

The impact of functional appliance treatment on bullying and quality of life in adolescents and their parents

**Thesis submitted in part of fulfillment of Clinical
Doctorate Degree (D.CH.Dent) in Orthodontics.**

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Declaration

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Abstract

Title: The impact of functional appliance treatment on bullying and quality of life in adolescents and their parents.

Aims and Objectives: The objectives of this prospective cohort study were to assess the impact of functional appliance treatment on bullying and oral health quality of life (OHRQoL) among adolescents during and after treatment, and to measure the discrepancy effect of bullying and OHRQoL between adolescents and their parents.

Methods: A total of 74 untreated patients between the ages of 11-14 years and categorized as 5a IOTN (increased overjet more than 9 mm) were recruited from the treatment waiting list at HSE Regional orthodontic unit in St James's Hospital, Dublin, Ireland. Adolescents and their parents were asked to complete validated questionnaires to measure the experience of bullying and OHRQoL immediately before, during and following completion of functional appliance treatment.

Results: The participation rate was 79% (n=57). The pre-treatment questionnaire reported fourteen participants were being bullied. Following completion of functional appliance treatment seven participants were no longer being bullied (T1= (14) 23.7%, T2= (10) 16.9%, T3= (7) 11.9%, $P = .128$). ANOVA analysis for CPQ revealed a statistically significant difference in the emotional-well being subscale reported by the adolescents ($P = .021$). The results indicate that adolescents' emotional well-being improved as they progressed through functional appliance treatment. At Pre-treatment adolescents who rated themselves as bullied reported poorer OHRQoL, specifically on the emotional well being ($t = -2.26$, $P = .028$), social well-being ($t = -2.26$, $P = .027$), and functional

limitation subscales ($t = -2.37, P = .021$). There was a good level of agreement in reporting bullying episodes between adolescents and their parents.

Conclusion-

- Functional appliance treatment for adolescent patients with Class II division I malocclusion has a positive impact on their OHRQoL.
- Functional appliance treatment for adolescent patients with Class II division I malocclusion reduces prevalence of bullying episodes. There is a relationship between adolescents' reports of being bullied and poor OHRQoL.
- There was a good level of agreement between adolescents' and parents' ratings of the adolescent's quality of life and the rate of bullying episodes during orthodontic treatment with a functional appliance.

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Table of Contents

DECLARATION	2
ABSTRACT	3
ACKNOWLEDGEMENTS	5
TABLE OF CONTENTS	6
TABLE OF TABLES.....	8
TABLE OF APPENDICES.....	9
1 INTRODUCTION	10
2. LITERATURE REVIEW	13
2.1 Class II malocclusion.....	13
2.1.1 Definition	13
2.1.2 Trauma incidence.....	13
2.1.3 Functional impairments	14
2.1.4 Psychosocial implications.....	14
2.1.5 Treatment options for CII malocclusion.....	17
2.2. Functional appliances	18
2.2.1 Background	18
2.2.2 Mode of action.....	20
2.3 Twin block appliance.....	23
2.3.1 Background	23
2.3.2 Modified twin block appliance.....	23
2.3.3 Effectiveness of the twin block appliance.....	24
2.3.4 Advantages of twin block appliance.....	24
2.3.5 Disadvantages of twin block appliance.....	25
2.3.6 Patient-reported outcomes	25
2.4 Oral health-related quality of life (OHRQoL).....	26
2.4.1 Definition	26
2.4.2 Background	27
2.4.3 Assessment of OHRQoL.....	28
2.5 Child oral health-related quality of life (COHRQoL)	29
2.5.1 CPQ 11-14	31
2.5.2 Development and testing.....	31
2.6 Parental-Caregiver Perception Questionnaire (P-CPQ)	33
2.6.1 Development and testing	34
2.7 QoL measures for orthodontic treatment.....	34
2.8 Impact of malocclusion and orthodontic treatment on OHRQoL among adolescents.....	36
2.8.1 Impact of orthodontic treatment on OHRQoL	39

2.9 Bullying	42
2.9.1 Definition	42
2.9.2 Prevalence of bullying	44
2.9.3 Bullying scales	45
2.9.3.1 Olweus bully/victim questionnaire.....	45
2.9.3.2 Shaw et al. questionnaire	46
2.9.3.3 Gatehouse scale.....	46
2.9.4 Psychosocial implications	47
3. MATERIALS AND METHODS.....	51
3.1 Aims and null hypotheses	51
3.2 Study Outline	51
3.3 Sample Size.....	52
3.4 Inclusion Criteria	52
3.5 Exclusion Criteria	52
3.6 Participants	53
3.7 Measure.....	53
3.8 Pre-treatment Records.....	54
3.9 TBA design.....	55
3.10 Procedure	56
3.11 Scoring system	57
3.12 Statistical analyses	58
4. RESULTS	59
4.1 Baseline characteristics	59
4.2 Impact of orthodontic treatment on adolescents' OHRQoL.....	60
4.3 Impact of orthodontic treatment on prevalence of bullying.....	63
4.4 Adolescents' CPQ subscales and total scores as a function of bullying status	66
4.5 Measure discrepancy effect of OHRQoL between adolescents and their parent.	68
4.6 Level of agreement between adolescents and their parents in reporting bullying	69
5.DISCUSSION	70
5.1 Impact of orthodontic treatment on prevalence of bullying.....	72
5.2 Impact of orthodontic treatment on adolescents' OHRQoL.....	74
5.3 The discrepancy effect between adolescents and their parents.....	76
5.4 Limitations, strengths and implications	77
5.5 Future research	79
6. CONCLUSIONS.....	80
7.REFERENCES	81
8.APPENDICES	88

Table of Tables

TABLE 1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS	59
TABLE 2 COMPARISON OF CPQ SUBSCALE AND TOTAL SCORE FOR CHILDREN ACROSS THREE MEASUREMENT PERIODS.	61
TABLE 3. COMPARISON OF CPQ SUBSCALE AND TOTAL SCORE FOR PARENTS ACROSS THREE MEASUREMENT PERIODS.	62
TABLE 4. COMPARISON OF RATE BULLYING ACROSS THREE MEASUREMENT PERIODS AS RATED BY CHILDREN AND PARENTS	63
TABLE 5. TYPES AND RATES OF BULLYING AS RATED BY ADOLESCENCES AND THEIR PARENTS AT PRE- TREATMENT	64
TABLE 6. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF BULLIED PARTICIPANTS	65
TABLE 7. COMPARISON OF CHILDREN CPQ SUBSCALE AND TOTAL SCORES AS A FUNCTION OF BULLYING STATUS.....	67
TABLE 8. COMPARISON OF PARENTS AND CHILDREN TOTAL SCORES ON THE CPQ AT PRE- TREATMENT, DURING TREATMENT AND POST TREATMENT	68
TABLE 9. RATE OF BULLYING BY PARENTS AND CHILDREN	68
TABLE 10. LEVEL OF AGREEMENT OF BULLYING STATUS BY PARENTS AND CHILDREN	69

Table of Appendices

APPENDIX 1. ETHICAL APPROVAL LETTER.....	88
APPENDIX 2. INVITATION LETTER	89
APPENDIX 3. PATIENT INFORMATION LEAFLET	90
APPENDIX 4. CONSENT FORM	92
APPENDIX 5. P-CPQ.....	94
APPENDIX 6. GATEHOUSE SCALE FOR PARENTS.....	105
APPENDIX 7. CPQ 11-14.....	113
APPENDIX 8. GATEHOUSE SCALE FOR ADOLESCENTS.....	124

1 Introduction

Malocclusion is defined as “a developmental condition that has deviated from the ideal occlusion and can be considered aesthetically or functionally unacceptable” (Mitchell 2002). The deviation can manifest as a simple dental anomaly or as something more complex, such as craniofacial deformity (Cunningham, 1999). The high prevalence of malocclusion and its impact on psychosocial well being makes it a universal public health issue (WHO, 2013).

Given the increased individual concern with dental and orofacial aesthetics, it seems likely that any deviation from what is considered “ideal” may have a detrimental effect on psychosocial well-being (Klages et al., 2004a). In their investigation of the impact of dentofacial appearance on an individual’s social attractiveness, Shaw et al. (1981) found that attractive children of normal dental appearance tended to be more socially accepted and perceived to be more intelligent. In contrast, children with unattractive features tend to have less friends, less intelligent and more anti-social (Baldwin, 1980, Walster et al., 1966, Dion, 1973). Visible unattractive malocclusion has been associated with bullying and low self-esteem and can have a negative impact on oral health-related quality of life among adolescents (Johal et al., 2007, Seehra et al., 2011). The primary reason for seeking orthodontic treatment, then, is to enhance social acceptance and quality of life rather than to improve oral health and function.

Adolescents commonly experience bullying in school either directly or indirectly (Olweus et al. 1994), and this may result in physiological and psychological

problems among both children and adolescents (Seehra et al. 2011). Bullying is defined as *“Specific form of aggressive behaviour and can be described as a situation when a student is repeatedly exposed over time to negative actions on the part of one or more students”* (Olweus, 1994).

Recent studies have found that many children are bullied because of a malocclusion; the most targeted dental features are Class II division I and increased overjet (Seehra et al., 2011, Al-Bitar et al., 2013). Bullying impacts negatively on social interaction and overall quality of life (Seehra et al., 2011), and there is evidence that the most common reason for parents to seek orthodontic treatment for their children is bullying due to an increased overjet (Pauli et al. 1993).

Functional appliances are known to rapidly and effectively reduce an overjet, and early treatment with a twin block appliance has been shown to improve patient self-concept and to reduce negative social experiences among patients with Class II malocclusion (O'Brien et al. 2009). There is disagreement in the current literature regarding the psychological benefits of orthodontic therapy following treatment; Shaw et al. (2007) suggested that there are no significant effects. However, other studies have demonstrated the positive impact of orthodontic treatment on quality of life (Seehra et al., 2012).

Advances in the development of variable scales and questionnaires have encouraged researchers to explore patient-reported outcomes for a more holistic understanding of the benefits, risks and experiences associated with orthodontic appliances.

As the TBA is widely used in orthodontics, patient-reported outcome research is needed to explore the psychological effects of functional appliance treatment and its impact on the prevalence of bullying and on overall oral health-related quality of life. Although the positive impact of orthodontic treatment on quality of life,

with a reduction in levels of bullying among adolescents has been demonstrated (Seehra et al., 2012), the impact of functional appliance treatment specifically on bullying and OHRQoL has not been investigated yet.

The purpose of this study was to assess the impact of functional appliance treatment on bullying and oral health quality of life (OHRQoL) among adolescents during and after treatment, and to measure the discrepancy effect of bullying and OHRQoL between adolescents and their parents.

2. Literature Review

2.1 Class II malocclusion

2.1.1 Definition

Class II malocclusion is considered the most common orthodontic problem, occurring in about 30% of the population. Whilst aetiological factors may include a combination of jaw, teeth or lip position, the most common characteristic of CII malocclusion is mandibular retrognathia (Proffit et al., 2006)

Class II Division I malocclusion is common among white Northern Europeans (Proffit et al., 2006), affecting about a quarter of 12-year-olds in the UK (Holmes, 1992). According to the British Standards Institute (1983), Class II Division I occurs when “the lower incisor edges occlude posterior to the cingulum plateau of the upper incisors and the upper incisors are proclined or of average inclination”.

2.1.2 Trauma incidence

Where maxillary incisors are proclined and there is an increased overjet, untreated Class II Division I malocclusion incurs a higher risk of trauma. A cross-sectional epidemiological study carried out in 2012 found that the most traumatic injuries were seen in children with Class II Division I incisor relationship with overjet greater than 5.5 mm (Patel and Sujon, 2012). In addition, children with inadequate lip coverage suffered approximately five times more injuries than those with adequate lip coverage (Patel and Sujon, 2012, Thiruvengkatachari et al., 2013). A Cochrane review by Thiruvengkatachri et al. (2013) recommended early treatment of protruding upper incisors to reduce the incidence of incisor trauma (Thiruvengkatachari et al., 2013).

2.1.3 Functional impairments

There is evidence that certain malocclusions have a detrimental effect on a person's ability to break down foods. For instance, a study by English et al. (2002) evaluated whether malocclusion negatively affects masticatory performance. The sample included patients with normal occlusion and Class I, Class II and Class III malocclusion. An objective evaluation of masticatory performance found that Class III patients reported the greatest difficulty in breaking down food, followed by Class II Division I patients with increased overjet. The study concluded that malocclusion negatively affects individual masticatory performance (English et al., 2002).

2.1.4 Psychosocial implications

The impact of oral health, dental appearance, and malocclusion on psychological well-being have drawn increasing attention from researchers (Hawker and Boulton, 2000a). In a 15-year follow-up study, 758 adolescents who have been recorded previously as having a malocclusion in a national survey of schoolchildren and had not received orthodontic treatment were investigated and compared to 152 patients without a malocclusion. Adolescents were asked to complete a questionnaire that included questions about body image and specific questions concerning self-perception and social implications of dental appearance. The authors concluded that occlusal traits such as increased overjet and increased overbite were identified as a potential threat to one's body image and self-concept. Teasing from schoolmates was considered an important factor (Helm et al., 1985). Unattractive occlusal traits and facial appearance can expose a child to nicknames,

harassment and teasing from other children (Shaw et al., 1980a). A meta-analysis of cross-sectional studies investigating the psychosocial effects of bullying found a strong association between being bullied and depression, low self-esteem and anxiety (Hawker and Boulton, 2000b). Bullying is measured using validated self-reported questionnaires. Seehra et al.'s (2011) cross-sectional study measured self-reported bullying among 360 patients with untreated malocclusions aged between 10-14 years old. The participants were asked to complete the Olweus bully/victim questionnaire. Peer victimization was reported by 12.8% of referred orthodontic patients. Moreover, Class II Division I malocclusion with an increased overjet and increased overbite was found to be strongly associated with being bullied. It was concluded that victims experienced a negative impact on their overall oral health-related quality of life because of the presence of malocclusion (Seehra et al., 2011). The negative impact of a malocclusion on oral health-related quality of life among adolescents, associated with functional limitations, psychological discomfort, and psychosocial disability have been confirmed (Johal et al., 2007). The most commonly used tool to measure OHRQoL is a multiple-item questionnaire. Questionnaires can be classified as either generic or specific instrument that measure specific oral health conditions or specific populations (Slade, 2002). The Child Oral Health Quality of Life Questionnaire (COHQoL) developed by Jokovic et al. (2002) was the first assessment tool designed specifically for children and has been widely used in orthodontics research. The questionnaire has been shown to exhibit adequate reliability and validity and has been translated into different languages (Jokovic et al., 2002a). Class II Division I malocclusion has been shown to be associated with a higher incidence of bullying, low self-concept and poor oral health-related quality of life (O'Brien et al., 2009, Seehra et al., 2011). Patients with Class II Division I malocclusion can present with

a retruded mandible, associated with an unattractive convex facial profile and prominent anterior teeth. They may also present with lower lip trap as a result of the increased overjet. The dental arches may be spaced or crowded. According to the Index of Orthodontics Treatment Needs (IOTN), patients with an increased overjet of more than 9 mm are in great need of orthodontic treatment (Brook and Shaw, 1989)

2.1.5 Treatment options for CII malocclusion

There are three broad treatment options for class II malocclusion:

1. Growth modification treatment with functional appliances; ideal cases include the following.
 - Increased overjet
 - Mild to moderate skeletal Class II
 - Average to reduced lower face height
 - Active growth
2. Orthodontic camouflage with fixed appliances; cases include the following:
 - Normal soft tissue morphology
 - Average vertical proportions
 - No transverse skeletal problems
 - Minimal crowding
3. Orthognathic surgery;cases include the following:
 - Non-growing patients with severe facial deformity.
 - Asymmetries
 - Poor soft tissue profile
 - Increased vertical proportions
 - Moderate-severe crowding
 - Increased overjet more than 10 mm in non growing patients

As the present study uses a type of functional appliance, the literature review briefly discusses the classification and mode of action of such appliances. The effectiveness of twin block appliances in reducing overjet will be discussed in greater detail.

2.2. Functional appliances

Functional appliances can be defined as “removable or fixed orthodontic appliances, which use forces generated by the stretching muscles, fascia and/or periodontium to alter skeletal and dental relationship”(Proffit et al., 2006). In orthodontics, functional appliances play a significant role in growth modification treatment. Most such appliances are designed to correct Class II skeletal malocclusion by posturing the mandible forward (Proffit et al., 2006).

2.2.1 Background

Orthodontic use of functional appliances was first introduced in Europe during the early twentieth century. The first functional appliance, developed by Robin, was known as the monoblock appliance. This was followed by the Andresen appliance, which was introduced in Norway in the 1920s and came to be widely accepted elsewhere in Europe. In the 1960s, the use of functional appliances became common in American orthodontics (Proffit et al., 2006).

Functional appliances can be classified according to their active components (Vig et al., 1986)

- Passive tooth-borne
 - Bionator appliance
 - Andresen appliance
- Active tooth-borne
 - Twin block appliance
 - Medium opening activator
- Tissue-borne
 - Frankel appliance
- Hybrid
 - Components designed to meet individual need

Graber et al. (1984) classified functional appliances in terms of the degree of muscle stretch produced

- Myotonic
 - Forces generated by passive muscle stretch
- Myodynamic
 - Forces generated by stimulating muscle activity

Functional appliances have also been classified.

- Fixed appliances (Herbst appliance)
- Removable appliances (Twin Block appliance, Medium opening activator)

2.2.2 Mode of action

There is ongoing debate in the dental literature regarding the mode of action of functional appliances.

Theories of functional appliances' mode of action

(1) Orofacial soft tissue

Functional appliances work by disturbing the soft tissue equilibrium between the lips, cheeks and tongue. When this equilibrium is altered, tooth movement may result in improvement of the soft tissue profile, especially in the presence of a lower lip trap.

(2) Muscles of mastication

Sagittal jaw discrepancy is eliminated by utilising forces generated via the stretched muscles when the mandible is held in forward position (Mills, 1991). It has been hypothesised that when the appliance holds the mandible forward, functional activity of the lateral pterygoid muscle results in condylar adaptation (Mills and McCulloch, 1998). While this hypothesis has been supported (mainly by animal studies) (Rabie et al., 2004, McNamara, 1973), Others were opponents of this theory (Voudouris et al., 2003). Testing this hypothesis in non-human primates using permanently implanted electromyographic sensors, they found that lateral pterygoid muscle hyperactivity was not associated with condyle-glenoid fossa growth modification with functional appliances.

(3) Dentition

Intermaxillary forces directed between the maxillary and mandibular dentitions generated by mandibular protrusion significantly reduce overjet, mainly by tipping movement of the upper and lower labial segments. Altering the sagittal relation results in a variable increase in vertical dimension, aiding in both correction of a Class II buccal segment and overbite reduction (Proffit et al., 2006).

The reported dentoalveolar effects of functional appliances are proclination of mandibular incisors, retroclination of maxillary incisors, distal tipping of maxillary molars and mesial eruption of mandibular molars (Lund and Sandler, 1998). Seventy percent of overjet reduction is due to dental tipping (O'Brien et al., 2003).

(4) Skeletal

Evidence in the literature regarding the skeletal effects of functional appliances is controversial, including the belief that 30% skeletal changes could be achieved by functional appliance therapy (O'Brien et al., 2003). There is some evidence that forces generated by functional appliances can apply some maxillary restraint, especially when supported by headgear (Tulloch et al., 1997), as well as increasing mandibular growth due to additional condylar growth and remodelling of the glenoid fossa (McNamara, 1973). These biological effects of functional appliances were based on animal and clinical studies. The applicability of animal models to humans is questionable because of significant differences in morphology, physiology and growth pattern. Most of the clinical evidence comes from retrospective studies with small sample size and poor design. Many also employed cephalometric analysis, which can result in high bias and error, as

cephalometric points are very difficult to identify and do not reflect true skeletal changes (Tulloch et al., 1990).

Several randomised controlled trials (RCTs) in the United States and the United Kingdom have investigated the effects of early treatment with functional appliances. A two-part randomized controlled trial by O'Brien et al. (2003) evaluated the effectiveness of early treatment with TBA for 174 children aged between 8 and 10 years with class II division I malocclusion. Participants were randomly allocated either to receive early treatment or late treatment. While patients in the early treatment group showed a small initial increase in mandibular growth, no significant differences were found at the end of the treatment between patients in the early treatment group and those treated later (O'Brien et al., 2003). A similar trial conducted in the United States by Tulloch et al. (1997) using a modified bionator appliance and headgear concluded similar findings regarding the skeletal changes in early treatment versus late treatment (Tulloch et al., 1997). These findings are in agreement with was other randomized controlled trials (Ghafari et al., 1998, Keeling et al., 1998).

In a recent meta-analysis, Koretsi et al. (2015) reviewed the literature to October 2013 assessing the effects of removable functional appliances in treated versus untreated patients using radiographic outcomes. Seventeen studies met the inclusion criteria for final analysis, comprising seven RCTs and ten prospective clinical controlled trials. Five of the seven trials were judged to be at high risk of bias; one was considered unclear, and one was at low risk of bias. The systematic review concluded that although functional appliances are efficient in Class II malocclusion treatment, their effects are mainly dentoalveolar rather than

skeletal. The included studies in this systematic review have low level of evidence; therefore, the conclusions of this systematic review should be interpreted with caution (Koretsi et al., 2015).

2.3 Twin block appliance

2.3.1 Background

Since William Clark introduced the twin block appliance (TBA) in 1982, it has become the most widely accepted and commonly used functional appliance for treatment of Class II Division I malocclusion in the UK (Chadwick et al., 1998). This removable appliance consists of interlocking upper and lower acrylic blocks that guide the mandible into a postured position (Clark, 1988).

2.3.2 Modified twin block appliance

The most common TBA in current use is a modified version of the original design described by Clark (1982). The upper appliance has Adam clasps of 0.7 mm, spanning the upper first molars and first premolars, and incorporates a midline expansion device. A labial bow can also be used as required to control upper incisor inclination.

In the lower appliance (depending on which teeth have erupted), Clark (1982) suggested ball end clasps; these are interdental clasps spanning two teeth at the incisor region. Articulation of the upper and lower appliance was achieved by interlocking of the bite blocks at 70 degrees to maintain a postured position. Inter-occlusal separation in the premolar region was 4–6 mm (Clark, 2010).

2.3.3 Effectiveness of the twin block appliance

TBAs have proved more efficient than other functional appliances for overjet reduction and growth modification in the treatment of Class II Division I malocclusion (Thiruvengkatachari et al., 2010). The effects of TBAs in correcting Class II division 1 malocclusion have been reported in a number of studies.

A randomised clinical trial comparing the TBA and the Dynamax appliance showed that patients treated with Dynamax reported greater incidence of adverse events and more breakages than those treated with the TBA (Thiruvengkatachari et al., 2010). When the TBA was compared to the fixed Herbst appliance for Class II malocclusion treatment, no difference was found in terms of dental or skeletal effects. However, more instances of breakage and debonding were reported in the Herbst group while the TBA achieved a high success rate of 66% (O'Brien et al., 2003). According to O'Brien et al. (2009), early treatment with the TBA in children with Class II profiles resulted in improved perception of facial profile attractiveness, especially when overjet was reduced (Proffit et al., 2006).

2.3.4 Advantages of twin block appliance

The TBA is reportedly the most patient-friendly of all functional appliances (Clark, 2010). The division of the appliance into two components makes it relatively well tolerated by patients (Harradine and Gale, 2000a), and it can be worn full-time. It is also robust and easy to fabricate and repair. Maxillary expansion can be achieved by incorporating an expansion screw. In cases of maxillary protrusion, headgear tubes can be attached to the upper part of the appliance. A fixed appliance can also be used simultaneously to facilitate leveling and aligning. A

simple adjustment to the TBA design allows vertical control during treatment.

3.3.5 Disadvantages of twin block appliance

The orthodontic effectiveness of removable appliances is dependent on patient compliance. O'Brien et al. (2003) reported poor compliance of 30% in the TBA group when compared to the Herbst appliance group. Failure to complete TBA treatment was reported in two studies at 9% (Illing et al., 1998) and 15% (Harradine and Gale, 2000b).

It seems likely that a TBA may impact negatively on a patient's social life because of its bulkiness, poor aesthetic and associated speech impairment. In school, a functional appliance's unattractive appearance may attract negative comments from other adolescents and expose the patient to persistent bullying (Seehra et al., 2012). Other factors that may contribute to poor TBA compliance include poor socio-economic background and poor design of the appliance—for instance, thick occlusal blocks result in excessively increased lower face height, compromising facial appearance as well as causing physical discomfort that makes it difficult to wear all the time. Additionally, a visible labial bow would have an adverse aesthetic effect, again resulting in poor compliance (Clark, 2010).

2.3.6 Patient-reported outcomes

Most existing studies have measured the effectiveness of the TBA in terms of cephalometric and dental changes rather than patient-reported outcomes. A systematic review by Tsichlaki and O'Brien showed that 63% of recent RCTs in orthodontics focused on clinical outcomes while other outcomes such as adverse effects of treatment, patient perceptions and treatment impact and compliance had not yet been investigated (Tsichlaki and O'Brien, 2014).

As the TBA is widely used in orthodontics, patient-reported outcome research is needed to explore the psychological effects of functional appliance treatment and its impact on the prevalence of bullying and on overall oral health-related quality of life. Advances in the development of variable scales and questionnaires have encouraged researchers to explore patient-reported outcomes for a more holistic understanding of the benefits, risks and experiences associated with orthodontic appliances. One such study by Khadkhoda et al. used a self-reported questionnaire to assess the impact of functional appliances on oral health-related quality of life among adolescents. Their findings indicated a negative impact, and further high quality research of this kind is needed (Kadkhoda et al., 2011).

2.4 Oral health-related quality of life (OHRQoL)

2.4.1 Definition

Definition of health

Health can be defined as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946).

Definition of quality of life

According to the World Health Organisation Quality of Life Group, “ quality of life is an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns” (WHOQOL, 1993b).

Oral health-related quality of life (OHRQoL)

While oral health-related quality of life is a relatively new concept with no strict or universal definition to date, it has been defined as “ a multidimensional construct that reflects (among other things) people’s comfort when eating, sleeping, and engaging in social interaction; their self-esteem; and their satisfaction with respect to their oral health ” (Satcher, 2000).

2.4.2 Background

Although the concept of general health-related quality of life was well established by the late 1960s, little attention was paid to the impact of oral diseases on QoL (Bennadi and Reddy, 2013). At that time, aside from pain and life-threatening cancers, oral conditions were not thought to have any negative impact on social life (Davis, 1976). Dental conditions were seen as unimportant problems that rarely contributed to classic “sick role” and were no excuse for absence from work (Gerson, 1972). The concept of OHRQoL began to emerge in the late 1970s, with documented evidence of the impact of oral conditions on social life (Cushing et al., 1986). This coincided with a shift in our understanding of health beyond absence of disease to a more complete sense of physical, mental and social well-being (Slade, 2002, Gift et al., 1997).

Quality of life measures have the following applications.

- Screening and monitoring for psychosocial problems
- Population surveys of perceived health problems
- Medical audit
- Health service outcome measures
- Evaluation of research
- Monitoring changes/response to treatment

(Fitzpatrick et al., 1992)

2.4.3 Assessment of OHRQoL

Increasing concern about OHRQoL has led to the development of many oral health measures to evaluate the physical, psychological, and social impact of oral health on the individual (Al Shamrany, 2006). According to Slade et al. (2002), there are three categories of OHRQoL measures: social indicators, global self-rating and multiple-item questionnaires. Social indicators are used mainly in surveys of large populations to assess the impact of oral health conditions at community level in terms of restricted activities and work and school absences. The second measure (global self-rating) assesses OHRQoL by asking the individual general questions about their oral health; responses may be categorical or in visual analogue scale (VAS) format (Slade, 2002). The third measure (multiple-item questionnaire) is the most commonly used. Questionnaires can be classified as either generic instruments that measure overall oral health or specific instruments that measure specific oral health conditions (such as dental anxiety, head and neck cancer or dentofacial deformity) or assess oral health impacts in specific populations (e.g. children) (Slade, 2002).

Fitzpatrick, Fletcher et al. 1992, specify the following requirements for quality of life measures.

- Reliability
- Validity
- Sensitivity to change
- Appropriateness to question or use
- Practical utility

2.5 Child oral health-related quality of life (COHRQoL)

Among the several OHRQoL measures developed to date, most are applicable only to adult populations. Until recently, few self-report-based OHRQoL measures were suitable for children because of the complex conceptual and methodological issues involved (Pal, 1996, Brook and Shaw, 1989). When developing any such self-report measure, the child's cognitive and emotional development must be taken into consideration, as this can affect the reliability of the reported outcomes (Connolly and Johnson, 1999). According to Hetherington (1999), children begin to develop a concept of self at 6 years of age and begin to compare themselves to others. By 11–12 years of age, children are fully aware of their emotions and have developed a self-concept that encompasses peer popularity. During early adolescence, peers play a central role, and the individual's views may be changed by the views of others (Hetherington et al., 1999). This continuous cognitive, emotional and social development means that the structure of self-report measures for children is necessarily age-dependent (Pal, 1996).

The Child Oral Health Quality of Life Questionnaire (COHQoL) developed by Jokovic et al. (2002) was the first such assessment tool designed specifically for children. The questionnaire has been shown to exhibit adequate reliability and validity and has been translated into different languages (Jokovic et al., 2002b).

The questionnaire has three components:

- P-CPQ: Parental-Caregiver Perceptions Questionnaire (for children aged 6 to 14)
- FIS: Family Impact Scale (for children aged 6 to 14)
- Three age-specific questionnaires for children:

CPQ₆₋₇—Child Perceptions Questionnaire for children aged 6 to 7

CPQ₈₋₁₀—Child Perceptions Questionnaire for children aged 8 to 10

CPQ₁₁₋₁₄—Child Perceptions Questionnaire for children aged 11 to 14

CPQ 8-10

This questionnaire for children aged between 8 and 10 years comprises 29 items, divided into four domains (oral symptoms, functional limitation, emotional well-being and social well-being), assessing the influence of oral health status in the previous month. The validity of this questionnaire has not yet been verified in any published research.

2.5.1 CPQ 11-14

As described and validated by Jokovic, the CPQ11-14 component measures children's own perceptions of their OHRQoL for those aged between 11 and 14 years with dental, orthodontic and orofacial disorders(Jokovic et al., 2002a). The development of CPQ11-14 was based on two models previously described by Guyatt et al. (1986) and Juniper et al. (1996). The questionnaire's 36 items are grouped into the same four domains (oral symptoms, functional limitation, emotional well-being and social well-being). The last of these refers to schooling, peer interaction and leisure activities. Each question addresses the frequency of events related to the teeth, jaw and mouth over the preceding three months; the response options are *never, once or twice, sometimes, often* and *every day or almost every day*. The questionnaire also includes a global rating of the overall impact of oral health on the child's QoL, rated on a five-point scale from *excellent* to *poor*; higher scores indicate poorer OHRQoL status (Jokovic et al., 2002b). Studies in several countries have confirmed the validity and reliability of CPQ11-14, including the United Kingdom (O'Brien et al., 2006) , New Zealand (Foster and Thomson, 2005), Saudi Arabia (Brown and AL - Khayal, 2006) , China (Li et al., 2008), Australia (Do and Spencer, 2007) and Brazil (Goursand et al., 2008). A validated short version of CPQ11-14 is also available.

2.5.2 Development and testing

For the development of CPQ 11-14 children aged 11 to 14 years attending the Craniofacial Unit, Hospital for Sick Children, Toronto and the Paediatric Orthodontic Clinics, Faculty of Dentistry, University of Ontario were recruited along with their parents.

The inclusion criteria were as follows.

- Presence of impact from oral and orofacial conditions
- Restorative or orthodontic treatment not yet commenced or in early stages
- Absence of cognitive impairment or other diagnosis
- Fluency in English
- Parental and child consent

Patients were divided into three groups: paedodontic patients, orthodontic patients and patients with orofacial conditions (mainly cleft lip and palate).

The preliminary questionnaire comprised 46 items based on existing oral health and child health measures and grouped into the four domains described above (oral symptoms, functional limitation, emotional well-being and social well-being). An expert panel of healthcare professionals and parents of affected children reviewed the selected items, and the preliminary questionnaire was modified accordingly. The items included in the final questionnaire were selected by means of an item impact study, ensuring that they were the most frequent and significant items for the target population. The selected items were then tested on a group of 83 children from the three different groups. Each child was asked to rate each item in terms of the importance of the problem it described on a four-point Likert scale from 0 (*does not bother me at all*) to 4 (*bothers me very much*). An impact score was calculated by multiplying the percentage of children with positive responses by the item's mean importance rating (as rated on the four-point Likert scale) (Jokovic et al., 2002b). Based on the impact scores, items were then ranked within the four health domains, and those above the median in each ranking were selected for the final questionnaire. In the final questionnaire, the number of items was reduced to 36 (Jokovic et al., 2002b).

2.6 Parental-Caregiver Perception Questionnaire (P-CPQ)

The Parental Caregiver Perception Questionnaire (P-CPQ) component of COHRQoL for children aged 6 to 14 years was described by Jokovic et al. (2003). The rationale for development of P-CPQ was to assess parental perceptions of their children's OHRQoL, but this was not proposed as a proxy measure to replace the child's report. Previously, assessment of children's OHRQoL was based on such proxy reports because of a concern that children might not accurately report their own health status because of such factors as their limited understanding of the questions and of their overall health status. There are conflicting findings regarding the level of agreement between proxy and child reports in studies adopting that approach (Jokovic et al., 2003c). Although parental reports can provide valuable information about their children's oral health, their knowledge is limited, especially in relation to activities or relationships outside the home and the emotional status of the child (Jokovic et al., 2004). For instance, a study comparing the independent OHRQoL assessments of children and their mothers on the CPQ11-14 and P-CPQ11-14 found that both mothers and children reported a similar overall impact of malocclusion on OHRQoL. However, mothers were found to exaggerate the emotional impact of a malocclusion and were more dissatisfied with the child's dental appearance (Benson et al., 2010). In short, parents' reports can augment but cannot replace those of their children (le Coq et al., 2000). As parents or caregivers are the main decision makers regarding their children's oral health status and treatment choices, parallel reporting has been recommended for measurement of OHRQoL in the child population (Jokovic et al., 2004).

2.6.1 Development and testing

The P-CPQ was developed on the basis of the model previously described by Guyat et al. (Guyatt et al., 1986). A preliminary pool of 46 items was based on existing models and interviews with clinicians and parents/caregivers of children from the three different groups (paedodontic, orthodontic and orofacial conditions). In an item impact study, 31 items rated most frequent and significant were selected for inclusion in the final questionnaire. The items were again grouped into four domains (oral symptoms, functional limitation, emotional well-being and social well-being). P-CPQ validity and reliability was tested using a new sample of 231 parents, 79 of whom completed two copies of the questionnaire for test-retest reliability assessment. The questionnaire was found to be valid and reliable, with excellent reproducibility (Do and Spencer, 2008, Jokovic et al., 2003a, Jokovic et al., 2003b, Zhang et al., 2007, Berger et al., 2009).

2.7 QoL measures for orthodontic treatment

Traditionally, orthodontic treatment need was evaluated using measures such as the Index of Orthodontic Treatment Need (IOTN). However such measures tend to underestimate the problem and do not evaluate the individual's perception of a malocclusion's severity. This perception has been found to differ between individuals; while patients with minor malocclusion may report a negative impact on their QoL and a definite need for treatment, others with severe facial deformity may be indifferent (Klages et al., 2004b). Investigation of the psychosocial impact of malocclusion on OHRQoL improves understanding of the reasons for seeking orthodontic treatment and is considered a subjective measure that complements clinical indicators of orthodontic treatment need. To date, there is no specific QoL

measure for malocclusion alone; For instance, Klags et al. (2004) introduced the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) as a QoL instrument for use with orthodontic patients aged 18 to 30. Although the questionnaire is known to be valid and reliable, further testing is required if it is to be used on adolescents (Klages et al., 2004b).

O'Brien et al. (2006) tested the validity and reliability of the CPQ11-14 among preschool children with malocclusion referred for orthodontic treatment in Greater Manchester. The study concluded that CPQ11-14 has acceptable reliability and validity with strong internal consistency for children with malocclusion. It was also concluded that CPQ11-14 is likely to be useful for measurement of OHRQoL in orthodontic trials (O'Brien et al., 2006). In addition, Locker et al. (2007) reported that the CPQ facilitates discrimination of different clinical situations in different groups and can be used with children in need of orthodontic treatment. Agou et al. (2008) confirmed that Child Perception Oral Health questionnaires are sensitive tools for the evaluation of changes in children's oral health-related quality of life following orthodontic treatment.

Although the Child Perceptions questionnaire has been validated for adolescents, it has two limitations; it is not developed specifically to measure malocclusion, and it does not elicit the specific cause of the reported impacts (Johal et al., 2007). In a study by O'Brien et al. (2007), patients with malocclusion aged 11 to 14 years were divided into three groups: crowding, overjet of more than 6 mm and hypodontia (at least one missing tooth). The aim of the study was to investigate the validity and reliability of CPQ11-14 for children with and without

malocclusion and to examine any reported differences in OHRQoL between the three types of malocclusion. The study concluded that adolescents with malocclusion experience a higher negative impact on OHRQoL than their counterparts without malocclusion. However, CPQ11-14 was unable to discriminate between the three groups, and the authors have proposed the development of shortened, condition-specific measures that are sensitive to changes (e.g. as a result of orthodontic intervention)(O'Brien et al., 2007).

2.8 Impact of malocclusion and orthodontic treatment on OHRQoL among adolescents

In most previous studies in this area, the target population was adolescents and children, who constitute the majority of orthodontic patients. This group is highly influenced by the school environment and by their peers. While attractive children with better social skills tend to achieve higher levels of learning and academic development (Shaw et al., 1980a), those with visible and unattractive malocclusions are less liked as friends, are less intelligent and have low self-esteem, as individuals who are insecure about their dental appearance often avoid smiling; socializing and speaking (O'Brien et al., 2007). Several studies in different populations have confirmed the negative impact of a malocclusion on oral health-related quality of life among adolescents, associated with functional limitations, psychological discomfort and psychosocial disability. This effect is greater for the most severe forms of malocclusion (Johal et al., 2007).

As most previous studies investigating the impact of OHRQoL were surveys conducted in schools, no specific form of malocclusion could be identified.

However, some studies have examined the impact of certain occlusal traits—for example, a cross-sectional study by Johal et al. investigated the impact of spacing and increased overjet on the quality of life of children and their families. The sample included 180 patients aged 13 to 15, who met the predetermined inclusion criteria, recruited from the clinics of orthodontic consultants. Patients and their parents were divided into three groups, based on the following occlusal traits: (1) increased overjet of more than 6 mm; (2) spaced dentition of more than 1.5 mm between adjacent upper anterior teeth and (3) control (i.e. no traits of malocclusion). Each child and parent completed the appropriate Child or Parental-Caregivers Perception questionnaire. The findings indicated a statistically significant difference between the control group and their counterparts in the increased overjet ($p = 0.002$) and spaced dentition ($p < 0.001$) groups. No difference was found between the increased overjet group and the spaced dentition group. Findings were similar for parents in all groups. The study concluded that increased overjet and spaced dentition have a significant negative impact on both the children's and their families quality of life (Johal et al., 2007).

A systematic review by (Liu et al., 2009) examined the impact of malocclusion and orthodontic treatment need on the individual's quality of life. Of 143 articles reviewed, 23 met the required inclusion criteria and used a standardised health-related quality of life measure. Most of the studies focused on the child/adolescent population. While the authors noted an association between OHRQoL and malocclusion/orthodontic treatment need, regardless of method of assessment, they described the strength of this association as “modest at best”, and the level of evidence from the reviewed studies was relatively low. Most were cross-sectional studies that sought only to identify a link between quality of life and malocclusion

and did not consider treatment outcomes. The authors were dubious about the prospects of any higher level of research in the future, as “orthodontics does not lend itself well to randomized clinical trials because of ethical issues, particularly when children are involved”.

Since 2009, a number of new studies have been conducted among different populations. In another recent systematic review, Dimberg et al. (2014) looked at the literature from 1960 to 2014 and identified 70 relevant studies, of which 22 satisfied their inclusion criteria. Sixteen articles were judged to be of low quality because they failed to control important confounders such as caries, gender, age and socio-economic factors, as well as using improper statistical methods and failing to declare dropouts (Dimberg et al., 2014). Of the six studies selected for final analysis, all were cross-sectional in design. Four studies were of high quality and reported that anterior malocclusion (anterior crowding, median diastema, increased overjet) had a negative impact on OHRQoL. The two remaining studies (of moderate quality) reported that increased need for orthodontic treatment impacted negatively on OHRQoL. Overall, the systematic review found strong evidence that malocclusion has a negative impact on OHRQoL, and in particular on the dimensions of emotional and social well-being (Dimberg et al., 2014).

2.8.1 Impact of orthodontic treatment on OHRQoL

In modern medicine, any treatment has to demonstrate an outcome that is of benefit to the patient. The main aim of orthodontic treatment is to improve overall dental health and aesthetics, so improving the patient's psychosocial well-being. (O'Brien et al., 2006). There is some disagreement in the current literature concerning the psychological benefits of orthodontic therapy following treatment (Seehra et al., 2012). Longitudinal follow-up of patients who have undergone orthodontic treatment as teenagers reveals no significant improvement on psychosocial parameters as compared to groups who did not receive orthodontic treatment (Shaw et al., 2007) However, the impact of orthodontic treatment on an individual's quality of life is clearly positive.

Fixed appliances

A prospective study by Zhang et al. (2008) looked at changes in children's oral health-related quality of life during fixed appliance therapy over a period of 6 months. A consecutive sample of 217 children was asked to complete CPQ11-14 at five different points: pre-treatment and at 1 week, 1 month, 3 months (T3), and 6 months after placement of the fixed appliance. The fixed appliance was reported to have a positive effect and improved emotional well-being during treatment (Zhang et al., 2008).

Another study assessed the effect of orthodontic treatment on the quality of life of Brazilian adolescents, involving 279 'cases' and 558 controls (randomly selected from 15 and 16-year-old adolescents, all attending secondary schools in Bauru, São Paulo, Brazil. The findings indicated that those who underwent orthodontic treatment were less likely to experience physical, psychosocial or social impacts

associated with their malocclusion on their daily performance (Bernabé et al., 2008). Similarly, Agou et al. (2011) reported improvements in most OHRQoL domains among adolescents who had completed orthodontic treatment (Agou et al., 2011).

Functional appliance

O'Brien et al. (2009) assessed improved facial attractiveness among CII patients with TBA. Using a five-point Likert scale, the facial attractiveness of 20 treated patients and 20 untreated controls aged between 8 and 10 years was assessed by 30 children (aged 10 to 11 years) and by 24 teachers. Features perceived as unattractive included CII profile, prominent front teeth with incompetent lips and increased overjet. Remarkably, the same sample judged the patients with CII profile as attractive following orthodontic treatment with functional appliances (O'Brien et al., 2009).

The assumption that orthodontic treatment would have a positive aesthetic effect, possibly improving self-esteem and self-concept, is undermined by conflicting results regarding the effect of functional appliances on self-concept. According to Dan et al, (1995), patients with CII malocclusion who underwent functional appliance therapy reported no change in self-concept. This contrasts with O'Brien et al. (2003), who noted a significant improvement in this group of patients. This difference is based on a mean overjet reduction of 2.1 mm in Dan et al. (1995) as against a reduction of 6.6 mm in O'Brien's study (Zhang et al., 2008). The authors suggested that larger overjet reduction would have a greater aesthetic impact than small or less noticeable changes.

The impact of functional appliance therapy on OHRQoL has recently been investigated by Kadkhoda et al. (2011) in a study of 187 children aged between 11 and 14 years. The short form of CPQ11-14 was used to assess OHRQoL in three groups: functional appliance (n = 67), headgear (n = 67) and those without malocclusion (n = 53). Using analysis of variance (ANOVA) to compare the total scores of the three groups, higher CPQ11-14 scores were reported in the functional appliance and headgear groups as compared to those without malocclusion group. Both functional appliance and headgear groups had similar overall scores. It was concluded that both appliances had a negative impact on patients OHRQoL. The authors noted that as both appliances were used for the same malocclusion (CII skeletal), confounders were not properly controlled for (Kadkhoda et al., 2011).

The relationship between malocclusion and bullying and the impact of orthodontic treatment on bullying prevalence among adolescents has been the subject of some debate.

2.9 Bullying

2.9.1 Definition

Bullying

"Specific form of aggressive behaviour and can be described as a situation when a student is repeatedly exposed over time to negative actions on the part of one or more students" (Olweus, 1994).

Victimization

"The action of singling someone out for cruel or unjust treatment" (Dictionary, 2007).

Victimization is form of aggressive act in that a more dominant and stronger individual repeatedly victimizes a subordinate and weaker individual (Pellegrini, 2004)

Harassment

"Aggressive pressure or intimidation" (Dictionary, 2007).

Bullying is a "specific form of aggressive behaviour and can be described as a situation when a student is repeatedly exposed over time to negative actions on the part of one or more students" (Olweus, 1994). Adolescents commonly experience bullying at school, either directly or indirectly (Olweus et al. 1994). While direct bullying involves physical aggression such as hitting and kicking or verbal aggression such as teasing and name-calling, indirect bullying includes the spreading of rumours and deliberate exclusion from group activities, causing emotional upset (Van der Wal et al., 2003). Although most bullying is done by boys, an equal number of boys and girls are victims (Olweus, 1994). Glew et al. (2005) identified the school environment as the most common site of bullying, but with increased use of networked computers and mobile phones among

adolescents, cyber-bullying can happen anywhere and at any time (Glew et al., 2005). Studies that have investigated the impact of bullying on adolescents have shown that bullying can lead to depression, low self-esteem, physical health problems (Hawker and Boulton, 2000b) and poor academic performance (Pellegrini, 2004). A study by Shaw et al. investigated the impact of bullying due to dental appearance among 531 school children aged between 9-13 years old using structured interviews. The children were asked if they had nicknames, how they felt about the names, whether they had been teased by others and how often they were teased. The interviewer made subjective judgments regarding whether the child was being bullied based on any specific characteristics. In this study, it was found that 67% of children reported having a nickname. A total of 19% of the children had nicknames related to their physical appearances, and 66% of the children had been bullied. Bullying related to dental features was found to affect 7% of schoolchildren aged 11 to 13 years. Comments about teeth appeared to be more hurtful than those about other features. Shaw et al. (1980) concluded that an unattractive dental appearance led to bullying, nicknames and harassment, which can result in low self-confidence and alienation (Shaw et al., 1980a).

In a cross-sectional study, the prevalence of bullying among 920 Jordanian schoolchildren aged 11 to 12 years was investigated, and about 47% of the adolescents were bullied. Of the victims, 40.9% had nicknames, which the children disliked. Twenty-seven per cent of the victims reported skipping school to avoid bullying, and 40% of this sample reported that bullying affected their grades and academic performance (Al-Bitar et al., 2013, Nansel et al., 2001). This finding confirmed the belief that bullying can negatively affect the concentration and academic performance of schoolchildren (Nansel et al., 2001). Adolescents who reported being bullied have a poorer OHRQoL compared to non-bullied

adolescents, therefore indicating that providing orthodontic treatment in children who are bullied can have a major impact on their OHRQoL (Al-Bitar et al., 2013, Fleming and Jacobsen, 2009).

2.9.2 Prevalence of bullying

The reported prevalence of bullying among school-aged children varies considerably. These differences may relate to methodological factors such as study design, participants' age, cultural differences, definition of bullying and criteria used to identify victims (Pearce, 2002). Analitis et al. (2009) investigated the prevalence of bullying among 8-18-year-old students in 11 European countries and reported that 20.6% of the entire sample were being bullied (Analitis et al., 2009). The UK was found to have the highest prevalence at 29.5%, although in Ireland, an earlier nationwide survey of 8249 students reported the prevalence of bullying as 49.8% (O'Moore and Kirkham, 2001). In the UK, the prevalence of cyber bullying has been estimated at 14.1% (Smith et al., 2008). A study looked at the prevalence of bullying among middle school students in 19 low and middle-income countries have found that bullying is common across the low-, middle-, and high-income countries. Boys reported being bullied more than girls and the prevalence of bullying was reduced with increasing age. Students who report being bullied reported higher rates of tobacco and drug use (Fleming and Jacobsen, 2009).

A cross-national survey was conducted among students aged between 11-15 years old to investigate the consistency of the relationship between bullying and psychosocial adjustment in 25 countries. It was found that the association between bullying and poor psychosocial adjustment is consistent in all 25

countries (Nansel et al., 2004, Spriggs et al., 2007). Springgs et al. (2006) investigated the association between bullying among adolescents in different ethnic groups. The study reported that the prevalence of bullying is similar across white, black and Hispanic (Spriggs et al., 2007).

2.9.3 Bullying scales

Measuring bullying is difficult, as no universal definition of bullying has been identified (Arora, 1996). Self-reporting questionnaires are the most common tool used to measure bullying among schoolchildren (Pellegrini and Bartini, 2000, Smith and Levan, 1995). While some scales include a definition for bullying, others do not (Rigby, 2007). Whether a definition for bullying should be included on the scale has been under debate for some time (Madsen, 1996). To avoid inconsistencies between bullying definitions, some scales ask about the frequency of different types of aggressive acts (Smith et al., 2002, Salin, 2001). Another limitation is that the length of some scales, which can include up to 36 items, can be time-consuming for researchers and inappropriate for young children (Rigby, 1996). The development of a measurement tool to assess bullying of a sexual nature and cyber bullying has been recommended.

2.9.3.1 Olweus bully/victim questionnaire

The Olweus bully/victim questionnaire is an anonymous self-reporting questionnaire that measures bullying and its severity. It was developed in Scandinavia by Olweus, and it has been translated into a number of languages (Olweus, 1994). The development of the first version of the questionnaire was in conjunction with a nationwide campaign in Norway in 1983. The second version

of the questionnaire, which has been used in several studies, has 36 main questions divided in two sections. One section includes questions for victims of bullying by other students, and the second section includes questions related to bullying other students (Boulton and Underwood, 1992). The Olweus bully/victim questionnaire is a validated questionnaire for schoolchildren aged between 11-16 years. The questionnaire has a clear cut-off point to identify victims. According to the criteria defined by Olweus and Solberg, bullied participants are identified as those who reported being bullied greater than two or three times a month or more in the preceding two months (Olweus, 1994)

2.9.3.2 Shaw et al. questionnaire

This questionnaire is an anonymous self-reporting questionnaire originally developed by Shaw et al., and it is used to measure bullying (Shaw et al., 1980a). The questionnaire includes three main sections: (1) personal experience with bullying, (2) feelings toward school and school attendance and the perceived effect on academic performance and (3) general physical characteristics and dentofacial features bullies use to target victims. A modified version of the Shaw et al. questionnaire has been used by Albitar et al.; however, the validity of this version is questionable (Al-Bitar et al., 2013).

2.9.3.3 Gatehouse scale

The Gatehouse scale is a self-reporting questionnaire used to measure bullying. It is a 12-item measurement that assesses overt and covert victimization (Bond et al., 2007). The scale is a simple, short and has been used to evaluate teasing and

bullying in several cross-sectional studies. It has been validated for both adults and children with clear-cut off points for identifying victims of bullying. This scale was developed by Bond et al. in the United Kingdom, and it helps identify the types of bullying based on four forms of aggressive acts (teasing, spreading rumors, isolation and threats) and the frequency of the events. In a comparison study between the Gatehouse scale and the peer relations questionnaire for schoolchildren in secondary schools, it was found that the Gatehouse questionnaire is a short and reliable instrument that can measure the episodes of bullying. The Gatehouse scale is a useful tool used to help establish interventions to address bullying in school environments (Bond et al., 2007).

2.9.4 Psychosocial implications

Shaw et al. (1980) reported that unattractive dental appearance attracted teasing, nicknames and harassment (Shaw et al., 1980a), which can result in physiological and psychological problems among both children and adolescents (Seehra et al. 2011). A meta-analysis of cross-sectional studies investigating the psychosocial effects of bullying found a strong association between being bullied and depression, low self-esteem and anxiety (Hawker and Boulton, 2000b).

A study of 70 schoolchildren aged 9 to 12 years investigating children's own opinion of their physical features, and which of these they would like to change, identified teeth as the feature that most would like to change first (Dunin-Wilczyńska, 1990). Teasing related to dental features was found to affect 7% of schoolchildren aged 11 to 13 years (Shaw et al., 1980b); in a group awaiting

orthodontic treatment, the prevalence of teasing increased to 15% (Baldwin DC, 1965, O'Brien et al., 2007). In their investigation of the reasons for seeking orthodontic treatment, Pauli et al. (1993) found that bullying due to increased overjet was commonly cited by parents seeking orthodontic treatment for their children.

The relationship between malocclusion and bullying during adolescence was further investigated by Al-Baitar et al. (2013). In this cross-sectional study, 920 Jordanian schoolchildren aged 11 to 12 years were randomly recruited from 12 schools in Jordan. They were asked to complete a questionnaire, modified from Shaw bullying questionnaire, measuring the self-reported frequency and severity of bullying and its effect on school performance, as well as the physical and dentofacial features most often targeted in the victims. The findings indicated that 47% of these adolescents were bullied. The victims reported disliking school and referred to low academic performance. The results identified teeth as the most frequently targeted feature for teasing; the most common malocclusions were prominent maxillary anterior teeth, spacing, missing teeth and abnormalities in tooth shape and colour. Al-Bitar et al. (2013) concluded that many Jordanian adolescents experience bullying in school because of their dentofacial appearance (Al-Bitar et al., 2013).

Seehra et al.'s (2011) cross-sectional study measured self-reported bullying and its severity among 360 patients with untreated malocclusions aged between 10-14 years old who were referred for orthodontic assessment at three UK hospitals. The participants were asked to complete the Olweus bully/victim questionnaire, which is a validated questionnaire for children in that age group and has been translated into a number of languages. According to the criteria defined by Olweus

and Solberg bullied participants are identified as those who report being bullied greater than two or three times a month or more in the preceding two months. In this study, peer victimization was reported by 12.8% of referred orthodontic patients. Moreover, Class II Division I malocclusion with an increased overjet and increased overbite was found to be strongly associated with being bullied. It was concluded that victims experienced a negative impact on their overall oral health-related quality of life because of the presence of malocclusion (Seehra et al., 2011). A follow-up study in 2012 measured the self-reported frequency and severity of bullying following orthodontic intervention in order to investigate the effect on self-esteem and ORHQoL. After commencing orthodontic treatment, 43 adolescents identified in the previous study as victims of bullying due to the presence of malocclusion were asked to complete three questionnaires. These three validated instruments were Olweus' bully/victim questionnaire, which was used to measure the prevalence, type and severity of bullying; the CPQ11-14, which was used to assess OHRQoL; and Harter's Self Perception Profile for children, used to measure self-esteem. Seehra et al (2012) reported that in comparison to pre-treatment scores, 78% of victims were no longer being bullied. In addition, those adolescents reported improvements in their OHRQoL as compared to those who continued to report bullying. The study concluded that although there was no effect on an individual's self-esteem, orthodontic treatment had a positive effect on the OHRQoL of the bullied adolescents (Seehra et al., 2012).

Seehra et al (2012) reported that although six participants continued to report being bullied, four of the six had not yet commenced orthodontic treatment at the time of questionnaire completion. One participant who was wearing a functional

appliance continued to report bullying during treatment, suggesting that the functional appliance can itself attract negative comment. There is evidence that orthodontic appliances can negatively affect children's perception of dental attractiveness (Shaw et al 1980), and patients wearing fixed appliances can be exposed to various negative comments such as "metal mouth" or "scaffolding". On the other hand, seeking orthodontic treatment to address their malocclusion can empower victims when facing any further bullying, and the appearance of the orthodontic appliance may distract from existing occlusal traits. In this sample, the impact of the functional appliance could not be precisely determined, as various appliances were used. The intervention included fixed appliances (55%), functional appliances (15%) and retainers (15%), as well as no appliance in situ (15%). In addition, questionnaires were completed at a single point during treatment only.

Although the positive impact of orthodontic treatment on quality of life has been demonstrated, the impact of functional appliance treatment on bullying and OHRQoL has not been investigated yet.

3. Materials and Methods

The study was designed as a prospective cohort study using a convenience consecutive sample of patients.

3.1 Aims and null hypotheses

Aims

- (1) Investigate the impact of functional appliance treatment on prevalence of bullying among adolescents during and after treatment.
- (2) Investigate the impact of functional appliance treatment on OHRQoL of adolescents during and after treatment.
- (3) Measure the discrepancy effect between adolescents and their parents in rating adolescent's OHRQoL and bullying status.

Null hypotheses

This research had the null hypotheses that

- (1) Functional appliance treatment does not increase the prevalence of bullying among adolescents during and after treatment.
- (2) Functional appliance therapy does not have a negative impact on orthodontic patient's quality of life during and after treatment.
- (3) There is no difference between adolescents and their parents in rating adolescent's OHRQoL and bullying status.

3.2 Study Outline

Participants were recruited from the treatment waiting list at HSE Regional orthodontic unit in St James's Hospital, Dublin, Ireland.

The Faculty of Health Sciences Research Ethics Committee of Trinity College, Dublin, Ireland, granted ethical approval for this research (Ref. 150514). (See appendix.1)

3.3 Sample Size

A minimum sample size of 73 participants was proposed to demonstrate a significant change in OHRQoL with power (1-Beta) of 0.95 and a significance level of 0.05. The sample size was calculated using the repeated Analysis of Variance (ANOVA) test with effect size of 0.5.

3.4 Inclusion Criteria

- Patients identified as being suitable for functional appliance therapy.
- Patients categorized as 5a according to IOTN (Index of Orthodontics Treatment Need)
- Patients aged 11-14 years old.
- Good motivation to maintain oral hygiene and undergo orthodontic treatment.
- Class II skeletal pattern

3.5 Exclusion Criteria

- Patients younger than 11 years and older than 14 years age.
- Patients who have undergone previous orthodontic treatment.
- Patients with craniofacial syndromes
- Children who do not assent to take part.

3.6 Participants

Patients categorized as 5a according to IOTN (Index of Orthodontics Treatment Need) and due to receive functional appliance treatment to correct their malocclusion were recruited from consecutive patients attending the HSE Regional orthodontic unit in St James's Hospital, Dublin, Ireland. A total of 74 untreated patients between the ages of 11-14 years fulfilled the inclusion criteria. The participants and their parents were invited to take part in the study at the assessment clinic. Written and verbal information about the study were offered to the adolescents and their parents immediately after their first appointment (See appendix.2). Both the patients and their parents had multiple ongoing opportunities to ask questions about the study and it was stressed that there is no obligation to take part in the study and that there will be no difference in quality or availability of care from staff for those adolescents who choose not to take part. Written informed consent from the parents and written assent from the adolescents were obtained at their second appointment.

3.7 Measure

Adolescents were asked to complete a questionnaire at the HSE Regional orthodontic unit in St James's Hospital immediately before, during and following completion of functional appliance treatment. The questionnaire included the gatehouse scale, which is a validated commonly used self-reported questionnaire that measures the prevalence, severity and type of bullying (Bond et al., 2007)

To assess the impact of functional appliance treatment on the patient's OHRQoL each adolescent was asked to complete the short version of the Child Perception

Questionnaire (CPQ 11-14), which is a component of the Child Oral Health. Described and validated by Jokovic, the CPQ11-14 component measures children's own perceptions of their OHRQoL for those aged between 11 and 14 years with dental, orthodontic and orofacial disorders (Jokovic et al., 2002a).

The questionnaire is divided into four subdomains: oral symptoms, functional limitation, emotional impact and social impact. Each participant completed a questionnaire with a specific identification number. In this study the questionnaire was not anonymous, as an intervention pathway for anti-bullying would be established if a child is identified as bullied. (See appendix 5,6,7,8)

3.8 Pre-treatment Records

The participants were assigned to three orthodontic consultants at the HSE Regional orthodontic unit at the HSE. At the initial visit a standard orthodontic clinical examination was carried out and each participant had maxillary and mandibular alginate (Zhermack fast setting elastic mint flavour hydrogum alginate, Zhermack SpA Via Bovazecchino, 100 45021 Badia Polesine (RO)-Italy) impressions made for study model fabrication. Disposable plastic stock trays (Dentaurum O-Trays, Dentaurum GmbH & Co. KG, Turnstrasse 31, 75228 Ispringen. Germany) were used to make each impression. The impressions were rinsed in water and then disinfected with CIDEX® OPA (ASP, 33 Technology Drive, Irvine, CA 92618 USA) for 5 minutes. The impressions were then washed again with water for 1 minute, as recommended by the manufacturers, before being placed in plastic sealed bags and labelled. The impressions were poured within one hour in Type 3 stone (Super White Orthodontic Stone, Whipmix, 361 Farmington Avenue, P.O. Box 17183, Louisville, KY, 40217 USA). A full series of

clinical photographs (Extraoral repose, smiling and profile: Intraoral frontal, right and left buccal, maxillary and mandibular occlusal) were taken of all participating patients using a Canon 1100D digital camera (Canon USA Inc, 1 Canon Park, Melville NY 11747, USA). A digital lateral cephalogram (Proline 2002 PM CC, Planmeca Oy, Asentajankatu 6, FIN-00880 Helsinki, Finland) was taken with the patient in the natural head position (looking into their own eyes in a mirror) immediately prior to the commencement of treatment.

The postured wax bite for TBA was taken using a 4 mm white “Projet Bite” gauge (Orthocare, (UK) Limited), with a softened wax adapted to it. The patients were instructed to posture forward with approximately 7 to 8 mm protrusion. The postured wax bite then was sent to the laboratory along with alginate impressions of the maxillary and mandibular arches and a written laboratory prescription sheet specifying the design of the TBA.

3.9 TBA design

A modified TBA, originally developed by Clark (Clark, 2010), was used in this study. This appliance consisted of upper and lower removable appliances retained with 0.7-mm Adams clasps on all first permanent molars and first premolars, and a 0.9-mm ball clasps on the mandibular incisor interproximal areas. A midline expansion screw was always included. The blocks were 7 mm in thickness and the steep inclined planes interlocked at about 70° to the occlusal plane. All patients were instructed to wear the appliance for 24 hours per day (except for contact sports, swimming and eating).

A patient is classified as non-compliant for treatment if there was not reduction in overjet after 6 months or if the patient refused to wear the appliance or there were repeatedly breakage of the appliance that meant treatment was discontinued.

3.10 Procedure

The prevalence of bullying and the impact of functional appliance therapy were assessed at three different points. Following obtaining the consent, the participants were asked to complete both the gatehouse scale and the CPQ (11-14) questionnaires prior to start the treatment (T1), three months into treatment (T2) and post-treatment (T3). Patient data was assessed to eliminate/exclude duplicates. The following data were collected at the three different times: gender, age, hospital number and initial overjet. Participants and their parents completed the questionnaires in separate rooms away from the dental clinic whenever possible.

Each participant completed questionnaire with a specific identification number. In this study the questionnaire was not anonymous, as an intervention pathway for anti-bullying would be established if a child is identified as bullied. Where a participant is identified as being bullied, the parents were informed and a information leaflet with the contact details of an organization who deal with bullying was offered. A report to the child's school was sent to establish an anti-bullying policy if bullying was taking part in the school if appropriate.

3.11 Scoring system

The CPQ11–14 includes 4 domains: oral symptoms, functional limitations, emotional well-being, and social well-being. Each question addresses the frequency of events related to the teeth, jaw, and mouth over the preceding three months; the response options are *never* = 0, *once or twice* = 1, *sometimes* = 2, *often* = 3, and *every day or almost every day* = 4. The questionnaire also includes a global rating of the overall impact of oral health on the child's QoL, rated on a five-point scale from *excellent* to *poor*; higher scores indicate poorer OHRQoL status (Jokovic et al., 2002b).

The Gatehouse scale includes 4 main questions about the participant's exposure to bullying (teasing, rumors, being left out deliberately, being physically threatened; see Appendix). If a participant answers *yes* to any of these questions, they are scored 1 and identified as bullied. This scale also rates severity of bullying.

3.12 Statistical analyses

Data will be collected in the format of a choice of paper or electronic questionnaire using survey monkey software. The data were coded and entered into a Microsoft Excel (2010 version) database. Statistical analysis was performed using SPSS version 16.0 (SPSS Inc, Chicago, USA).

The statistical analysis included:

- (1) Descriptive statistics for all measures included (gender, age, ethnicity)
- (2) The data were normally distributed, therefore the repeated Analysis of Variance (ANOVA) analyses was used to assess the changes of OHRQoL across the three measurement periods.
- (3) Cochran Q test was used to assess the change in bullying across the three time periods.
- (4) A *t* test was used to compare the mean scores of CPQ for bullied and non-bullied participants.
- (5) Cohen's kappa coefficient test was used to assess the level of agreement between adolescents and their parents. Gwet's test was carried out to overcome kappa paradoxes.

4. Results

4.1 Baseline characteristics

In total, 75 adolescents with class II division I malocclusion who were due to start functional appliance therapy consented and were recruited to this study. After 16 participants were excluded because of poor compliance and attendance, the final sample comprised 59 adolescents. Of these, 22% were aged 14, about 40.7% were aged 13 years, 27.1% were aged 12 and 10% were aged 11 years. About 86% of participants were Caucasian. Table 1 summarizes participants' socio-demographic characteristics.

TABLE 1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

	Total N in group
Gender	
Male	32
Female	27
Age (years)	
11	6 (10.2%)
12	16 (27.1%)
13	24 (40.7%)
14	13 (22.0%)
Ethnicity	
Caucasian	51 (86.4%)
Other	8 (13.6%)

4.2 Impact of orthodontic treatment on adolescents' OHRQoL

Table 2 presents mean total score and subscale scores for the CPQ11–14, along with the results of the repeated measures ANOVA. The only difference was found on the Emotional Well-Being subscale ($F(2,154) = 4.69, p = .021$). Comparison of the three time periods reveals differences between T1 ($M = 1.00, SD = .799$) and T2 ($M = .743, SD = .711$), and between T1 and T3 ($M = .708, SD = .728$). The direction of the results indicates that participants' emotional well-being improved as they progressed through orthodontic treatment.

Table 3 reveals mean total score and subscale scores for the P-CPQ, along with the results of the repeated measures ANOVA. There was also a significant difference on the Emotional Well-Being subscale ($F(1,154) = 14.86, p < .001$). Again, parents reported improvements in emotional well-being as the child progressed through orthodontic treatment.

TABLE 2. COMPARISON OF CPQ SUBSCALE AND TOTAL SCORE FOR CHILDREN ACROSS THREE MEASUREMENT PERIODS.

	Pre- Treatment	During Treatment	Post Treatment	<i>F</i>	<i>P</i> value	Comparisons
Adolescents						
Oral Symptoms						
Mean (SD)	1.06 (.518)	1.01 (.538)	1.05 (.504)	.273	.734	NS
Median	1.00	1.00	1.00			
Confidence Interval	.925-1.195	.870 - 1.15	.919 - 1.81			
Functional Limitations						
Mean (SD)	.604 (.584)	.735 (.612)	.724 (.559)	1.35	.262	NS
Median	.400	.600	.559			
Confidence Interval	.452 - .756	.576 - .894	.578 - .870			
Emotional Well-Being						
Mean (SD)	1.00 (.799)	.743 (.711)	.708 (.728)	4.69	.021	a (.027)
Median	1.00	.500	.500			b (.022)
Confidence Interval	.792 - 1.21	.557 - .929	.518 - .898			
Social Well-Being						
Mean (SD)	.816 (.669)	.967 (.660)	.817 (.628)	2.03	.146	NS
Median	.667	.880	.600			
Confidence Interval	.642 - .990	.795 - 1.14	.653 - .981			
Total Score						
Mean (SD)	3.48 (1.78)	3.46 (1.81)	3.30 (1.90)	.378	.619	NS
Median	3.30	3.30	2.65			
Confidence Interval	3.02 - 3.94	2.99 - 3.93	2.80 - 3.80			

Note: a = significant difference between pre-treatment and during treatment, b = difference between pre-treatment and post-treatment.

TABLE 3. COMPARISON OF CPQ SUBSCALE AND TOTAL SCORE FOR PARENTS ACROSS THREE MEASUREMENT PERIODS.

Parents	Pre-treatment	During-treatment	Post-treatment	F	<i>P value</i>	Comparisons
Oral Symptoms						
Mean (SD)	.897 (.550)	.934 (.540)	.915 (.551)	.107	.866	NS
Median	.75	1.00	1.00			
Confidence Interval	.753 - 1.04	.793 - 1.07	.772 - 1.06			
Functional Limitations						
Mean (SD)	.479 (.526)	.620 (.529)	.609 (.592)	1.97	.156	NS
Median	.400	.600	.400			
Confidence Interval	.341 - .617	.486 - .754	.455 - .763			
Emotional Well-Being						
Mean (SD)	1.32 (.740)	.833 (.750)	.873 (.776)	14.86	<.001	a (<.001)
Median	1.25	.750	.750			b(<.001)
Confidence Interval	1.13 - 1.51	.637 - 1.03	.671 - 1.08			
Social Well-Being						
Mean (SD)	1.14 (.856)	.949 (.771)	.845 (.762)	3.03	.056	NS
Median	1.00	.800	.750			
Confidence Interval	.918 - 1.36	.749 - 1.15	.647 - 1.04			
Total Score						
Mean (SD)	3.82 (2.04)	3.34 (1.94)	3.24 (2.18)	.243	.107	NS
Median	3.75	3.35	2.90			
Confidence Interval	3.29 - 4.35	2.83 - 3.85	2.67 - 3.81			

Note: a = significant difference between pre-treatment and during treatment, b = difference between pre-treatment and post-treatment.

4.3 Impact of orthodontic treatment on prevalence of bullying

In this part of the analysis, Cochran Q test was used to evaluate the change in incidence of bullying as assessed by the Gatehouse scale across the three time periods (T1—pre-treatment; T2—3 months during treatment; and T3—post-treatment). Table 4 summarizes the descriptive statistics for Gatehouse scores for both adolescents and their parents. These reveal that 23.7% of participants were bullied pre-treatment with functional appliance, and that the incidence of bullying decreased across the three time periods (T1 = 23.7%; T2 =16.9%; T3 = 11.9%). Parents also reported that the incidence of bullying decreased during that time (T1 = 22.0%; T2 = 20.3%; T3 = 15.3%). However, these reported decreases did not reach statistical significance either for children ($Q = 4.11, p = .128$) or for parents ($Q = 1.73, p = .420$).

TABLE 4. COMPARISON OF RATE BULLYING ACROSS THREE MEASUREMENT PERIODS AS RATED BY CHILDREN AND PARENTS

	Pre- Treatment	During Treatment	Post Treatment	Cochran Q	<i>P</i> value
Children					
Bullied	14 (23.7%)	10(16.9%)	7 (11.9%)	4.11	.128
Not Bullied	45 (76.3%)	49(83.1%)	52 (88.1%)		
Parents					
Bullied	13 (22.0%)	12(20.3%)	9 (15.3%)	1.73	.420
Not Bullied	46 (78.0%)	47(79.7%)	50 (84.7%)		

Table 5 summarizes the descriptive statistics for frequency and types of bullying. Teasing was the type most frequently reported by both children and parents (15.3% and 18.6%, respectively); other types, including rumors, purposeful exclusion, and threatening behaviors, were less often reported by both children and parents. Among bullied children, most of that bullying occurred less than once per week.

Table 6 shows the socio-demographic characteristics of participants identified as being bullied. Females reported being bullied more than males, but the chi square test found no significant difference in incidence of bullying by gender, age, or ethnicity.

TABLE 5. TYPES AND RATES OF BULLYING AS RATED BY ADOLESCENCES AND THEIR PARENTS AT PRE- TREATMENT

Type of Bullying	Number who reported to be bullied	Most Days	About Once a Week	Less Than Once a Week
Children				
Teased	9 (15.3%)	0 (0.00%)	3 (5.1%)	3 (5.1%)
Rumors	4 (6.8%)	0 (0.00%)	0 (0.00%)	1 (1.7%)
Deliberately Left Out	3 (5.1%)	2 (3.4%)	1 (1.7%)	3 (5.1%)
Threatened	5 (8.5%)	0 (0.00%)	0 (0.00%)	3 (5.1%)
Parents				
Teased	11 (18.6%)	1 (1.7%)	4 (6.8%)	6 (10.2%)
Rumors	3 (5.1%)	0 (0.00%)	1 (1.7%)	2 (3.4%)
Deliberately Left Out	3 (5.1%)	0 (0.00%)	0 (0.00%)	4 (6.8%)
Threatened	2 (3.4%)	0 (0.00%)	1 (1.7%)	1 (1.7%)

TABLE 6. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF BULLIED PARTICIPANTS

	Total N in group	N (%) bullied	*<i>P value</i>
Gender			
Male	32	14.8%	.139
Female	27	31.3%	
Age (years)			
11	6 (10.2%)	50.0%	.244
12	16 (27.1%)	25.0%	
13	24 (40.7%)	25.0%	
14	13 (22.0%)	7.7%	
Ethnicity			
Caucasian	51 (86.4%)	23.5%	.928
Other	8 (13.6%)	25.0%	

* Chi-square test

4.4 Adolescents' CPQ subscales and total scores as a function of bullying status

Table 7 summarizes the descriptive statistics and results of t-tests for adolescents' scores on the CPQ subscales and their total scores as a function of bullying. At pre-treatment, those participants who rated themselves as bullied ($M = .878$, $SD = .68$) reported higher scores on the Emotional Well-Being subscale when compared to children who did not rate themselves as bullied ($M = 1.41$, $SD = 1.04$, $t(57) = -2.26$, $p = .028$). The same outcome was noted during treatment ($t(57) = -2.60$, $p = .012$). At pre-treatment, children rating themselves as bullied ($M = 1.16$, $SD = .90$) scored higher on the Social Well-Being subscale (indicating lower social well-being) than children who did not rate themselves as bullied ($M = .709$, $SD = .53$, $t(57) = -2.26$, $p = .027$). The same outcome was noted during treatment ($t(57) = -3.35$, $p = .001$) and at post-treatment ($t(57) = -2.46$, $p = .017$). At all three measurement points, children who did not rate themselves as bullied reported higher social well-being. At post-treatment, children who reported being bullied ($M = 1.14$, $SD = .67$) had more functional limitations than those who did not report being bullied ($M = .668$, $SD = .53$, $t(57) = -2.37$, $p = .021$).

TABLE 7. COMPARISON OF CHILDREN CPQ SUBSCALE AND TOTAL SCORES AS A FUNCTION OF BULLYING STATUS

	Bullied Mean (SD)	Not Bullied Mean (SD)	<i>t</i>	<i>P value</i>
Children Pre-Treatment				
Oral Symptoms	1.08 (.59)	1.06 (.50)	-.127	.892
Functional Limitations	.514 (.43)	.632 (.63)	.657	.514
Emotional Well-Being	1.41 (1.04)	.878 (.68)	-2.26	.028
Social Well-Being	1.16 (.90)	.709 (.53)	-2.26	.027
Total Score	4.16 (1.92)	3.27 (1.70)	-1.65	.104
Children During Treatment				
Oral Symptoms	.917 (.54)	1.03 (.54)	.616	.540
Functional Limitations	.900 (.78)	.701 (.58)	-.937	.353
Emotional Well-Being	1.25 (.81)	.640 (.65)	-2.60	.012
Social Well-Being	1.56 (.84)	.847 (.56)	-3.35	.001
Total Score	4.62 (2.58)	3.22 (1.54)	-2.32	.024
Children Post- Treatment				
Oral Symptoms	1.07 (.43)	1.05 (.52)	-.106	.916
Functional Limitations	1.14 (.67)	.668 (.53)	-2.18	.034
Emotional Well-Being	1.07 (1.08)	.659 (.67)	-1.42	.161
Social Well-Being	1.34 (.93)	.746 (.55)	-2.46	.017
Total Score	4.63 (2.68)	3.2 (1.73)	-1.44	.194

4.5 Measure discrepancy effect of OHRQoL between adolescents and their parent.

Table 9 presents mean total CPQ scores for the participants and their parents at pre-treatment, during treatment, and post-treatment, along with the results of dependent t-tests. Table 9 reveals that there were no differences between children and their parents in terms of total CPQ scores across the three measurement periods ($p > .05$).

TABLE 8. COMPARISON OF PARENTS AND CHILDREN TOTAL SCORES ON THE CPQ AT PRE-TREATMENT, DURING TREATMENT AND POST TREATMENT

	Children Mean (SD)	Parent Mean (SD)	<i>T</i>	<i>P</i>
Pre Treatment	3.48 (1.78)	3.82 (2.04)	-1.51	.136
During Treatment	3.46 (1.81)	3.34 (1.94)	.538	.592
Post Treatment	3.30 (1.90)	3.24 (2.18)	.259	.797

TABLE 9. RATE OF BULLYING BY PARENTS AND CHILDREN

	Pre Treatment		During Treatment		Post Treatment	
Parent	Not Bullied	Bullied	Not Bullied	Bullied	Not Bullied	Bullied
Children	Not Bullied	Bullied	Not Bullied	Bullied	Not Bullied	Bullied
Not Bullied	40	5	44	5	48	4
Bullied	6	8	3	7	2	5

4.6 Level of agreement between adolescents and their parents in reporting bullying

Table 10 summarizes the ratings of bullying as reported by the participants and their parent for the three time periods. Table 11 presents the descriptive statistics and results of Cohen's kappa coefficient test to assess the level of agreement in rating adolescent's bullying status between the adolescents' and their parents. The results indicate that there is good level of agreement between adolescents and their parents.

TABLE 10. LEVEL OF AGREEMENT OF BULLYING STATUS BY PARENTS AND CHILDREN

	Percent agreement	KAPPA			GWETS		
		κ	95% CI	P value	AC	95% CI	P value
Pre-treatment	.81	.47	.19- .74	0	.71	.53- .89	6.2
During-treatment	.86	.55	.27- .83	0	.80	.66- .94	2.2
Post-treatment	.89	.56	.25- .88	0	.86	.75- .97	0

*AC =Gwets agreement coefficient

*K =Kappa coefficient

5. Discussion

This study investigated the impact of functional appliance therapy on bullying and oral health-related quality of life among a sample of adolescents and their parents, who were recruited from a waiting list for orthodontic patients. The study found that functional appliance treatment for adolescents with class II division I malocclusion may have a positive effect on their OHRQoL, reducing the incidence of bullying episodes related to their malocclusion. Adolescents who rated themselves as bullied reported poorer OHRQoL, specifically on the emotional well-being and social well-being subscales. The present study found a good level of agreement between adolescents and their parents regarding the child's OHRQoL and bullying status. Therefore, all the three proposed null hypothesis were accepted.

Visible unattractive malocclusion has been associated with bullying and low self-esteem and can have a negative impact on oral health-related quality of life among adolescents (Johal et al., 2007, Seehra et al., 2011). However, there is some disagreement in the current literature regarding the psychological benefits of orthodontic therapy following treatment. While Shaw et al. (2007) suggested that there are no significant effects; other studies have demonstrated a positive impact of orthodontic treatment on quality of life, with a reduction in levels of bullying (Seehra et al. 2012). Investigation of the psychosocial impact of malocclusion on OHRQoL helps to clarify the reasons for seeking orthodontic treatment as a subjective measure complementing clinical indicators of orthodontic treatment need.

The recruited patients were classified as 5a IOTN (increased overjet more than 9 mm). This malocclusion was selected for present purposes because previous research has shown that bullying is significantly associated with a class II division I incisor relationship and increased overjet (Seehra et al., 2011, Johal et al., 2007), and the most common reason for parents to seek orthodontic treatment for their children is bullying due to an increased overjet (Pauli et al. 1993).

TBA was chosen as a widely used orthodontic appliance that is known to rapidly and effectively reduce an increased overjet. In addition, patient-reported outcome research is needed to explore beneficial effects of such appliances and their impact on oral health-related quality of life. TBA is most efficient for patients aged between 11 and 14 years, and this age group has also been identified by previous studies as the principal target population for bullying (Fleming and Jacobsen, 2010). In addition, sampling of this age group allows our results to be compared with those from previous studies.

The CPQ11–14 was used to measure change in OHRQoL following functional appliance treatment. The short version of the questionnaire was chosen because it is less time consuming and causes less disruption to the dental appointment. CPQ11–14 has been shown to be sensitive and valid for measuring change in OHRQoL during or following orthodontic treatment (Agou et al., 2008) and is a validated and reliable instrument for the selected age group, with good psychometric properties (Jokovic et al., 2006).

Parents were also asked to complete the Parental Caregiver Perception Questionnaire (P-CPQ), a component of COHRQoL used for children aged 6 to 14 years as described and validated by Jokovic et al. (2003). The rationale for

development of the P-CPQ was to assess parental perceptions of their children's OHRQoL. As parents or caregivers are the main decision makers regarding their children's oral health status and treatment choices, parallel reporting has been recommended for measurement of OHRQoL in the child population (Jokovic et al., 2004).

Participants and their parents also completed the Gatehouse scale, a questionnaire assessing bullying. This simple, short scale has been used to evaluate teasing and bullying in several cross-sectional studies and has been validated for both adults and children, with clear-cut off points for identifying bullied. To reduce the risk of bias, participants and their parents completed the questionnaires in separate rooms whenever possible. A pilot study was conducted with a small group of adolescents to ensure that the questionnaire was not overlong for the target population, and that it used language they could understand.

5.1 Impact of orthodontic treatment on prevalence of bullying

Seventy-five adolescents and their accompanying parent were recruited and agreed to participate in this study. A dropout rate of 21% (n = 16) resulted in a final participation rate of 79% (n = 59); reasons for exclusion included poor compliance and attendance. The age range of participants fulfilled the inclusion criteria to maintain the validity of the questionnaires for all three time periods.

In the initial questionnaire, 14 of the 57 (23.7%) participants reported being bullied. During treatment, 10 (16.9%) of those participants reported being bullied. Following completion of functional appliance treatment, 7 (11.9%) participants continued to be bullied despite correction of their malocclusion.

While females appeared to be bullied more than males, there was no correlation between incidence of bullying and socio-demographic characteristics such as gender, age, or ethnicity. Both children and their parents reported that teasing was the most frequent type of bullying. When asking adolescents what they were teased about, they could choose from 5 response options: *teeth*, *jaw*, *mouth*, *brace*, *lips*, and *other*. In the pre-treatment questionnaire, the first of these (*teeth*) was the most common answer. Further analysis of the 7 participants still being bullied at the end of treatment revealed that 3 were being teased about *teeth*, one about *jaw*, one about *mouth*, and 2 about *brace*. Bullied children are also assigned unpleasant nicknames. In our sample, participants reported being called “shark,” “beaver,” “SpongeBob,” “Nanny McPhee,” and “bunny rabbit.” Among the children who reported being bullied, most of the bullying occurred less than once per week.

These findings confirm that bullying of children with class II division I malocclusion was reduced by approximately 50% following functional appliance treatment. This aligns with Seerha et al., (2012) who found that 78% of bullied adolescents with a malocclusion reported a reduction in bullying following interceptive orthodontic treatment. However, this reduction might be attributed to the fact that patients wore the appliance only at night at T3, so reducing the focus of negative comments with the TBA. . In this study the questionnaire was not anonymous, as an intervention pathway for anti-bullying would be established if a child is identified as bullied. Where a participant is identified as being bullied, the parents were informed and an information leaflet with the contact details of an organization who deal with

bullying was offered. A report to the child's school was sent to establish an anti-bullying policy if bullying was taking part in the school if appropriate.

5.2 Impact of orthodontic treatment on adolescents' OHRQoL

The impact of malocclusion and bullying on these participants was further investigated here by measuring their OHRQoL throughout treatment. Orthodontic treatment has been shown to have a positive impact on OHRQoL; for example, Agou et al. (2011) reported improvements in most OHRQoL domains among adolescents who had completed orthodontic treatment. De Oliveira et al. (2004) found that the OHRQoL of participants who completed orthodontic treatment was better than for those still under treatment or who had never been treated (de Oliveira and Sheiham, 2004, Javidi et al., 2017). The present results show a positive effect on OHRQoL, specifically on the emotional well-being subscale. The direction of the results indicates that adolescents' emotional well-being improved as they progressed through functional appliance treatment.

A recent systematic review and meta-analysis by Javidi (2017) examined the evidence for changes in OHRQoL following orthodontic treatment for patients treated before the age of 18 years. The study found low to moderate quality evidence that orthodontic treatment during adolescence leads to a moderate improvement on the emotional and social well-being subscales of OHRQoL, concluding that higher quality research is needed (Javidi et al., 2017).

As most studies have evaluated OHRQoL with fixed appliances, it was difficult to compare the present results with earlier research. Only a study by Kadkhoda et al. (2011) of 187 patients aged between 11 and 14 years with class II malocclusion had previously looked at the impact of functional appliances on OHRQoL. The short form of CPQ11-14 was used to assess OHRQoL in three groups: functional appliance, headgear, and those without malocclusion. The study concluded that both appliances had a negative impact on patients OHRQoL. However, one limitation of that study was that it evaluated OHRQoL for a single time period (Kadkhoda et al., 2011).

In the present study, comparison of overall CPQ and subscale scores for bullied and non-bullied participants revealed that those participants who did not rate themselves as bullied scored higher on the Emotional Well-Being subscale than children who rated themselves as bullied. At pre-treatment, children who rated themselves as bullied scored higher on the Social Well-Being subscale (indicating lower social well-being) than children who did not rate themselves as bullied. In all three measurement periods, non-bullied children reported higher social well-being. After completion of treatment, children who reported being bullied reported more functional limitations than non-bullied participants. A similar result was reported by Seehra et al. (2012), who looked at the impact of interceptive orthodontic treatment on bullying and OHRQoL. They found a general negative impact on OHRQoL when participants with a malocclusion reported being bullied as compared to non-bullied participants (Seehra et al., 2012).

It remains unclear whether higher levels of functional limitation and lower emotional well-being relate directly to malocclusion or bullying. Patients with Class II division I malocclusion may experience oral symptoms because of the

effects of malocclusion, such as trauma or failure to create oral seal due to lack of lip competency. It seems likely that both factors may contribute, resulting in a negative impact on OHRQoL and low self esteem (Seehra et al., 2012).

5.3 The discrepancy effect between adolescents and their parents

The present findings confirm a good level of agreement between adolescents and their parents on the perceived impact of functional appliance treatment on adolescents' bullying status.

Across the three measurement periods, there were no statistically significant differences between children and their parents in terms of overall CPQ and P-CPQ scores. Both adolescents and their parents reported improvements in emotional well-being as the child progressed through orthodontic treatment.

There are conflicting findings regarding level of agreement between proxy and child reports about OHRQoL (Jokovic et al., 2003c). A study comparing the independent OHRQoL assessments of children and their mothers on the CPQ11-14 and P-CPQ found that mothers and children reported a similar overall impact of malocclusion on OHRQoL. However, mothers were found to exaggerate the emotional impact of malocclusion and were more dissatisfied with the child's dental appearance (Benson et al., 2010). One systematic review, (Eiser and Morse, 2001) sought to determine the relationship between parents' and children's ratings of the child's OHRQoL. They reported that the level of agreement varies by subscale, with good agreement on oral symptoms and functional limitations and poor agreement on the emotional and social subscales. As parents or caregivers are the main decision makers regarding their children's oral health status and

treatment choices, parallel reporting has been recommended for measurement of OHRQoL in the child population (Jokovic et al., 2004).

5.4 Limitations, strengths and implications

The present cohort study has a number of limitations. Firstly, as a questionnaire-based study, it has several potential limitations, including bias, subjectivity, dependence on participants' honesty and accuracy, differences in participants' interpretations of bullying, and failure to provide a clear cut-off point. However, self-report questionnaires are commonly used in cross-sectional studies; this is a validated, reliable, and practical instrument, and the principal investigator was available to any participant requiring assistance.

Qualitative interviews offer an alternative method of measuring bullying, but there is a possibility that participants may not wish to talk about embarrassing events or to disclose any relevant information. Secondly, it has been reported that as children get older, psychological and physiological development enables them to better tolerate and manage bullying (Olweus, 1994), and as interpretations of bullying are likely to change with age, this may lead to overestimation of the effect of treatment. Potential risk of bias in this trial included attrition bias, 16 patients dropped out after the initial questionnaire. Some of the reasons for these drop out included poor compliance and attendance. For this reason, the prevalence of bullying might be underestimated. As this study involved a self-reporting questionnaire, there is a risk of recall bias. The patient's ability to recall information might reduce over time and thus is not as accurate. The patient may also be suppressing the memory of traumatic event. Another source of bias is reporting bias. The participant might report information that they believe it

would please the clinician. Furthermore patient may have become lethargic while completing multiple questionnaires and be susceptible to response bias

Thirdly, the absence of an untreated control group (for ethical reasons) may also lead to overestimation of the impact of orthodontic treatment in reducing bullying and improving OHRQoL. Only the 14 questions in the P-CPQ, that were similar to those in the CPQ 11–14, were used. This justified the lower scores for P-CPQ reported in this study compared to other studies. This method was used previously by Abreu et al. (2014)(Abreu et al., 2014).

This study has several strengths. It is the first study to examine the psychological benefits of functional appliance treatment and its impact on bullying and OHRQoL as perceived by adolescents and their parents. Here, the sample population was narrowed to class II division I malocclusion and was limited to a standardized twin block appliance to reduce bias and to allow comparison across three different time periods. Validated reliable questionnaires were used to measure both adolescents' and parents' views of bullying and OHRQoL. Taking account of the parent's view helped to develop a comprehensive understanding of the impact of orthodontic treatment on adolescents' OHRQoL. The results of this study could be generalized to the average 11-14 years old adolescents with class II division I malocclusion in Irish population due to the generic inclusion criteria and sample selection. It will be of interest, to investigate the impact of functional appliance treatment on bullying and the OHRQoL in different populations.

5.5 Future research

The present study highlights the importance of addressing bullying when assessing patient and during orthodontic treatment and help providing a healthy school environment by implementing anti-bullying programs. Health care professionals can play a major role in developing preventive measures to address this issue in the context of malocclusion. Long-term follow-up studies are needed, with larger sample sizes and examining different occlusal traits. It will be of interest, to continue the investigation of the impact of fixed appliance treatment on bullying and the OHRQoL in this patient cohort. As a subjective measure that complements clinical indicators of orthodontic treatment need, the recent emergence and rapid growth of patient-reported outcome research can clarify the reasons for seeking orthodontic treatment and help to improve treatment outcomes.

6. Conclusions

- Functional appliance treatment for adolescent patients with Class II division I malocclusion has a positive impact on their OHRQoL.
- Functional appliance treatment for adolescent patients with Class II division I malocclusion reduces prevalence of bullying episodes. There is a relationship between adolescents' reports of being bullied and poor OHRQoL.
- There was a good level of agreement between adolescents' and parents' ratings of the adolescent's quality of life and the rate of bullying episodes during orthodontic treatment with a functional appliance.

7. References

- ABREU, L. G., MELGAÇO, C. A., ABREU, M. H. N. G., LAGES, E. M. B. & PAIVA, S. M. 2014. Agreement between adolescents and parents;caregivers in rating adolescents' quality of life during orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics*, 148, 1036-1042.
- AGOU, S., LOCKER, D., MUIRHEAD, V., TOMPSON, B. & STREINER, D. L. 2011. Does psychological well-being influence oral-health-related quality of life reports in children receiving orthodontic treatment? *American journal of orthodontics and dentofacial orthopedics*, 139, 369-377.
- AGOU, S., MALHOTRA, M., TOMPSON, B., PRAKASH, P. & LOCKER, D. 2008. Is the Child Oral Health Quality of Life Questionnaire Sensitive to Change in the Context of Orthodontic Treatment? A Brief Communication. *Journal of Public Health Dentistry*, 68, 246-248.
- AL SHAMRANY, M. 2006. Oral health-related quality of life: a broader perspective.
- AL-BITAR, Z. B., AL-OMARI, I. K., SONBOL, H. N., AL-AHMAD, H. T. & CUNNINGHAM, S. J. 2013. Bullying among Jordanian schoolchildren, its effects on school performance, and the contribution of general physical and dentofacial features. *American journal of orthodontics and dentofacial orthopedics*, 144, 872-878.
- ANALITIS, F., VELDERMAN, M. K., RAVENS-SIEBERER, U., DETMAR, S., ERHART, M., HERDMAN, M., BERRA, S., ALONSO, J. & RAJMIL, L. 2009. Being bullied: associated factors in children and adolescents 8 to 18 years old in 11 European countries. *Pediatrics*, 123, 569-577.
- ARORA, C. M. 1996. Defining bullying: Towards a clearer general understanding and more effective intervention strategies. *School Psychology International*, 17, 317-329.
- BALDWIN, D. C. 1980. Appearance and aesthetics in oral health. *Community dentistry and oral epidemiology*, 8, 244-256.
- BALDWIN DC, B. M. 1965. psychosocial factors motivating orthodontic treatment. *Br J Dent Res*, 44.
- BENNADI, D. & REDDY, C. 2013. Oral health related quality of life. *Journal of International Society of Preventive & Community Dentistry*, 3, 1.
- BENSON, P., O'BRIEN, C. & MARSHMAN, Z. 2010. Agreement between mothers and children with malocclusion in rating children's oral health-related quality of life. *American Journal of Orthodontics and Dentofacial Orthopedics*, 137, 631-638.
- BERGER, T. D., KENNY, D. J., CASAS, M. J., BARRETT, E. J. & LAWRENCE, H. P. 2009. Effects of severe dentoalveolar trauma on the quality-of-life of children and parents. *Dent Traumatol*, 25, 462-9.
- BERNABÉ, E., SHEIHAM, A., TSAKOS, G. & DE OLIVEIRA, C. M. 2008. The impact of orthodontic treatment on the quality of life in adolescents: a case-control study. *The European Journal of Orthodontics*, 30, 515-520.
- BOND, L., WOLFE, S., TOLLIT, M., BUTLER, H. & PATTON, G. 2007. A comparison of the Gatehouse Bullying Scale and the Peer Relations Questionnaire for students in secondary school. *Journal of School Health*, 77, 75-79.
- BOULTON, M. J. & UNDERWOOD, K. 1992. Bully/victim problems among middle school children. *British Journal of Educational Psychology*, 62, 73-87.

- BROOK, P. H. & SHAW, W. C. 1989. The development of an index of orthodontic treatment priority. *The European Journal of Orthodontics*, 11, 309-320.
- BROWN, A. & AL - KHAYAL, Z. 2006. Validity and reliability of the Arabic translation of the child oral - health - related quality of life questionnaire (CPQ11- 14) in Saudi Arabia. *International Journal of Paediatric Dentistry*, 16, 405-411.
- CHADWICK, S., BANKS, P. & WRIGHT, J. 1998. The use of myofunctional appliances in the UK: a survey of British orthodontists. *Dental update*, 25, 302-308.
- CLARK, W. 1988. The twin block technique A functional orthopedic appliance system. *American Journal of Orthodontics and Dentofacial Orthopedics*, 93, 1-18.
- CLARK, W. 2010. Design and management of Twin Blocks: reflections after 30 years of clinical use. *Journal of orthodontics*, 37, 209-216.
- CONNOLLY, M. A. & JOHNSON, J. A. 1999. Measuring quality of life in paediatric patients. *Pharmacoeconomics*, 16, 605-25.
- CUNNINGHAM, S. 1999. The psychology of facial appearance. *Dental update*, 26, 438-443.
- CUSHING, A., SHEIHAM, A. & MAIZELS, J. 1986. Developing socio-dental indicators--the social impact of dental disease. *Community dental health*, 3, 3-17.
- DAVIS, P. 1976. Compliance structures and the delivery of health care: the case of dentistry. *Social Science & Medicine (1967)*, 10, 329-337.
- DE OLIVEIRA, C. M. & SHEIHAM, A. 2004. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *J Orthod*, 31, 20-7; discussion 15.
- DICTIONARY, O. E. 2007. Oxford English dictionary online. JSTOR.
- DIMBERG, L., ARNRUP, K. & BONDEMARK, L. 2014. The impact of malocclusion on the quality of life among children and adolescents: a systematic review of quantitative studies. *The European Journal of Orthodontics*, cju046.
- DION, K. K. 1973. Young children's stereotyping of facial attractiveness. *Developmental Psychology*, 9, 183.
- DO, L. G. & SPENCER, A. 2007. Oral Health - Related Quality of Life of Children by Dental Caries and Fluorosis Experience. *Journal of public health dentistry*, 67, 132-139.
- DO, L. G. & SPENCER, A. J. 2008. Evaluation of oral health-related quality of life questionnaires in a general child population. *Community Dent Health*, 25, 205-10.
- DUNIN-WILCZYŃSKA, I. 1990. [Reactions of school children to the appearance of teeth]. *Czasopismo stomatologiczne*, 43, 629-632.
- EISER, C. & MORSE, R. 2001. Can parents rate their child's health-related quality of life? Results of a systematic review. *Quality of Life Research*, 10, 347-357.
- ENGLISH, J. D., BUSCHANG, P. & THROCKMORTON, G. 2002. Does malocclusion affect masticatory performance? *The Angle orthodontist*, 72, 21-27.
- FITZPATRICK, R., FLETCHER, A., GORE, S., JONES, D., SPIEGELHALTER, D. & COX, D. 1992. Quality of life measures in health care. I: Applications and issues in assessment. *Bmj*, 305, 1074-1077.
- FLEMING, L. C. & JACOBSEN, K. H. 2009. Bullying among middle-school students in low and middle income countries. *Health promotion international*, 25, 73-84.

- FLEMING, L. C. & JACOBSEN, K. H. 2010. Bullying among middle-school students in low and middle income countries. *Health Promotion International*, 25, 73-84.
- FOSTER, P. L. & THOMSON, W. 2005. Malocclusion and uptake of orthodontic treatment in Taranaki 12-13-year-olds. *The New Zealand dental journal*, 101, 98-105; quiz 111.
- GERSON, L. 1972. Expectations of "sick role" exemptions for dental problems. *Journal of the Canadian Dental Association*, 38, 370-372.
- GHAFAARI, J., KING, G. & TULLOCH, J. 1998. Early treatment of Class II, division 1 malocclusion--comparison of alternative treatment modalities. *Clinical orthodontics and research*, 1, 107-117.
- GIFT, H. C., ATCHISON, K. A. & DAYTON, C. M. 1997. Conceptualizing oral health and oral health-related quality of life. *Social Science & Medicine*, 44, 601-608.
- GLEW, G. M., FAN, M.-Y., KATON, W., RIVARA, F. P. & KERNIC, M. A. 2005. Bullying, psychosocial adjustment, and academic performance in elementary school. *Archives of pediatrics & adolescent medicine*, 159, 1026-1031.
- GOURSAND, D., PAIVA, S. M., ZARZAR, P. M., RAMOS-JORGE, M. L., CORNACCHIA, G. M., PORDEUS, I. A. & ALLISON, P. J. 2008. Cross-cultural adaptation of the Child Perceptions Questionnaire 11-14 (CPQ 11-14) for the Brazilian Portuguese language. *Health and quality of life outcomes*, 6, 1.
- GUYATT, G. H., BOMBARDIER, C. & TUGWELL, P. X. 1986. Measuring disease-specific quality of life in clinical trials. *CMAJ*, 134, 889-95.
- HARRADINE, N. & GALE, D. 2000a. The effects of torque control spurs in twin - block appliances. *Orthodontics & Craniofacial Research*, 3, 202-209.
- HARRADINE, N. & GALE, D. 2000b. The effects of torque control spurs in twin - block appliances. *Clinical orthodontics and research*, 3, 202-209.
- HAWKER, D. S. & BOULTON, M. J. 2000a. Twenty years' research on peer victimization and psychosocial maladjustment: A meta-analytic review of cross-sectional studies. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41, 441-455.
- HAWKER, D. S. & BOULTON, M. J. 2000b. Twenty years' research on peer victimization and psychosocial maladjustment: a meta - analytic review of cross - sectional studies. *Journal of child psychology and psychiatry*, 41, 441-455.
- HELM, S., KREIBORG, S. & SOLOW, B. 1985. Psychosocial implications of malocclusion: a 15-year follow-up study in 30-year-old Danes. *American journal of orthodontics*, 87, 110-118.
- HETHERINGTON, E. M., PARK, R. D. & LOCKE, V. O. 1999. *Child psychology: a contemporary viewpoint*, New York, USA, The McGraw-Hill companies.
- HOLMES, A. 1992. The Prevalence of Orthodontic Treatment Need. *British Journal of Orthodontics*, 19, 177-182.
- ILLING, H. M., MORRIS, D. O. & LEE, R. T. 1998. A prospective evaluation of bass, bionator and twin block appliances. Part I-the hard tissues. *The European Journal of Orthodontics*, 20, 501-516.
- JAVIDI, H., VETTORE, M. & BENSON, P. E. 2017. Does orthodontic treatment before the age of 18 years improve oral health-related quality of life? A systematic review and meta-analysis. *American Journal of Orthodontics and Dentofacial Orthopedics*, 151, 644-655.
- JOHAL, A., CHEUNG, M. & MARCENES, W. 2007. The impact of two different malocclusion traits on quality of life. *British dental journal*, 202, E6-E6.

- JOKOVIC, A., LOCKER, D. & GUYATT, G. 2004. How well do parents know their children? Implications for proxy reporting of child health-related quality of life. *Quality of life research*, 13, 1297-1307.
- JOKOVIC, A., LOCKER, D. & GUYATT, G. 2006. Short forms of the Child Perceptions Questionnaire for 11-14-year-old children (CPQ(11-14)): Development and initial evaluation. *Health and Quality of Life Outcomes*, 4, 4-4.
- JOKOVIC, A., LOCKER, D., STEPHENS, M. & GUYATT, G. 2003a. Agreement between mothers and children aged 11-14 years in rating child oral health-related quality of life. *Community Dent Oral Epidemiol*, 31, 335-43.
- JOKOVIC, A., LOCKER, D., STEPHENS, M., KENNY, D., TOMPSON, B. & GUYATT, G. 2002a. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *Journal of dental research*, 81, 459-463.
- JOKOVIC, A., LOCKER, D., STEPHENS, M., KENNY, D., TOMPSON, B. & GUYATT, G. 2002b. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res*, 81, 459-63.
- JOKOVIC, A., LOCKER, D., STEPHENS, M., KENNY, D., TOMPSON, B. & GUYATT, G. 2003b. Measuring parental perceptions of child oral health-related quality of life. *J Public Health Dent*, 63, 67-72.
- JOKOVIC, A., LOCKER, D., STEPHENS, M., KENNY, D., TOMPSON, B. & GUYATT, G. 2003c. Measuring Parental Perceptions of Child Oral Health - related Quality of Life. *Journal of public health dentistry*, 63, 67-72.
- KADKHODA, S., NEDJAT, S. & SHIRAZI, M. 2011. Comparison of oral - health - related quality of life during treatment with headgear and functional appliances. *International Journal of Paediatric Dentistry*, 21, 369-373.
- KEELING, S. D., WHEELER, T. T., KING, G. J., GARVAN, C. W., COHEN, D. A., CABASSA, S., MCGORRAY, S. P. & TAYLOR, M. G. 1998. Anteroposterior skeletal and dental changes after early Class II treatment with bionators and headgear. *American Journal of Orthodontics and Dentofacial Orthopedics*, 113, 40-50.
- KLAGES, U., BRUCKNER, A. & ZENTNER, A. 2004a. Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *Eur J Orthod*, 26, 507-14.
- KLAGES, U., BRUCKNER, A. & ZENTNER, A. 2004b. Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *The European Journal of Orthodontics*, 26, 507-514.
- KORETSI, V., ZYMPERDIKAS, V. F., PAPAGEORGIOU, S. N. & PAPADOPOULOS, M. A. 2015. Treatment effects of removable functional appliances in patients with Class II malocclusion: a systematic review and meta-analysis. *European Journal of Orthodontics*, 37, 418-434.
- LE COQ, E. M., BOEKE, A. J., BEZEMER, P. D., COLLAND, V. T. & VAN EIJK, J. T. 2000. Which source should we use to measure quality of life in children with asthma: the children themselves or their parents? *Qual Life Res*, 9, 625-36.
- LI, X., HUANG, H., LIN, T. & HUANG, G. 2008. [Validation of a Chinese version of the child perception questionnaire]. *Hua xi kou qiang yi xue za zhi= Huaxi kouqiang yixue zazhi= West China journal of stomatology*, 26, 267-270.
- LIU, Z., MCGRATH, C. & HÄGG, U. 2009. The impact of malocclusion/orthodontic treatment need on the quality of life: a systematic review. *The Angle orthodontist*, 79, 585-591.
- LUND, D. I. & SANDLER, P. J. 1998. The effects of Twin Blocks: a prospective controlled study. *American Journal of Orthodontics and Dentofacial Orthopedics*, 113, 104-110.

- MADSEN, K. 1996. differing perceptions of bullying and their practical implications. *Educational child psychology journal*, 13, 14-22.
- MCNAMARA, J. A. 1973. Neuromuscular and skeletal adaptations to altered function in the orofacial region. *American Journal of Orthodontics*, 64, 578-606.
- MILLS, C. M. & MCCULLOCH, K. J. 1998. Treatment effects of the twin block appliance: A cephalometric study. *American Journal of Orthodontics and Dentofacial Orthopedics*, 114, 15-24.
- MILLS, J. R. E. 1991. The Effect of Functional Appliances on the Skeletal Pattern. *British Journal of Orthodontics*, 18, 267-275.
- NANSEL, T. R., CRAIG, W., OVERPECK, M. D., SALUJA, G. & RUAN, W. J. 2004. Cross-national consistency in the relationship between bullying behaviors and psychosocial adjustment. *Archives of pediatrics & adolescent medicine*, 158, 730-736.
- NANSEL, T. R., OVERPECK, M., PILLA, R. S., RUAN, W. J., SIMONS-MORTON, B. & SCHEIDT, P. 2001. Bullying behaviors among US youth: Prevalence and association with psychosocial adjustment. *Jama*, 285, 2094-2100.
- O'BRIEN, K., MACFARLANE, T., WRIGHT, J., CONBOY, F., APPELBE, P., BIRNIE, D., CHADWICK, S., CONNOLLY, I., HAMMOND, M. & HARRADINE, N. 2009. Early treatment for Class II malocclusion and perceived improvements in facial profile. *American Journal of Orthodontics and Dentofacial Orthopedics*, 135, 580-585.
- O'MOORE, M. & KIRKHAM, C. 2001. Self-Esteem and Its Relationship to Bullying behaviour. *Aggressive Behavior*, 27, 269-283.
- O'BRIEN, C., BENSON, P. & MARSHMAN, Z. 2007. Evaluation of a quality of life measure for children with malocclusion. *Journal of Orthodontics*, 34, 185-193.
- O'BRIEN, K., WRIGHT, J., CONBOY, F., SANJIE, Y., MANDALL, N., CHADWICK, S., CONNOLLY, I., COOK, P., BIRNIE, D. & HAMMOND, M. 2003. Effectiveness of early orthodontic treatment with the Twin-block appliance: a multicenter, randomized, controlled trial. Part 1: dental and skeletal effects. *American journal of orthodontics and dentofacial orthopedics*, 124, 234-243.
- O'BRIEN, K., WRIGHT, J. L., CONBOY, F., MACFARLANE, T. & MANDALL, N. 2006. The child perception questionnaire is valid for malocclusions in the United Kingdom. *American Journal of Orthodontics and Dentofacial Orthopedics*, 129, 536-540.
- OLWEUS, D. 1994. Bullying at school: basic facts and effects of a school based intervention program. *Journal of child psychology and psychiatry*, 35, 1171-1190.
- PAL, D. K. 1996. Quality of life assessment in children: a review of conceptual and methodological issues in multidimensional health status measures. *Journal of epidemiology and community health*, 50, 391-396.
- PATEL, M. & SUJAN, S. 2012. The prevalence of traumatic dental injuries to permanent anterior teeth and its relation with predisposing risk factors among 8-13 years school children of Vadodara city: an epidemiological study. *Journal of Indian Society of Pedodontics and Preventive Dentistry*, 30, 151.
- PEARCE, J. 2002. What can be done about the bully. *Bullying a practical guide to coping for schools*, 74-91.
- PELLEGRINI, A. D. 2004. Bullying during the middle school years. *Bullying: Implications for the classroom*, 177-202.

- PELLEGRINI, A. U. & BARTINI, M. 2000. An empirical comparison of methods of sampling aggression and victimization in school settings. *Journal of Educational Psychology*, 92, 360.
- PROFFIT, W. R., FIELDS JR, H. W. & SARVER, D. M. 2006. *Contemporary orthodontics*, Elsevier Health Sciences.
- RABIE, A., XIONG, H. & HÄGG, U. 2004. Forward mandibular positioning enhances condylar adaptation in adult rats. *The European Journal of Orthodontics*, 26, 353-358.
- RIGBY, K. 1996. *Manual for the Peer Relations Questionnaire (the PRQ)*, Underdale, South Australia: University of South Australia.
- RIGBY, K. 2007. *Bullying in schools: And what to do about it*, Aust Council for Ed Research.
- SALIN, D. 2001. Prevalence and forms of bullying among business professionals: A comparison of two different strategies for measuring bullying. *European journal of work and organizational psychology*, 10, 425-441.
- SATCHER, D. 2000. Oral Health in America: A Report of the Surgeon General. In: DEPARTMENT OF HEALTH AND HUMAN SERVICES & SERVICE, U. S. P. H. (eds.). National Institute of Dental and Craniofacial Research.
- SEEHRA, J., FLEMING, P. S., NEWTON, T. & DIBIASE, A. T. 2011. Bullying in orthodontic patients and its relationship to malocclusion, self-esteem and oral health-related quality of life. *Journal of Orthodontics*, 38, 247-256.
- SEEHRA, J., NEWTON, J. & DIBIASE, A. T. 2012. Interceptive orthodontic treatment in bullied adolescents and its impact on self-esteem and oral-health-related quality of life. *The European Journal of Orthodontics*.
- SHAW, W., MEEK, S. & JONES, D. 1980a. Nicknames, teasing, harassment and the salience of dental features among school children. *British Journal of Orthodontics*, 7, 75-80.
- SHAW, W. C., MEEK, S. C. & JONES, D. S. 1980b. Nicknames, teasing, harassment and the salience of dental features among school children. *Br J Orthod*, 7, 75-80.
- SHAW, W. C., RICHMOND, S., KENEALY, P. M., KINGDON, A. & WORTHINGTON, H. 2007. A 20-year cohort study of health gain from orthodontic treatment: psychological outcome. *American Journal of Orthodontics and Dentofacial Orthopedics*, 132, 146-157.
- SLADE, G. D. 2002. Assessment of oral health related quality of life.
- SMITH, P. K., COWIE, H., OLAFSSON, R. F. & LIEFOOGHE, A. P. 2002. Definitions of bullying: A comparison of terms used, and age and gender differences, in a Fourteen-Country international comparison. *Child development*, 73, 1119-1133.
- SMITH, P. K. & LEVAN, S. 1995. Perceptions and experiences of bullying in younger pupils. *British Journal of Educational Psychology*, 65, 489-500.
- SMITH, P. K., MAHDAVI, J., CARVALHO, M., FISHER, S., RUSSELL, S. & TIPPETT, N. 2008. Cyberbullying: Its nature and impact in secondary school pupils. *Journal of child psychology and psychiatry*, 49, 376-385.
- SPRIGGS, A. L., IANNOTTI, R. J., NANSEL, T. R. & HAYNIE, D. L. 2007. Adolescent bullying involvement and perceived family, peer and school relations: Commonalities and differences across race/ethnicity. *Journal of Adolescent Health*, 41, 283-293.
- THIRUVENKATACHARI, B., HARRISON, J. E., WORTHINGTON, H. V. & O'BRIEN, K. D. 2013. Orthodontic treatment for prominent upper front teeth (Class II malocclusion) in children. *Cochrane Database Syst Rev*, 11.

- THIRUVENKATACHARI, B., SANDLER, J., MURRAY, A., WALSH, T. & O'BRIEN, K. 2010. Comparison of Twin-block and Dynamax appliances for the treatment of Class II malocclusion in adolescents: A randomized controlled trial. *American Journal of Orthodontics and Dentofacial Orthopedics*, 138, 144. e1-144. e9.
- TSICHLAKI, A. & O'BRIEN, K. 2014. Do orthodontic research outcomes reflect patient values? A systematic review of randomized controlled trials involving children. *American Journal of Orthodontics and Dentofacial Orthopedics*, 146, 279-285.
- TULLOCH, J. C., PHILLIPS, C., KOCH, G. & PROFFIT, W. R. 1997. The effect of early intervention on skeletal pattern in Class II malocclusion: a randomized clinical trial. *American Journal of Orthodontics and Dentofacial Orthopedics*, 111, 391-400.
- TULLOCH, J. F. C., MEDLAND, W. & TUNCAY, O. C. 1990. Methods used to evaluate growth modification in Class II malocclusion. *American Journal of Orthodontics and Dentofacial Orthopedics*, 98, 340-347.
- VAN DER WAL, M. F., DE WIT, C. A. & HIRASING, R. A. 2003. Psychosocial health among young victims and offenders of direct and indirect bullying. *Pediatrics*, 111, 1312-1317.
- VIG, P. S., ORTH, D. & VIG, K. W. 1986. Hybrid appliances: a component approach to dentofacial orthopedics. *American Journal of Orthodontics and Dentofacial Orthopedics*, 90, 273-285.
- VOUDOURIS, J. C., WOODSIDE, D. G., ALTUNA, G., ANGELOPOULOS, G., BOURQUE, P. J. & LACOUTURE, C. Y. 2003. Condyle-fossa modifications and muscle interactions during Herbst treatment, Part 2. Results and conclusions. *American journal of orthodontics and dentofacial orthopedics*, 124, 13-29.
- WALSTER, E., ARONSON, V., ABRAHAMS, D. & ROTTMAN, L. 1966. Importance of physical attractiveness in dating behavior. *Journal of personality and social psychology*, 4, 508.
- WHO. 22 July 1946. Preamble to the Constitution of the World Health Organisation as adopted by the International Health Conference. 19-22 June 1946 New York. WHO.
- WHO 2013. Oral health surveys: basic methods.
- WHOQOL, G. 1993b. Measuring Quality of Life: The Development of the World Health Organisation Quality of Life Instrument (WHOQOL). Geneva: WHO.
- ZHANG, M., MCGRATH, C. & HÄGG, U. 2008. Changes in oral health-related quality of life during fixed orthodontic appliance therapy. *American Journal of Orthodontics and Dentofacial Orthopedics*, 133, 25-29.
- ZHANG, X., CHEN, L., LIU, J., ZHAO, Z., QU, E., WANG, X., CHANG, W., XU, C., WANG, Q. K. & LIU, M. 2007. A novel DSPP mutation is associated with type II dentinogenesis imperfecta in a Chinese family. *BMC Med Genet*, 8, 52.

8. Appendices

Appendix 1. Ethical approval letter



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin
Ollscoil Átha Cliath | The University of Dublin

Fatmah Aljumah
School of Dental Science
Dublin Dental University Hospital
Trinity College
Lincoln Place
Dublin 2

Ref: 150514

Title of Study: The impact of orthodontic intervention using functional appliance therapy on bullying and quality of life.

Dear Fatmah,

Further to a meeting of the Faculty of Health Sciences Ethics Committee held in May 2016, we are pleased to inform you that the above project has been approved without further audit.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Prof. Brian O'Connell'.

Prof. Brian O'Connell
Chairperson
Faculty Research Ethics Committee

Appendix 2. Invitation letter



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



INVITATION LETTER

Dear Sir/Madam,

We would like to invite you and your child to consider taking part in a study which Dr. Fatmah Aljumah from the Dublin Dental University Hospital, Trinity College Dublin is undertaking as part of her postgraduate research in orthodontics. Dr Aljumah wants to collect information about the benefit of orthodontic treatment. She would also like your child and yourself to complete a questionnaire about the impact of orthodontic treatment on bullying.

You and your child can read more about the study in the information sheet provided and if you want to ask questions about the study, Dr Aljumah's contact details are supplied below. If you are interested in taking part then Dr Aljumah will meet you on your first appointment

If you are interested in taking part in the study, then please contact her as follows:

- (1) Telephone contact 016127210
- (2) Email fatmah.aljumahf@dental.tcd.ie
- (3) By filling in the form below and handing it in personally to one of the staff.
- (4) By post, put the slip below, in the envelope supplied.

Thank you for your interest in this project

We are interested in taking part or learning more about the study with DR. FATMAH ALJUMAH and we are willing for her to contact us.

PARTICIPANT NAME:

SIGNATURE:

PARENT NAME:

SIGNATURE:

Telephone Number

E-mail :

Appendix 3. Patient information leaflet



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



PATIENT INFORMATION LEAFLET

Title of the study: The impact of functional appliances on bullying and quality of life in adolescents and their parents

Principal investigator: Dr. Fatmah Aljumah

Introduction

I am Dr. Fatmah Aljumah from Dublin Dental University Hospital, Trinity College. I am carrying out research about functional appliance wear and the impact of orthodontic treatment on bullying as part of my postgraduate research with Trinity College Dublin.

I would like to invite [you and your child](#) to join this postgraduate research study. The purpose of this study is to collect information about the benefit of orthodontic treatment, to assess the impact of the appliance therapy on bullying among adolescents, and to assess the effect of functional appliances on oral health related quality of life.

Choosing not to take part in this study will not affect/change the treatment that you will be provided. Before you decide whether you and your child want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully. Ask Dr Fatmah if there is anything that is not clear or if you would like more information.

The study Details

I will ask your child and yourself to complete a questionnaire before, during and after functional appliance treatment. The questionnaire is validated and is used commonly. The questions will include: have you been bullied at school, have you been teased. The questionnaire will take no more than ten minutes to complete. The questionnaire will remain confidential as part of the study.

Eligibility:

Children aged between 11-15 years, undergoing functional appliance treatment, are eligible to take part in this study. The child must be accompanied by a parent at every visit.

Risks

The patient may disclose personal, sensitive information that could be upsetting. A specialized counselor will be provided to the patient if requested.

The results of this study may also be published in journals or conferences.

Voluntary participation:

It is up to you and your child to decide whether to participate in this research. If you decide not to participate in this study, there will be no difference in quality or availability of care from staff.

Review of this study:

This study has been reviewed and received Research Ethics Committee approval from the Faculty of Health Sciences, Trinity College Dublin.

Further information:

If you have any questions or require more information about this study, please contact the researcher using the following details:

Dr.Fatmah aljumah , Dublin Dental University Hospital, Trinity College Dublin, Lincoln Place, dublin2.
[Tel:016127210](tel:016127210) or email fatmah.aljumahf@dental.tcd.ie

Appendix 4. Consent form



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

CONSENT FORM



Please complete this form after you have read the Information Sheet and listened to an explanation about the research

PROJECT TITLE: The impact of functional appliance therapy on bullying and quality of life in adolescents and their parents

Principal investigator: Dr Fatma Aljumah

Thank you for considering taking part in this research. The person who is organizing the research must explain the project to you before you agree to participate. If you have any questions arising from the information sheet or the explanation already given to you, please ask the researcher before you decide whether to consent. You will be given a copy of this consent form.

You and your child understand that if you decide at any time during the research that you no longer wish to participate in this study, you can notify the researcher involved and withdraw from it immediately without giving any reason. Furthermore you understand that you will be able to withdraw any data pertaining to you, up to the point of publication.

My child and I are agreeing to participate in a research project which is being carried out by Dr. Fatmah Aljumah as part of her postgraduate research with Dublin Dental University Hospital.

The study is designed to investigate the benefit of orthodontic treatment and the impact of functional appliances on bullying and quality of life among adolescents and their parents. We agree to participate in the questionnaire survey. Any information or data which is obtained from me during this research will be treated confidentially and stored securely. Data from this research project maybe published in future:

Declaration

We have read the information leaflet for this project and I understand the contents. We had the opportunity to ask questions and all my questions have been answered to my satisfaction. We freely and voluntarily agree to be part of this study, though without prejudice to my legal and ethical rights. We understand that we may withdraw from the study at any time and we have received a copy of this agreement.

PARTICIPANT NAME:

PARTICIPANT SIGNATURE:

DATE:

PARENT NAME :

SIGNATURE:

DATE:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent

INVESTIGATOR SIGNATURE:

DATE

Appendix 5. P-CPQ

* 1. Patient identifier

* 2. TIME OF QUESTIONNAIRE

- ☐ PRIOR TO STARTING
- ☐ DURING THEFUNCTIONAL
- ☐ POST FUNCTIONAL

* 3. Can you confirm that you are.....parent

- ☐ MOTHER
- ☐ FATHER

4. What is your ethnic origin?(UK and Ireland specific)

- ☐ White British
- ☐ White Irish
- ☐ Other White background (please give details below)
- ☐ Mixed white and black Caribbean
- ☐ Mixed white and black african
- ☐ Mixed white and black Asian
- ☐ Mixed white and other background (please give details below)
- ☐ Asian
- ☐ Asian British
- ☐ Asian Irish
- ☐ Asian Indian
- ☐ Asian Pakistani
- ☐ Asian Bangladeshi
- ☐ Other Asian background(please give details below)
- ☐ Black
- ☐ Black British
- ☐ Black Irish
- ☐ Black Caribbean
- ☐ Black African
- ☐ Other Black background (please give details below)
- ☐ Chinese
- ☐ Middle Eastern
- ☐ Prefer not to answer

Other (please specify)

* 5. In the past 3 months, how often has your child had sores in his/her mouth?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer

* 6. In the past 3 months, how often has your child had bad breath ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer

* 7. In the past 3 months, how often has your child had food stuck in between his/her teeth?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 8. In the past 3 months, how often has your child had difficulty biting or chewing food like apples, corn on the cob or steak ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 9. In the past 3 months, how often has your child found it difficult to drink or eat hot or cold foods?

- ☐ Never
 - ☐ Once or twice
 - ☐ Sometimes
 - ☐ Often
 - ☐ Everyday or almost everyday
 - ☐ Don't know
 - ☐ Prefer not to answer
-

* 10. In the past 3 months, how often has your child had difficulty saying any words?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 11. In the past 3 months, how often has your child had trouble sleeping ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 12. In the past 3 months, how often has your child had pain in his/her teeth, lips, jaws or mouth ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 13. In the past 3 months, how often has your child had taken longer than others to eat a meal?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer

* 14. In the past 3 months, how often has your child felt irritable or frustrated?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer

* 15. In the past 3 months, how often has your child felt shy or embarrassed?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 16. In the past 3 months, how often has your child been upset ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 17. In the past 3 months, how often has your child been concerned what other people think about his/her teeth, lips, mouth or jaws?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 18. In the past 3 months, how often has your child avoided smiling or laughing when around other children?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 19. In the past 3 months, how often has your child not wanted to speak to speak or read out loud in class?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 20. In the past 3 months, how often has your child had other children ask him/her questions about his/her teeth, lips, jaws or mouth?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 21. Did that bother your child ?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer

22. In the past 3 months, how often have other children teased your child or called him/her names?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 23. Did that bother your child ?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer

* 24. In the past 3 months, how often has your child argued with other children or his/her family?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer

* 25. Would you say the standard or health of your child's teeth, lips, jaws and mouth is :

- ☐ Excellent
- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Don't know
- ☐ Prefer not to answer

* 26. So overall, taking everything into account ...How much does the condition of your child's teeth, lips, jaws, or mouth bother him/her or affect his/her life would you say?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer

Appendix 6. Gatehouse scale for parents

* 27. How does your child like school ?

- ☐ He/she dislikes school very much
- ☐ He/she dislikes school
- ☐ He/she neither likes nor dislikes school
- ☐ he/she likes school
- ☐ he/she likes school very much

* 28. How many good friends does your child have in his/her class(es)?

- ☐ None
- ☐ 1 good friend in his/her class(es)
- ☐ 2 or 3 good friends in his/her class(es)
- ☐ 4 or 5 good friends in his/her class(es)
- ☐ 6 or more good friends in his/her class(es)

* 29. Has anyone TEASED your child or called him/her names recently

- ☐ Yes
- ☐ No

* 30. How often has anyone teased your child or called him/her names recently

- ☐ Most Days
- ☐ About Once a week
- ☐ Less than Once a week

* 31. How upsetting was it on your child when they were teased?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

32. How upsetting was it for you when your child was teased ?

- ☐ I wasn't upset
- ☐ I was upset

* 33. Has anyone spread RUMOURS about your child recently ?

☐ Yes

☐ No

* 34. How often has anyone spread rumours about your child recently ?

- ☐ Most days
- ☐ about once a week
- ☐ less than once a week

* 35. How upsetting were the rumours for you child?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

36. How upsetting were the rumours for you ?

- ☐ I wasn't upset
- ☐ i was upset

* 37. Has your child DELIBERATELT LEFT OUT OF THINGS recently

☐ Yes

☐ No

* 38. How often has your child been deliberately left out things recently ?

- ☐ Most days
- ☐ About once a week
- ☐ Less then once a week

* 39. How upsetting was it on your child when they were being left out of things ?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

40. How upsetting was it for you when you child was being left out ?

- ☐ I wasn't upset
- ☐ I was

* 41. Has your child THREATENED PHYSICALLY OR ACTUALLY HURT by another student recently ?

☐ Yes

☐ No

* 42. How often has your child THREATENED PHYSICALLY OR ACTUALLY HURT by another student recently ?

- ☐ Most days
- ☐ About once a week
- ☐ less than once a week

* 43. How upsetting was it on your child when they were being threatened or hurt ?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quite upset

44. How upsetting was it for you when your child was being threatened or hurt ?

- ☐ I wasn't upset
- ☐ I was upset

Appendix 7. CPQ 11-14

* 1. Patient identifier

* 2. Time of questionnaire

- ☐ Pre treatment
- ☐ During the treatment
- ☐ Post treatment

3. Age

* 4. Gender

- ☐ Female
- ☐ Male

* 5. What is your ethnic origin ?(UK and Ireland Spcecific)

- ☐ White British
- ☐ White Irish
- ☐ Other white background (please give details below)
- ☐ Mixed white and black Caribbean
- ☐ Mixed white and black African
- ☐ Mixed white and black Asian
- ☐ Mixed white and other background (please give details below)
- ☐ Asian
- ☐ Asian British
- ☐ Asian Irish
- ☐ Asian Indian
- ☐ Asian Pakistani
- ☐ Asian Bangladeshi
- ☐ Other Asian background (please give details below)
- ☐ Black
- ☐ Black British
- ☐ Black Irish
- ☐ Black Caribbean
- ☐ Black African
- ☐ Other Black Background (please give details below)
- ☐ Chinese
- ☐ Middle Eastern
- ☐ Prefer not to answer

Other (please specify)

**So if you don't mind I am going to ask you a few questions about your mouth.
theres a choice of answers and you can choose to answer never, once or twice, sometimes,
often, everyday or if you are not sure you can say don't know.
ok off we go**

*** 6. In the past 3 months, how often have you had sores in your mouth?**

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer this

*** 7. In the past 3 months, how often have you had bad breath ?**

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost every day
- ☐ Don't know
- ☐ Prefer not to answer this

*** 8. In the past 3 months, how often have you had food stuck in between your teeth?**

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 9. In the past 3 months, how often have you had difficulty biting or chewing food like apples, corn on the cob or steak ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 10. In the past 3 months, how often have you found it difficult to drink or eat hot or cold foods?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 11. In the past 3 months, how often have you had difficulty saying any words?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 12. In the past 3 months, how often have you had trouble sleeping ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 13. In the past 3 months, how often have you had pain in your teeth, lips, jaws or mouth ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 16. In the past 3 months, how often have you felt shy or embarrassed?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 17. In the past 3 months, how often have you been upset ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 18. In the past 3 months, how often have you been concerned what other people think about your teeth, lips, mouth or jaws?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 19. In the past 3 months, how often have you avoided smiling or laughing when around other children?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 20. In the past 3 months, how often have you not wanted to speak to speak or read out loud in class?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 21. In the past 3 months, how often have you had other children ask you questions about your teeth, lips, jaws , mouth or braces ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 22. Did that bother you ?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer this

23. In the past 3 months, how often have other children teased you or called your names about your teeth , lips , jaw , mouth or braces ?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 24. Did that bother you ?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer this

25. What did they tease you about? (you can choose more than one answer)

- ☐ Teeth
- ☐ Lips
- ☐ Jaw
- ☐ Mouth
- ☐ Braces
- ☐ Other

* 26. In the past 3 months, how often have you argued with other children or your family?

- ☐ Never
- ☐ Once or twice
- ☐ Sometimes
- ☐ Often
- ☐ Everyday or almost everyday
- ☐ Don't know
- ☐ Prefer not to answer this

* 27. Would you say the standard or health of your teeth, lips, jaws and mouth is :

- ☐ Excellent
- ☐ Very good
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Don't know
- ☐ Prefer not to answer this

* 28. So overall, taking everything into account ...How much does the condition of your teeth, lips, jaws, or mouth bother you or affect your life would you say?

- ☐ Not at all
- ☐ Very little
- ☐ Some
- ☐ A lot
- ☐ Very much
- ☐ Don't know
- ☐ Prefer not to answer this

Appendix 8. Gatehouse scale for adolescents.

* 27. How does your child like school ?

- ☐ He/she dislikes school very much
- ☐ He/she dislikes school
- ☐ He/she neither likes nor dislikes school
- ☐ he/she likes school
- ☐ he/she likes school very much

* 28. How many good friends does your child have in his/her class(es)?

- ☐ None
- ☐ 1 good friend in his/her class(es)
- ☐ 2 or 3 good friends in his/her class(es)
- ☐ 4 or 5 good friends in his/her class(es)
- ☐ 6 or more good friends in his/her class(es)

* 29. Has anyone TEASED your child or called him/her names recently

- ☐ Yes
- ☐ No

* 30. How often has anyone teased your child or called him/her names recently

- ☐ Most Days
- ☐ About Once a week
- ☐ Less than Once a week

* 31. How upsetting was it on your child when they were teased?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

32. How upsetting was it for you when your child was teased ?

- ☐ I wasn't upset
- ☐ I was upset

* 33. Has anyone spread RUMOURS about your child recently ?

☐ Yes

☐ No

* 34. How often has anyone spread rumours about your child recently ?

- ☐ Most days
- ☐ about once a week
- ☐ less than once a week

* 35. How upsetting were the rumours for you child?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

36. How upsetting were the rumours for you ?

- ☐ I wasn't upset
- ☐ i was upset

* 37. Has your child DELIBERATELT LEFT OUT OF THINGS recently

☐ Yes

☐ No

* 38. How often has your child been deliberately left out things recently ?

- ☐ Most days
- ☐ About once a week
- ☐ Less then once a week

* 39. How upsetting was it on your child when they were being left out of things ?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

40. How upsetting was it for you when you child was being left out ?

- ☐ I wasn't upset
- ☐ I was

* 41. Has your child THREATENED PHYSICALLY OR ACTUALLY HURT by another student recently ?

☐ Yes

☐ No

* 42. How often has your child THREATENED PHYSICALLY OR ACTUALLY HURT by another student recently ?

- ☐ Most days
- ☐ About once a week
- ☐ less than once a week

* 43. How upsetting was it on your child when they were being threatened or hurt ?

- ☐ He/she wasn't upset at all
- ☐ He/she was a bit upset
- ☐ He/she was quit upset

44. How upsetting was it for you when your child was being threatened or hurt ?

- ☐ I wasn't upset
- ☐ I was upset