) n (%)	No self-perceived malocclusion (n = 307) n (%)	p value[1]
Total PIDA	460 (87.8)	201 (92.6)	259 (84.4)	0.004
PI	397 (75.8)	182 (83.9)	215 (70.0)	<0.0001
DSC	311 (59.4)	170 (78.3)	141 (45.9)	<0.0001
SI	256 (48.9)	133 (61.3)	123 (40.1)	<0.0001
AC	116 (22.1)	76 (35.0)	40 (13.0)	<0.0001

[1]Chi-square test; level of significance was set at $p < 0.05$

The overall prevalence of PIDA among the study participants was 87.8%. A significantly higher overall prevalence was observed among participants with self-perceived malocclusion (92.6%) ($p = 0.04$). The prevalence among participants with no self-perceived malocclusion was lower at 84.4%.

Overall, the Psychological impact (PI) domain had the highest prevalence, followed with the Dental Self-Confidence (DSC) domain, Social Impact (SI) domain and Aesthetic Concern (AC) domain. Similar trends among PIDA domains were observed by the two groups of self-perceived malocclusion and no self-perceived malocclusion ($p < 0.001$). In addition, the prevalence of impact on the OHRQoL due to dental aesthetics concern was higher among participants with self-perceived malocclusion compared to those with no self-perceived malocclusion.

4.4 Severity of psychosocial impact of dental aesthetics among the participants by self-perceived malocclusion [Objectives (a) and (b)]

Table 4.5 shows the mean, standard deviation and median scores for total PIDA and its domains among the participants and by self-perceived malocclusion.

Table 4.5: Severity of PIDA and its domains amongst the study participants and by self-perceived malocclusion (N=524)

	All (n = 524)		Self-perceived malocclusion (n = 217)		No self-perceived malocclusion (n = 307)		p value[1]
	Mean	SD	Mean	SD	Mean	SD	
Total PIDA	36.3	17.1	43.9	16.1	31.0	15.7	<0.001
PI	11.2	5.3	13.4	5.1	9.6	4.9	<0.001
DSC (Reverse)	11.1	5.2	13.5	4.5	9.4	4.9	<0.001
SI	11.1	6.9	13.4	6.7	9.5	6.5	<0.001
AC	2.9	1.8	3.5	1.8	2.4	1.7	<0.001

[1]Independent t-test; level of significance was set at $p < 0.0$

For all participants, the overall mean PIDA score was 36.3 (SD = 17.1). Overall, the participants with self-perceived malocclusion had higher mean, median and IQR compared to their counterparts ($p < 0.001$).

The mean PIDA score was higher among participants with self-perceived malocclusion at 43.9±16.1 compared to those with no self-perceived malocclusion (31.0±15.7). The median score for participants with self-perceived malocclusion (44.0) was also higher compared with all participants (35.4) and those with no self-perceived malocclusion (30.0). The similar applies to their interquartile range (IQR) with higher IQR was noted with the ones with self-perceived malocclusion (21) compared to the ones without self-perceived malocclusion (19).

In PI domain, participants with self-perceived malocclusion had a mean score of 13.4±5.1, all participants with 11.2±5.3 and participants with no self-perceived malocclusion (9.6±4.9). As for reverse-DSC domain, the mean score for participants with self-perceived malocclusion is 13.5±4.5, for all participants (11.1±5.2) and participants with no self-perceived malocclusion (9.4±4.9).

The mean score for SI domain is 13.4±6.7 for participants with self-perceived malocclusion, 11.1±6.9 for all participants and 9.5±6.5 for participants with no self-perceived malocclusion. Finally, for AC domain, the mean score for participants with self-perceived malocclusion is 3.5±1.8, 2.9±1.8 for all participants and 2.4±1.7 for participants with no self-perceived malocclusion.

4.5 Extent of psychosocial impact of dental aesthetics among the participants by self-perceived malocclusion [Objectives (a) and (b)]

Table 4.6 shows that the extent of PIDA and its domains amongst the study participants and by self-perceived malocclusion.

Table 4.6: Extent of PIDA and its domains amongst the study participants and by self-perceived malocclusion (N=524)

Number of domains with significant impact in ≥1 item	Overall (n = 524) n (%)	Self-perceived malocclusion (n = 217) n (%)	No self-perceived malocclusion (n=307) n (%)	P-value[1]
0	64 (12.2)	16 (7.4)	48 (15.6)	
1	129 (24.6)	31 (14.3)	98 (31.9)	<0.001
2	130 (24.8)	42 (19.4)	88 (28.7)	
3	113 (21.6)	66 (30.4)	47 (15.3)	
4	88 (16.8)	62 (28.6)	26 (8.5)	

[1]Chi-square test; level of significance was set at $p < 0.05$

The extent of significant impacts involving all four domains affected 16.8% of all participants while significant impacts involving three domains affected about a fifth (21.6%) of all participants. About a quarter of all participants had either one or two significant impacts at 24.6% and 24.8%, respectively. Only about 12.2% of participants reported no significant impact on their OHRQOL. The participants with self-perceived malocclusion had higher extent of impact compared to participants without self-perceived malocclusion ($p<0.001$).

There was an increasing trend for the extent of impacts among those with self-perceived malocclusion as the number of domain increases, which is lowest at none of the domains affected (7.4%), peaked at the total of three domains affected (30.4%) but reduced slightly at the all domains affected (28.6%).

There were more participants with no self-perceived malocclusion with no domains affected (15.6%) compared to those with self-perceived malocclusion (7.4%). The highest proportions for the extent of impact amongst participants with no self-perceived malocclusion were at the total of one domain affected (31.9%) with a decreasing trend as the total of domains affected increases to four (8.5%).

4.6 Factors associated with OHRQoL related to dental aesthetics across demographics of Malaysian young adults [Objective (c)]

4.6.1 The association between age and OHRQoL related to dental aesthetics

Figure 4.1 is the scatter plot showing the association between interval factor i.e. age and OHRQoL related to dental aesthetics.

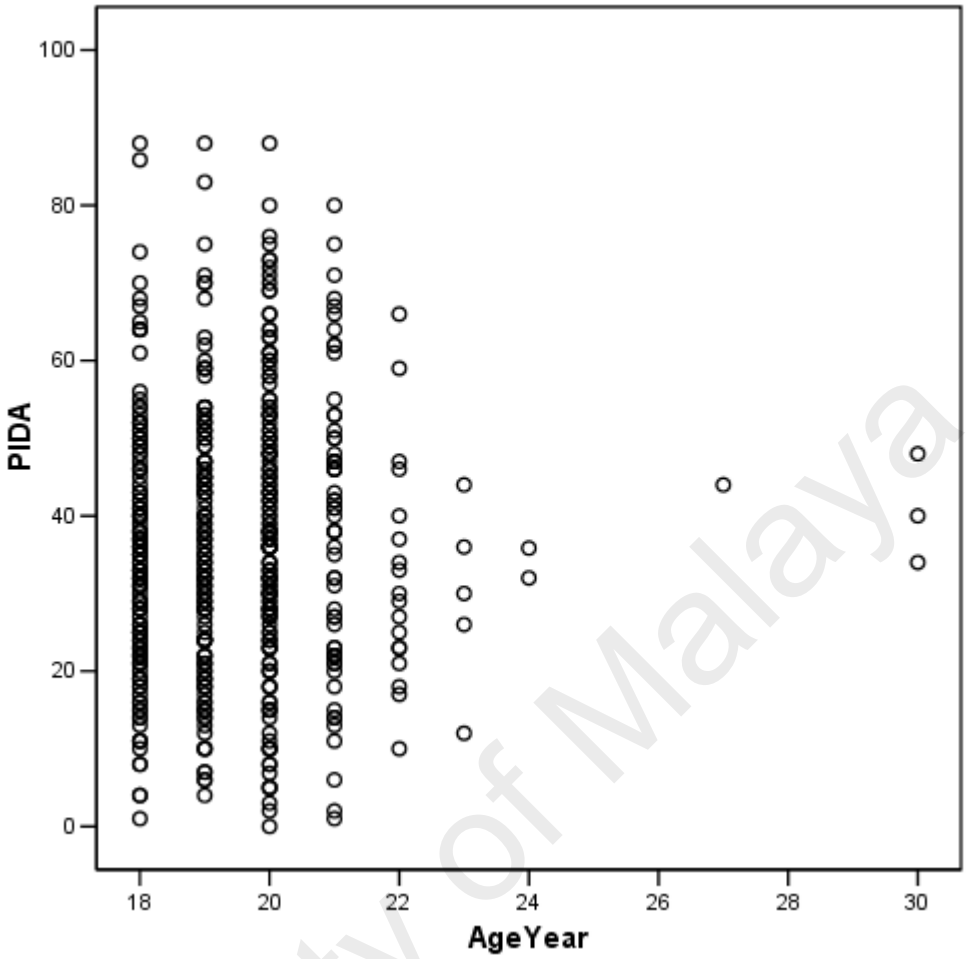

Figure 4.1: The association between age and PIDA total score (OHRQoL related to dental aesthetics)

The scatter plot showed no obvious relationship between the two variables (i.e. age and OHRQoL related to dental aesthetics). The Pearson's correlation test showed that the R-value is less than 0.1 (r = .038) and not statistically significant (p=0.388). This confirmed that there is no relationship between age and total PIDA score.

4.6.2 The association between gender, ethnic, household income, place of residence and self-perceived malocclusion with OHRQoL of Malaysian young adults related to dental aesthetics

Table 4.7 shows the univariate analyses (i.e. independent t-test and one-way ANOVA) of the total PIDA score between the identified nominal factor groups i.e. gender, ethnic, place of residence and self-perceived malocclusion status, and identified ordinal factor groups i.e. household income.

Table 4.7: Comparison of mean total PIDA score between the identified factors

Factors		n	Mean (SD)	t-stat/F-stat (df)	p-value
Gender	Male	240	33.2 (15.0)	-3.85 (522)[a]	<0.001*
	Female	284	38.9 (18.3)		
Ethnic	Malay	465	37.1 (16.9)	3.89(3)[b]	0.09
	Chinese	21	34.2 (19.5)		
	Indian	30	26.4 (15.5)		
	Others	8	34.2 (19.7)		
Household Income (RM)	499 and below	38	35.4 (14.4)	0.769(9)[b]	0.645
	500-999	33	38.4 (18.4)		
	1,000-1,499	79	38.4 (18.8)		
	1,500-1,999	74	37.2 (15.8)		
	2,000-2,499	66	37.2 (18.11		
	2,500-2,999	47	36.0 (18.2)		
	3,000-3,499	57	33.9 (14.7)		
	3,500-3,999	18	30.8 (18.7)		
	4,000-4,999	27	32.0 (16.3)		
	5,000 and above	85	36.9 (17.1)		
Place of Residence	Urban	299	36.1 (17.3)	0.764(2)[b]	0.466
	Sub-urban	122	35.4 (15.8)		
	Rural	103	38.1 (17.8)		
Self-perceived malocclusion status	Yes	217	43.9 (16.1)	-9.217 (522)[a]	<0.001*
	No	307	31.0(15.7)		

[a]Independent t-test was applied; [b]One-way ANOVA test was applied

The univariate analyses showed that only gender and self-perceived malocclusion status were the statistically significant ($p<0.05$) factors affecting the impact of dental aesthetics on the OHRQoL.

Table 4.8 shows the subsequent multifactorial ANOVA conducted to identify the association between the identified nominal factors i.e. gender, ethnic, household income, place of residence and self-perceived malocclusion status with the total PIDA score.

Table 4.8: Multifactorial ANOVA analysis between factors and total score of PIDA

Variables	Unit	Adjusted mean (95% CI)	F-stat (df)	p-value	Effect size (ηp^2)
Gender	Male	30.5 (26.5,34.4)	18.18(1)	<0.001*	0.035
	Female	35.3 (31.5,39.2)			
Race	Malay	37.4 (35.7,39.1)	4.27(3)	0.005*	0.025
	Chinese	33.9 (27.1,40.7)			
	Indian	27.6 (21.8,33.4)			
	Others	32.6 (21.6,43.7)			
Household Income (RM)	499 and below	32.2 (26.3,38.1)	0.52(9)	0.858	0.009
	500-999	35.1 (28.7,41.4)			
	1,000-1,499	35.2 (30.6,39.8)			
	1,500-1,999	34.7 (29.8,39.6)			
	2,000-2,499	33.7 (28.6,38.8)			
	2,500-2,999	33.5 (28.0,39.0)			
	3,000-3,499	31.3 (25.9,36.7)			
	3,500-3,999	29.3 (21.4,37.4)			
	4,000-4,999	30.5 (23.6,37.4)			
	5,000 and above	33.3 (28.5,38.2)			
Place of residence	Urban	33.3 (29.3,36.9)	0.17(2)	0.878	0.001
	Sub-urban	32.3 (28.0,36.6)			
	Rural	33.2 (28.6,37.9)			
Self-perceived malocclusion status	Yes	36.2 (35.2,43.1)	81.26(1)	<0.001*	0.138
	No	26.6 (22.8,30.4)			
Gender*Residence			3.18(2)	0.043*	0.012

The main effects model in the Table 4.8 above showed that there were three factors found to statistically significantly ($p<0.05$) affect the total PIDA score: Gender, race and self-

perceived malocclusion status were significantly associated with OHRQoL. Among the significant factors, females had higher total PIDA mean score (35.31) compared to males (30.45). However, the effect size (partial eta squared (ηp^2)) was small at 0.035. Meanwhile, the participants with self-perceived malocclusion had higher total PIDA score with a mean of 36.16 as compared to participants with no self-perceived malocclusion (26.59). The effect size was large at 0.14.

For the ethnic factor, post hoc Bonferroni analysis revealed that only the mean PIDA score of the Malay and Indian was significantly different ($p = 0.002$). The results showed that Malay participants had the higher mean at 37.39 compared to the Indian participants (mean = 27.6).

In addition, the multivariate ANOVA showed that there was a significant interaction effect in this model, which was between gender and residence (Table 4.9).

Table 4.9: The adjusted mean for interaction gender*residence

Gender	Residence	Mean	Standard Error (SD)	95% Confidence Interval	
				Lower Bound	Upper Bound
Male	Urban	32.25	2.18	27.96	36.53
	Sub-urban	28.88*	2.56	23.84	33.92
	Rural	27.08*	3.14	20.92	33.24
Female	Urban	32.24	2.08	30.16	38.32
	Sub-urban	35.88*	2.68	30.62	41.14
	Rural	37.90*	2.59	32.81	43.00

The mean score of the sub-urban and rural males and females were significantly different because the scores did not overlap with the corresponding 95% confidence interval for the other groups. The male sub-urban's mean total PIDA score (28.88) did not overlap with the female sub-urban's 95% confidence interval of the total PIDA score (30.62, 41.14). Similarly, the female sub-urban's mean total PIDA score (35.88) that did not overlap with

male sub-urban's 95% confidence interval of the total PIDA score (23.84, 33.92). The male rural's mean total PIDA score (27.1) did not overlap with the female rural's 95% confidence interval of the total PIDA score (32.8, 43.0). Likewise, the female rural's mean total PIDA score (37.9) that did not overlap with male rural's 95% confidence interval of the total PIDA score (20.9, 33.2).

Only participants in urban residences did not have significant differences in their total PIDA score in relation to their gender.

CHAPTER 5: DISCUSSION

This study is a pioneer OHRQoL study measuring the impact of dental aesthetics of Malaysian young adults based on the PIDA questionnaire.

5.1 Demographic data

Malaysia had recently redefined youth as 15 to 30 years old (Rahman, 2019), however this study recruited participants starting from 18 years old. This is because the ones aged 15 to 17 years old still given priority on subsidized orthodontic treatments by Ministry of Health. Thus, this study would like to focus on the young adults without access to subsidized orthodontic treatment (18 years old and above) unless they have great treatment need, functional problems or require complex multidisciplinary management. Majority of the study participants came from the younger young adults (18 to 21 years old) which may be due to the exam season and semester break during the data collection, and the lack of postgraduates volunteered online and offline despite the long participant recruitment duration.

As for the gender distribution, the total number of female participants (54.2%) in this study is higher than male (45.8%) since it is a typical situation in Malaysia's higher education for the female students counts to exceed the male students (Annie & Hamali, 2006). The race distributions of the study participants did not reflect the Malaysian's distribution probably due to this study only involved with the government-based tertiary institutions. Further discussion ensued in subchapter 5.4.2.2.

For household income, even though the highest percentage of participants come from household income more than RM5,000 and above (16.1%), the majority of participants (61.7%) come from the household income ranging from RM1,000 to RM2,999. However, this did not correspond to the Malaysia's household income distribution in 2016 (Economic

Planning Unit, 2017). According to the data, there were about 19.1% and 52.6% of Malaysian with household income of RM1,000-RM2,999 and more than RM5,000 respectively. These might have contributed by the fact that the ones with lower income preferred to enrol in government-based higher educational institutions since it is more economical option. Furthermore, the government efforts in boosting their chance to further their studies through quota for their enrolment and special entry for them (Edirin, 2018).

About 19.66% of study participants resided in rural area, with accumulated 80.34% of participants from urban and suburban area in this study. The numbers were close to the population distribution estimation for rural area (26.3%) and 73.7% for urban and suburban (Edirin, 2018).

There were about 58.6% of participants without self-perceived malocclusion in this study, compared to 23.1% (Palomares et al., 2012), 47% (Klages, Bruckner, et al., 2005), 72.08% (Oshagh et al., 2011) and 86.4% (Isiekwe et al., 2016).

5.2 Objective (a) - Prevalence, severity and extent of the impact of self-perceived malocclusion on the OHRQoL related to dental aesthetics of Malaysian young adults

The first objective of this study was to assess the prevalence, severity and extent of the psychosocial impact of dental aesthetics in Malaysian young adults. To date, limited publications revealed the prevalence of general OHRQoL of adults.

5.2.1 Prevalence of the impact of self-perceived malocclusion on the OHRQoL related to dental aesthetics of Malaysian young adults

In this study, there was about 87.8% of Malaysian young adults experienced problems with their OHRQoL.

The previous literatures (Table 5.1) had used words such as “general” or “overall” and “prevalence” in order to define the prevalence-related findings in their study. Further discussion will refer on the summary of information in Table 5.1.

Table 5.1 Prevalence of OHRQoL in adult-related literatures

Year	Author(s)	Sample size	Questionnaire (Domains)	Prevalence (%)	Age group	Study population
2007	Klages, Rost, Wehrbein, & Zentner	470	**Perception of Occlusion Scale (POS)** **S**ubjects losing more than one tooth with the highest rating on perceived malocclusion **NIDAS (Short form of PIDAQ)** **S**ubjects losing more than one tooth with the **highest** negative impacts on dental aesthetics	 16.0 23.1	$\bar{x}$: 19.8± 1.2	German male naval recruits.
2009	Akarslan, Sadik, Erten, & Karabulut	1014	**Self-developed Questionnaire** Dissatisfied with the color of the teeth Dissatisfied with dental appearance	 55.1 42.7	16-70	Patients attended a dental school in Turkey.
2011	Tin-Oo, Saddki, & Hassan	235	**Self-developed questionnaire** Dissatisfied with general dental appearance	 52.8	18-62	Patients of Hospital Universiti Sains Malaysia dental clinic.
2013	Ahsan et. al.	400	**Self-developed questionnaire** Dissatisfied with general dental appearance	 46.5	20-27	Students of Dhaka University, Bangladesh.
2015	Nagarajappa et. al	800	**OIDP** Prevalence of the overall impacts	 60	17-24	Students attending various degree colleges at India.
2019	Wan Hassan et. al, 2019	901	**PIDAQ** Prevalence of impacts of self-perceived malocclusion	 90.2	13-18	Malaysian schoolchildren

Table 5.1 had shown prevalence of OHRQoL from few studies done at various countries. Most of the studies were also associated to the dental aesthetics aspects of the OHRQoL. Based on the table, the numbers related to prevalence of OHRQoL of adults ranged from 16.0% (Klages et al., 2007) to 60% (Nagarajappa et al., 2015).

The German study had used a short version of PIDAQ or Negative Impacts of Dental Appearance Scale (NIDAS) to assess the negative impacts of dental aesthetics (Klages et al., 2007). They categorized participants' NIDAS scores into quartiles, with the first quartile regarded as low impact and the fourth quartile as high impact (Klages et al., 2007). The first, second and third quartile had 8.5%,10.4% and 9.7% of male naval recruit participants with more than one tooth loss respectively. In the fourth quartile or highest negative impact on dental aesthetics, 23.1% of similar participants had their OHRQoL affected, which was the highest percentage recorded for said study (Klages et al., 2007). However, the value was the lowest compared to other studies and this study, which might be related to lack of oral health awareness and care within military population (Špalj et al., 2012).

OHRQoL studies involving students from tertiary educational institutions, similar to this study but from two other countries (Ahsan et al., 2013; Nagarajappa et al., 2015) had found higher prevalence compared to the naval group (Klages et al., 2007). In Bangladesh, 186 out of 400 (46.5%) Dhaka University students had reported a dissatisfaction over their teeth appearance (Ahsan et al., 2013). Meanwhile 60% of students in Rajasthan, India had general impacts on their oral daily performances (Nagarajappa et al., 2015).

A Malaysian study involving patients aged 18 to 62 years old had found that about 52.8% were discontent with their general teeth appearances (Tin-Oo et al., 2011), with comparable findings by Turkey dental patients noting 42.7% and 55.1% for general dissatisfaction towards teeth colour and appearances, respectively (Akarslan et al., 2009).

In addition to that, a recent OHRQoL study similar to the current study had reported that the prevalence of impacts on the OHRQoL related to dental aesthetics among Malaysian school children (aged 12 to 17 years old) was 90.2% (Wan Hassan et al., 2019).

The lack of disparity in prevalence of impact between the two life stages (adolescents and young adulthood) suggests that the low OHRQoL suffered from the impact of dental aesthetics during adolescence may persist into adulthood. A prospective longitudinal study to measure the pattern of impact on the OHRQoL related to dental aesthetics among non-orthodontic subjects is proposed to determine the duration of the impact of dental aesthetics on the OHRQoL throughout an individual's life.

There were about 59.4% of participants having less dental self-confidence in this study. In comparison, there were comparable items in other OHRQoL questionnaires found in past literatures. The items such as hating and had bad impression on own teeth appearance, as well as dislike own teeth colour were similar to the item number 4 (I am proud of my teeth) and 21 (I am satisfied with the look of my teeth) (Ahsan et al., 2013; Akarslan et al., 2009; Claudino & Traebert, 2013; Tin-Oo et al., 2011). All mentioned studies prepared self-developed questionnaire with an exception to study by (Claudino & Traebert, 2013) that used Oral Aesthetic Subjective Impact Scale (OASIS). Item 7 in DSC domain (I like showing my teeth when I smile) was comparable to the previous researches that noted affected daily performance of smiling in Oral Impacts on Daily Performance (OIDP) questionnaire (Åstrøm et al., 2006; Nagarajappa et al., 2015).

The prevalence of those associated factors for *negative impression on own teeth* was 10.1%, (Claudino & Traebert, 2013), and *general dissatisfaction towards teeth* for Claudino and Traebert (2013) study was 25.4%, Akarslan et al. (2009) (42.7%), Ahsan et al. (2013) (46.5%) and Tin-Oo et al. (2011) (52.8%). As for *dissatisfaction towards teeth colour* aspect,

the prevalence Tin-Oo et al. (2011) noted for Akarslan et al. (2009) and Tin-Oo et al. (2011) studies were 55.1% and 56.2% respectively. About 4.6% (Åstrøm et al., 2006) and 12% (Nagarajappa et al., 2015) of study subjects were reported having *smiling* as the affected oral daily performances.

Based on above numbers, the percentages of participants dissatisfied with their own teeth appearance and colour were almost analogous with the finding of present study (59.4%) - with the prevalence ranging from 25.4% to 52.8%. The high prevalence among the studies had proven that dental self-confidence is one of the most concerned parts in discussing OHRQoL as compared with other domains.

As for psychological impact, this study had found that about 75.8% of the participants were affected psychologically by the dental aesthetics. However, the numbers were more widespread in other previous studies which ranging from 14.2 to 68 percent for related oral psychological aspects, with majority of the study reported prevalence around 20 to 40 percent (Gava et al., 2013; Isiekwe et al., 2016; Palomares et al., 2012; Rusanen et al., 2011)

Moving on to social impact, previous studies had found around 2.1 to 33 percent had suffered problems in their social life due to low oral health status as compared to 48.9% reported in this study (Åstrøm et al., 2006; Rusanen et al., 2011). Despite the difference in prevalence, social impact was the less impacted domain all studies including the present study when the aesthetic concern domain was excluded.

In addition, the order for prevalence according to PIDA domains is PI (75.8%), DSC (59.4%), SI (48.9%) and AC (22.1%), similarly to the Malaysian malocclusion OHRQoL study involving schoolchildren (Wan Hassan et al., 2019).

5.2.2 Severity of the impact of self-perceived malocclusion on the OHRQoL related to dental aesthetics of Malaysian young adults

Table 5.2 described the severity found in past literatures.

Table 5.2 The severity of OHRQoL in adult-related literatures

Year	Author(s)	Sample size	Questionnaire (Domains)	Mean	Age group	Study population
2011	Lin, Quan, Guo, Zhou, Wang, & Bao	436	**PIDA** (POS > 9) Overall mean Dental Self-confidence Social Impact Aesthetic concern	 48.91 19.89 11.08 17.94	18-36	Young adults from Guangzhou, China.
2014	Chen, Feng, Liu, Li, Cai & Wang	212	**OHIP-14 & IOTN-DHC** Overall mean (before treatment) – Total score 56 • Little/No treatment needed • Borderline need • Treatment required	 6.07 9.06 12.75	18-25	Patients of orthodontic clinics at Guanghua School of Stomatology, Hospital of Stomatology, Sun Yat-sen University, China.
2015	Choi, Kim, Cha, & Hwang	429	**OHIP-14 & IOTN-DHC** -Patients needing extensive orthodontic treatment had *significantly greater mean OHIP-14 total scores* than the patients needing no treatment		18-32	Patients of dental department of the Health Services of the Capital Defense Command, Seoul, Republic of Korea.
2015	Bourzgui, Serhier, Sebbar, Diouny, Othmani & Ngom	99	**PIDA** mean Dental Self-confidence Social Impact Aesthetic concern Psychological Impact	 2.50 1.60 1.57 1.80	$\bar{x}$: 20.97 ± 1.10	Students of Faculty of Dental Medicine, Casablanca.
2017	Garg, Tripathi, Rai, Sharma & Kanase	93	**PIDA (IOTN-AC >8)** Overall mean Dental Self-confidence Social Impact Aesthetic concern Psychological Impact	 66.40 20.82 20.00 8.83 17.07	10-19 20-35	Patients at Maulana Azad Institute of Dental Sciences, Delhi, India

In the current study, the overall mean of PIDA score for 524 participants was 36.31±17.07. Higher mean was noted with participants with self-perceived malocclusion (43.90±16.06). Similar trend were noticed in past studies, where the mean from groups with self-perceived need scored higher than the ones who did not (Bucci et al., 2015; Chen et al., 2014; Choi et al., 2015; Garg et al., 2017; Lin et al., 2011). These trends probably happened since the ones with self-perceived malocclusion had more self-consciousness towards the dental aesthetic issue (Hassan & Amin, 2010), thus affecting their OHRQoL.

The mean for participants with self-perceived malocclusion or with IOTN-AC scores of 3 and above (43.90±16.06), was lower, yet not far off with Indian PIDA studies with IOTN-AC scores 1 to 4 (53.50±18.15), 5 to 7 (62.95±14.47), 8 and above (66.40±16.33) (Garg et al., 2017).

The means for all subjects according to domains were as follows; Psychological Impact (PI) (11.21±5.31), Social Impact (SI) (11.12±6.87), the reverse-scored Dental Self-Confidence (DSC) (11.10±5.16) and finally Aesthetic Concern (2.88±1.84). The means for the PI, SI and DSC domain were close to each other, which relates to the Indian PIDA study (Garg et al., 2017). Other past studies had higher means for DSC domain compares with the other two domains (PI & SI), since the scores were not yet reversed for further calculation (Bourzgui et al., 2015; Bucci et al., 2015; Lin et al.,2011). On the similar note, AC domains was the lowest (Bourzgui et al., 2015; Bucci et al., 2015; Garg et al., 2017).

For all subjects, the means of the domains were following the ascending order from the extrinsic domains (social impact) towards intrinsic domain (psychological impact/dental self-confidence) if disregarding the total numbers of items for each domain. This finding was similar with the Korean young adult study (Kang & Kang, 2014).

The psychological impact domains had higher mean despite having only six items as compared to social impact domains, yet opposite findings were discovered in adolescent studies done in Spain and Brazil (de Paula et al., 2009; Montiel-Company et al., 2013).

These might suggest a declining self-esteem (the intrinsic issues) from adolescence until young adult age, however it may increase later in adulthood (Robins et al., 2002). Further OHRQoL studies related to self-esteem are needed in order to rectify on the probability of extrinsic and intrinsic factors (OHRQoL) and their interaction to affect self-esteem.

5.2.3 Extent of the impact of self-perceived malocclusion on the OHRQoL related to dental aesthetics of Malaysian young adults

The highest percentage of all study participants were noted having "significant impact" (strong positive rating (3-4) in SI, PI and AC domain as well as strong negative rating (0,1) in DSC domain) in two out of total four PIDA domains (24.8%), closely followed by having significant impacts in one out of four domains (24.6%) and in three out of four domains (21.6%). Then, the highest extent for participants with self-perceived malocclusion was three out of four domains (30.4%), meanwhile the participants without self-perceived malocclusion had highest extent at one out of four domains (31.9%). These results were comparable to the Malaysian adolescent study (Wan Hassan et al., 2019).

Extent of PIDA questionnaire was rarely discussed in past studies, thus the extent of other OHRQoL instruments were used as comparison with current study. A study done with the orthodontic patients in South Korea had noted that the malocclusion group scored the highest in five out of total seven domains in OHIP-14 as compared to normal occlusion and retention groups (Kang & Kang, 2014). Meanwhile another study by Åstrøm et al. (2006) had found that about 18.3% of normal Norwegian participants experienced problems in at least one daily activity due to oral issues, which is a bit lower

compared to this study for experiencing at least one domain with significant impacts (24.6%).

Meanwhile, in adolescent studies there were about 26.9% of children had impacts on three out of eight oral performances (Gherunpong et al., 2004b) and 77.4% had impacts on one out of four oral daily performances (Bernabé et al., 2008) as the highest prevalence having the extent of impact on their OHRQoL.

5.3 Objective (b) - Prevalence, extent and severity of psychosocial impact of dental aesthetics in Malaysian young adults with and without self-perceived malocclusion

The relationship between the participants that reported at least one significant impact in PIDA items and self-perceived malocclusion status was established by Pearson's chi-square test, thus there were significant differences of prevalence scores according to self-perceived malocclusion status.

In this study, the prevalence of participants without self-perceived malocclusion had lower percentages in all domains and in overall as compared to participants with self-perceived malocclusion. About 92.6% out of participants with self-perceived malocclusion were affected as compared to 84.4% among participants with no self-perceived malocclusion.

On the other hand, there were obvious differences in the extent of impacts between the participants with and without self-perceived malocclusion. Most of the participants with self-perceived malocclusion (59%) were affected three to all domains in PIDA, meanwhile majority of participants without self-perceived malocclusion (60.6%) had impacts on one to two domains. This had explained on the widespread percentages on all domains affected except none.

Similar trends were observed the severity scores across the two groups. The participants with self-perceived malocclusion had higher mean and standard deviation for all domains and overall PIDA score as compared to participants without self-perceived malocclusion.

In short, the participants with self-perceived malocclusion were more affected towards all domains of PIDA in terms of the prevalence, extent and severity compared to their counterparts. These possibly related to their broken self-concept, after experiencing bad impression and comparisons from others because of their teeth, which further affecting their emotional states and social relations (Klages et al., 2004; Klages, Claus, et al., 2005).

The null hypothesis of the present study had stated that there is no significant difference in OHRQoL impacts between young adults with or without self-perceived malocclusion. The results from this study had shown that there were indeed differences between participants with and without self-perceived in terms of prevalence, extent and severity of impacts on their OHRQoL. Therefore, the alternative hypothesis is accepted.

In summary, the participants with self-perceived malocclusion were more affected in their OHRQoL (Isiekwe et al., 2016; K. A. Kolawole et al., 2012). Further discussions ensued in subchapter **5.2.2.3**.

5.4 Objective (c) - Factors associated with psychosocial impact of dental aesthetics in Malaysian young adults

The final objective for this study is to identify factors associated with the psychosocial impact of dental aesthetics in Malaysian young adults. Table 5.3 listed significant factors associated with OHRQoL in previous studies.

Table 5.3 Factors associated with OHRQoL in literatures

Year	Author	Sample size	Prevalence (Questionnaire)	Significant factors	Age group	Study population
2004	Klages, Bruckner & Zetner	148	• Orthognathic quality of life questionnaire • IOTN-AC	Gender	18-30	University students (Europe)
2005	Soh, Sandham & Chan	339	• British Standard Institute (BSI) • Angle's classification	Race	17-22	Male Singaporean army recruits
2009	Mtaya, Brudvik & Åstrøm	1601	• Oral hygiene index (OHI-S) • basic Angle classification	Locality	12-14	Tanzanian schoolchildren
2011	Rusanen et al.	94	• OHIP-14	Genders	16-64	Patients at Oral and Maxillofacial Department, Oulu University Hospital, Pakistan
2013	Masood et al.	325	• OHIP-14 • IOTN-DHC	Age Education level Gender	15-25	Orthodontic patients, UiTM, Malaysia
2015	Gardezi, Ul- Haq, Hussain, & Irfan	100	• OHIP • DAI	Age Gender Education level	18-25	Patients at orthodontics department, de'Montmorency College of Dentistry, Lahore, Pakistan

5.4.1 Age

The evidence of this study revealed that age was found not statistically significant as factor. Thus, we can infer that all participants in this study are affected similarly despite their age.

On the other hand, previous related research had discovered varying results. A literature review by Cohen-Carneiro et al. (2011) found that the proportion of association of age and OHRQoL as positive, negative and none were 11:7:7 respectively. Most of the studies were using adults as participants.

Furthermore, few of adult-based studies suggested that age may playing a role in extending the OHRQoL impacts (Åstrøm et al., 2006; Gardezi et al., 2015; Masood et al., 2013). On the contrary, there were indeed other studies that concur with this study result (Choi et al., 2015; John et al., 2004).

Based from these findings, there were differences of the impact according to age. Younger participants might be affected more, and the older participants might be affected less as the 'response shift' theory (Masood et al., 2013) mentioned before in subchapter **2.5.4**. The theory brings the belief that there was negative association between age and OHRQoL since human will gradually adapted and embraced the aesthetic concern (Masood et al., 2013).

Yet, this study did not correspond to the said theory. It might be due to the asymmetry in the age distributions of the participants, which was the limitations of this study. Majority were come from the "younger" side (less than 24 years old) and there were less representatives of "older" young adults (25-30 years old).

5.4.2 Significant factors associated with psychosocial impact of dental aesthetics in Malaysian young adults

5.4.2.1 Gender factor and Gender*Residence interaction

The result from this study had shown that female had shown significantly higher impact on the OHRQoL compared to males.

The outcome from previous literature had shown that female is more affected than male in terms of their OHRQoL (Cohen-Carneiro et al., 2011; Gardezi et al., 2015; Klages et al., 2004; Rusanen et al., 2011). Hence, the finding from the present study is supported and follows the similar trend from these OHRQoL studies.

Women typically had more concern over their appearances. They are generally being associated with extra care and anxiety for their looks as compared to their male counterparts. In a South Korea study, facial appearance was found as the second most concerned part among women in early adulthood (Park & Son, 2009) and teeth indeed played the role in contributing for the concern as one of the face parts. Other than that, men were commonly thought to be more ignorant of their looks compared to females (Frith & Gleeson, 2004).

In this study, gender was found to interact with residence. There were differences between genders according to their place of residence. Men residing in urban area were found to impact them similarly as women in the same area, shown that they are also having problems with their OHRQoL as women do. Similar findings were found in another urban population (Eslamipour et al., 2010; Xiao et al., 2007).

This situation might propose that urban men tend to become more metrosexual – a heterosexual, urban man who is diligently managing his appearances; ("Metrosexual definition and meaning,"). The term was coined by Simpson (1994) in his newspaper

essay but later became famous globally by his reference to David Beckham as the epitome of metrosexual in his article in Salon.com (Simpson, 2002).

The residence area had influenced them to be more open-minded and giving them more opportunities to learn and exposed to the shop items related to upgrading their looks, as well as leading them to be inside the metrosexual environment. Moreover, young adults prioritized appearance the most despite their gender (Harris & Carr, 2001). Race aspect also did not affect these urbanites in perceiving the men's look; a study involving various ethnics – Asian, Black, Hispanic and White in urban area had found no significant difference between genders in deciding the men's attractiveness (Cachelin et al., 2002).

However, the suburban and rural men still follow the traditional approach and had lower OHRQoL impacts as compared to females residing in the similar area. These had indicated that despite females are more affected as general, extra attention also needs to be given to the urban males in terms of their OHRQoL in general.

Future studies are suggested to investigate on the difference of diagnostic and self-rating prevalence of the malocclusion of urban men and female as well as the reasons for seeking orthodontic treatments.

5.4.2.2 Race

Malaysia is a multiracial country with an estimated population of 32.4 million in 2018, consisting of three main races (Department of Statistics, 2018). According to national data, Bumiputera (Malays and aborigines) are the majority with 69.1%, followed by Chinese (23.0%) and Indians (6.9%) (Department of Statistics, 2018).

In contrast, the study participants had been unevenly distributed. There were more Malay participants (88.7%) with notably lesser Indian (5.7%) and Chinese (4%). The difference with estimation of population distribution was too apparent especially with the lack of Chinese ethnic representation. Even though the participants' race distribution did not reflect the national data, the assumptions for the multifactorial ANOVA analysis were met (as mentioned in subchapter 3.8.2.3) thus the disproportionate distribution of the races did not affect the whole statistical analysis.

Most of the tertiary institutions involved in this study are comprised mainly of Bumiputera race as compared to other races. This distribution of races that did not seem to represent the Malaysian national may have been attributed to the allocations for races to enter government tertiary institutions or racial preferences to enrol in government or private tertiary institutions, which originated back to the Malaysian educational history.

The mainstream Malaysia educational system had promoted the assimilation among its diverse culture and races, however there are also other options which brings them back to their roots such as the vernacular Chinese and Tamil schools as well as Islamic religious schools which predominantly Malay-occupied (Raman & Sua, 2010). Furthermore, the residence factor also influenced these race-based educational institutions with Chinese primarily in urban area, Malay in rural areas and Indians dispersed in between the two areas (Raman & Sua, 2010).

Unfortunately, these had eventually segregated these Malaysians further into tertiary educational phase, with the blooming private college and universities had been attended mostly by Chinese and some Indians, with lesser Malays noted (Raman & Sua, 2010). These corroborated with the lack of Chinese in present study. Most of the them that participated in this study were public university students, thus explained the shortage of them in this study.

Moreover, the New Economic Policy (NEP) had introduced of enrolment quotas in 1970s to encourage Malays in higher learning institution (Raman & Sua, 2010). However, the government had since gradually reintroduced more of the non-Malays in the institutions through meritocracy in 2001, as well as the inclusion of 10% of non-Bumiputera students to enroll in matriculation starting from 2003 (Man & Mokhles, 2002). Therefore, it is suggested for the future malocclusion related OHRQoL studies among Malaysian young adults to also include participants from the private tertiary educational institutions in order to establish more non-Bumiputera representatives in the study data.

As a factor, race was not as popular as other socioeconomic factors in OHRQoL study since few countries have diversely multiracial population. In a diagnostic study involving Singaporean male army however did found race as significant factor in the occlusion status (Soh et al., 2005).

Other than that (Cohen-Carneiro et al., 2011) had also found 8 out of 40 OHRQoL research in that used OHIP, GOHAI and OIDP instruments exhibit the significance of race factor in their studies. Similarly, the multifactorial analysis found that race factor was significant with small effect size in the present study.

5.4.2.3 Self-perceived malocclusion status

Table 5.2.1 listed the studies that including both malocclusion and OHRQoL.

Table 5.2.1 Malocclusion and OHRQoL in related literature

Year	Author	Sample size	Questionnaire & Results	Age group	Study population
2014	Kang & Kang	860	**OHIP-14** -The malocclusion and fixed treatment groups had *higher OHIP-14 scores* than the normal occlusion and retention groups. **PIDAQ** -PIDAQ score was the *highest* for the malocclusion group, followed by the fixed treatment group, with the normal occlusion and retention groups having the lowest scores	18-39	Patients from orthodontic department at three Wonkwang University dental hospitals and six private dental clinics in Korea.
2014	Chen, Feng, Liu, Li, Cai & Wang	212	**OHIP-14 & IOTN-DHC** - Participants with high treatment need reported a *significantly greater negative impact* on the overall OHRQoL score and in each domain of the OHIP-14, except the physical disability domain.	18-25	Patients of orthodontic clinics at Guanghua School of Stomatology, Hospital of Stomatology, Sun Yat-sen University, China.

Over the years, it had been established in literatures that malocclusion is one of dental conditions that causes low OHRQoL, regardless of life stages – adolescent (Aldrigui et al., 2011; Dawoodbhoy et al., 2013), adults (Gardezi et al., 2015; Liu et al., 2009; Masood et al., 2013) and elderly (De Abreu, 2017).

This factor had been found to be statistically significant with large effect size, indicating that it was greatly influencing the OHRQoL. Based on Table 5.2.1, the 2014

studies done in China and Korea with patients as study participants had similar findings with present study, indicating that malocclusion certainly had negative impacts on OHRQoL, regardless of different levels of treatment need (Kang & Kang, 2014) or comparison with other oral conditions (Chen et al., 2014). The OHRQoL usually had been measured by self-rating, with the OHIP was among the instruments that mostly being used in literatures.

Malocclusion can be measured clinically by dentists as well as by self-rating. This study practiced the use of self-rated malocclusion by the participants instead of diagnostic malocclusion done by dentists to emphasize the psychological aspects of malocclusion. Deng et al. (2018) had discovered IOTN-AC scores were found to be statistically indifferent regardless if it was rated by patient or orthodontist.

Previous OHRQoL studies that used IOTN-AC as self-rating tool for malocclusion (Klages et al., 2004; Kolawole et al., 2014) or as clinical and self-rating tool (Deng et al., 2018; Kok et al., 2004; Kolawole et al., 2014) also reported similar findings with this study.

These imply that once you had a perception that you had a malocclusion; the probability for your OHRQoL declining is higher.

5.4.3 Factors with less significance to the psychosocial impact of dental aesthetics in Malaysian young adults

The current study findings depicted that both household incomes and place of residence factors were found to be not significant with OHRQoL. Positive association between household incomes and place of residences were evident in previous OHRQoL studies, meanwhile no association findings were found more as compared to negative association in OHRQoL studies (Cohen-Carneiro et al., 2011). Thus, this can be interpreted as it will be more likely that poor or rural people may have higher impacts on their OHRQoL if there is any significant association.

5.4.3.1 Household income

Household income is one of the factors contributed in the socioeconomic status (SES) which typically related to the individual health status (Adler et al., 1994). The household income in this study was based on the financial source of the participant, as in if they are still a full-time student, the total income from the parents were considered, and if they are already had a fulltime job then their income was inputted. The 10-level classification of the household income was taken from the table of Percentage Distribution of Households by Income Class, Malaysia, from 1970 to 2017 by Economic Planning Unit (2017). Malaysians had been grouped into three income categories, Top 20% (T20), Middle 40% (M40) and Bottom 40% (B40) based on their median annual income. T20 has a median of RM 13,148; with M40 (RM 6,275) and B40 (RM3,000) respectively (Department of Statistics, 2017). Yet, these did not actually affect them in accessing the public healthcare services.

Ministry of Finance had allocated funding from consolidated revenue fund (CRAW) in providing the public healthcare and medical services (Kananatu, 2002). The outpatient fee is as low as RM1 for the citizens. The subsidized medical and healthcare services

might have impacts in less in concerns of getting treatments. On a similar note, other Malaysian OHRQoL studies also found insignificant relation of income and OHRQoL (Mohamed et al., 2017; Sari et al., 2011; Singh et al., 2015).

On the contrary, it was also discovered that richer people tend to have better OHRQoL in studies in other countries. (Åstrøm et al., 2006; Rebelo et al., 2016). However, it is essential to note that despite the availability of subsidized dental services for Malaysians, the extensive orthodontic services are still luxuries for the ones aged 18 years above, unless if they experienced a very great treatment need, have functional problems or require complex multidisciplinary management.

5.4.3.2 Place of residence

This study categorized the place of residence into three – namely urban, sub-urban and rural. The participants were asked to select based on the location of their home, not according to their place of study.

Place of residence is usually associated with the household income, with the existence of studies related to the urban-rural income gap (Hoerr, 1973). Urbanites are usually labelled with more stable income and rural area is likely to be associated with poverty – despite the presence of urban poverty cases (Mok et al., 2007).

Therefore, it was understandable that both the household income and place of residences were found to be as not significant in OHRQoL differences. As mentioned before, Malaysians had a better access to public healthcare regardless of their income and status, with 95% of basic services available (dental clinics included) in Peninsular Malaysia and 70% in Borneo region (Merican & Yon, 2002). There are also mobile clinics customized for rural areas, with one-stop health center dedicated for urban areas thus ensuring further coverage of the health services for public (Merican & Yon, 2002).

The health education programs – including oral health education are also actively being promoted throughout these facilities, thus ensuring that the health awareness is distributed to all Malaysians irrespective to their place of residence (Merican & Yon, 2002). Therefore, it was possible that the results of this study did reflect to this situation.

In comparison, residence factor was found significantly related to OHRQoL in previous research. The low OHRQoL was proven to be more prevalent in rural area (Drachev et al., 2018; Meneses-Gómez et al., 2016; Mtaya et al., 2009).

5.5 Implications of the research findings

In the present study, the prevalence, severity and extent of the impact of the self-perceived malocclusion was focused on Malaysian young adults. There are various suggestions that can be made after the end of this research.

The evidence of this study had revealed that the OHRQoL of Malaysian young adults are impacted by self-perceived malocclusion. It is essential to understand the oral well-being of young adults after transitioning from adolescent stage. Many research had shown that children and teenagers were greatly affected by aesthetic problems of malocclusion (Rodd et al., 2011). However, there still lack malocclusion-specific prevalence studies on the OHRQoL status of the youth, especially in Malaysia.

From the results of this study, the policy makers are able to use the epidemiological data of young adults affected with self-perceived malocclusion. The statistics trend that continues from adolescent (Wan Hassan et al., 2019) until young adults as seen in this study manifests the continuation of negative influence of malocclusion on their oral well-being. Therefore, this study can be referred in efforts of reviewing policies regarding orthodontic treatments for young adults in this country.

This study is a pioneer study on the use of the malocclusion specific OHRQoL PIDA instrument for young adults in Malaysia. Future OHRQoL research will be able to use this study as reference for malocclusion-specific condition, particularly with self-perceived malocclusion.

Other than that, orthodontists and others dental health professionals will be able to understand the aesthetic concern faced by the Malaysian population impacted by their self-perceived malocclusion through results of this study. The participants may have never visited orthodontic clinics before to consult their problem; therefore the

malocclusion is purely based on their own perception. This study is a good chance to truly understand the self-perceived impact among public.

5.6 Limitation on the research findings

Understanding the shortcomings of a study is important. Analysing the limitation faced throughout the study will prepare the researcher to develop a better research as well as becoming a reference for further potential OHRQoL studies.

The most visible limitation faced in this study is the lack of representative of "older" young adults (24 to 30 years old). This is may be due to the tertiary institutions involved are lack of postgraduate students that aged around 23 years old and above. Only one university was participated in this study and thus explained the lack of volunteers to answer the questionnaires. Consequently, this had contributed to the lower mean age of the study despite the maximum age is 30 years old.

CHAPTER 6: CONCLUSION

6.1 Conclusion on the research findings

6.1.1 Objective (a): To assess the prevalence, severity and extent of the psychosocial impact of dental aesthetics in Malaysian young adults

The overall prevalence of PIDA among Malaysian young adults was 87.8% with mean PIDA score of 36.3 (SD = 17.1). The overall extent of impact was highest with two domains with significant impacts (24.8%). The statistics from this study had shown that the impact towards OHRQoL among Malaysian young adults is prevalently high.

6.1.2 Objective (b): To compare the prevalence, severity and extent of psychosocial impact of dental aesthetics in Malaysian young adults with and without self-perceived malocclusion

On the other hand, participants with self-perceived malocclusion generally had higher PIDA prevalence, extent and severity compared to the ones without, consistent with past studies.

About 92.6% of participants with self-perceived malocclusion with significant impact on their PIDA compared to 84.4% of participants without self-perceived malocclusion. The mean (43.9±16.1) and median (44.0) of participants with self-perceived malocclusion were also higher than their counterparts (mean 31.0±15.7, median 30.0). The highest extent of impact for participants with self-perceived malocclusion was three domains with significant impacts (30.4%). Meanwhile, the extent of impact was highest at one domain with significant impacts (31.9%) for participants without self-perceived malocclusion.

6.1.3 Objective (c): To identify factors associated with psychosocial impact of dental aesthetic in Malaysian young adults

Female in particular is greatly affected with the aesthetic concerns as supported by several OHRQoL studies and further proven through this study. Being a female that resides in the sub-urban and rural area further increases the probability of having higher impacts on the OHRQoL as compared to the men. Yet, the impacts on OHRQoL is felt similarly among both genders at the city, indicating that men also put priority on their looks as women do.

As for race factor, Malay had found to have higher impacts on their OHRQoL compared to Indian. Self-perceived malocclusion status also related to PIDA with large effect size. Age, place of residence and household income had found to have no significant impacts associated with PIDA of Malaysian young adults.

6.1.4 General conclusion

Overall, this study had revealed that Malaysian youth are still affected greatly by the malocclusion. This supports that young adults still regard that dental aesthetics as essential for their well-being. Throughout this study, researcher had found several youths that voiced on their deep concern over the appearance of their teeth despite no physical pain or hindrance due to their malocclusion.

The null hypothesis of this study had stated that there is no significant difference in OHRQoL impacts between young adults with or without self-perceived malocclusion. However, multifactorial analysis had discovered that the OHRQoL of the participants with self-perceived malocclusion had higher impacts as compared to their counterparts. Therefore, the null hypothesis for this study is rejected. Alternative hypothesis of this study was found true in accordance with the statistical analyses.

6.2 Recommendations for further research

More future research on malocclusion specific OHRQoL should be done in order to attain comprehensive understanding on the impending negative impacts.

This study had somehow unintentionally fell short of reasonable amounts of "older" young adults (24 years old and above). There was poor participation from this group in this study despite intense recruitment during data collection period. Future studies may need to seek diverse population, such as including the workers from institutions of different level (big, medium or small companies). This is to boost the participation rate of "older" young adults.

Developing a longitudinal study of the similar objectives is beneficial in general. It is intriguing to determine on the age effect towards the aesthetic concerns on OHRQoL. Currently, there are only two Malaysian studies that used newly translated PIDA; which involving two different age group. Adolescent (12 to 17 years old) (Wan Hassan et al., 2019) and young adults (18 to 30 years old) of this study are the age group participated in the two cross-sectional studies.

Investigating the existence of consistency or changes in OHRQoL impacts due to self-perceived malocclusion is crucial to establish the truth of "respond shift" theory (Masood et al., 2013). The theory had presented similar belief logically; that the aesthetic concern of malocclusion will fades through aging. In order to study this phenomenon in thorough manner, researchers need to include the similar individuals in the future study to know the OHRQoL trend following the age, starting from childhood until adulthood.

Related factors, such as gender and ethnic might already become too apparent in the OHRQoL study. The interaction between gender and residence in this study can be researched further. Future studies can be done to determine whether this interaction is still significant or not. The results can be implemented while choosing target population and

location to set up an orthodontic clinic, in addition to fully ensure that more potential patients will come to get their consultation and treatment.

Other than that, other factors such as levels of education and working status can be added into the future study. It is essential to know the impacts of education level and working status had on OHRQoL, while analysing the reasons that they did not seek orthodontic treatments.

This study had shown that Malaysian young adult had been significantly impacted with their OHRQoL when they had self-perceived malocclusion. In view of the current finding, public health policies for providing orthodontic treatment should not limit orthodontic treatment to adolescents only. It is recommended that the orthodontic services should be considered for young adults, who are impacted by their self-perception of their malocclusion.

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