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SCIENTIFIC SECTION

Bullying in orthodontic patients and its relationship to malocclusion, self-esteem and oral health-related quality of life

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Objectives: To measure the self-reported frequency and severity of bullying amongst patients referred for orthodontic treatment and to investigate whether there is a relationship between levels of self-reported bullying, malocclusion and need for orthodontic treatment and an individual's self-esteem and oral health-related quality of life (OHRQoL).

Design and setting: Cross-sectional study of an adolescent group referred for orthodontic assessment at three UK hospitals.

Subjects and methods: Three hundred and thirty-six participants aged between 10 and 14 years were recruited. Validated questionnaires were used to measure the self-reported frequency and severity of bullying, self-esteem and OHRQoL. Orthodontic treatment need was assessed using IOTN.

Results: The prevalence of bullying was 12.8%. Being bullied was significantly associated with Class II Division 1 incisor relationship ($P=0.041$), increased overbite ($P=0.023$), increased overjet ($P=0.001$) and a high need for orthodontic treatment assessed using AC IOTN ($P=0.014$). Bullied participants also reported lower levels of social competence ($P<0.001$), athletic competence ($P<0.001$), physical appearance related self-esteem ($P<0.001$) and general self-esteem ($P<0.001$). Higher levels of oral symptoms ($P=0.032$), functional limitations ($P<0.001$), emotional ($P<0.001$) and social impact ($P<0.001$) from their oral condition, resulting in a negative impact on overall OHRQoL ($P<0.001$), were also reported.

Conclusions: Significant relationships exist between bullying and certain occlusal traits, self-esteem and OHRQoL.

Key words: Bullying, self-esteem, oral health-related quality of life, malocclusion

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Introduction

Bullying or peer victimization among school children has been defined as 'a specific form of aggressive behaviour and can be described as a situation when a student is exposed repeatedly and over time, to negative actions on the part of one or more students'.[1] Negative actions in this context refer to an imbalance of power between the victim and aggressor which can manifest as direct or indirect forms of aggression causing harm to the victim. Direct forms include both physical and verbal aggression such as kicking, hitting, name calling and threatening. In contrast, indirect forms operate at an emotional and social level and include exclusion from peer circles, gossiping and spreading rumours.[2] The term bullying seems to be synonymous with teasing within the literature. Teasing is regarded as a milder form of aggressive behaviour; however, if it results in harm and distress, it is considered as bullying.[3]

Within the UK, cross-sectional studies have investigated peer victimization in schools. It has been reported that 26% of 8–9 year olds are bullied 'sometimes or more often' and 10% are bullied 'several times a week'. Within 11–12 year olds, 15% are bullied 'sometimes or more often' and 2% 'several times a week'.[4] Similarly, Whitney and Smith[5] reported 27% of 8–11 year olds are 'bullied sometimes' and 10% 'bullied at least once a week'. In adolescents aged between 11 and 16 years, 10% are 'bullied sometimes' and 4% 'bullied at least once a week'. It is clear that peer victimization among school children is endemic.[6] Both male and female victims of bullying are subjected to both types of aggression. However, differences exist; males tend to endure direct forms of aggression such as physical attacks;

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females are exposed to more indirect types such as spreading rumours and isolation.[1,5]

Dental and social effects of malocclusion have been reported[7] and the prevalence of teasing in children has been reported in both normal and orthodontic samples. The frequency of teasing related to dental features has been reported at 7% within a sample of 531 school children aged between 9 and 13 years.[8] In contrast, in adolescent groups awaiting orthodontic treatment, the prevalence of teasing related to dental appearance has been reported at 15%.[9] Specific dental characteristics reported to elicit negative responses and cause patients to seek treatment include increased overjet, crowding and a deep overbite.[8,10,11]

The psychosocial effects of bullying and teasing related to dentofacial aesthetics remain unclear. It is often assumed that poor dental and facial appearance is associated with low esteem, self-concept and a negative body image. In addition, low self-esteem may be a long-term consequence of teasing related to malocclusion;[8,10] however, the relationship between malocclusion and self-esteem remains equivocal.

It has been reported that children aged between 14 and 15 years have a lower self-perception in the presence of poor dental aesthetics of their anterior teeth.[12] In contrast, a 20-year longitudinal follow-up of patients with an untreated malocclusion revealed no negative association between malocclusion and social or psychological well-being.[13]

Despite the lack of evidence that malocclusion has a negative impact on self-esteem, it is generally accepted that a malocclusion can have an impact on an individual's oral health-related quality of life (OHRQoL).[14,15] Occlusal traits that have been reported to have a negative impact include an increased overjet,[16] spacing[16] and an anterior open bite.[17] The relationship between self-esteem, OHRQoL and malocclusion is complex. It has been suggested that self-esteem may influence the effect on an individual's OHRQoL due to malocclusion.[18] As such, the impact of a malocclusion on an individual's OHRQoL is significant in children with low self-esteem. However, the converse is detected in children with high self-esteem, who report a higher than average OHRQoL.[18] Additionally, the relationship between self-esteem, OHRQoL and malocclusion could be affected by other factors.

There appears to be a relationship between teasing and malocclusion. However, the precise association between bullying and malocclusion and its effect on self-esteem and in particular OHRQoL remains unclear due to a lack of stringently designed investigations. Previous research has failed to report the incidence of bullying within a sample of orthodontic patients, often limiting the description of aggressive behaviour to teasing and using questionnaires of uncertain reliability and validity.

The study aimed to measure the self-reported frequency and severity of bullying in orthodontic patients and to investigate whether there is a relationship between levels of self-reported bullying, malocclusion and need for orthodontic treatment and an individual's self-esteem and OHRQoL.

Subjects and methods

Participants

Ethical approval was obtained from the East Kent Research Ethics Committee (no. 07/H1103/53). The target population for this cross-sectional study was untreated patients between the ages of 10 and 14 years referred for an orthodontic assessment due to the presence of a malocclusion either on suggestion of the family dentist or on request of the child or parent. The participants were recruited from consecutive patients attending the orthodontic new patient clinics at Kent and Canterbury Hospital, William Harvey Hospital and Guy's campus of King's College London Dental Institute between October 2007 and December 2008. Potential participants satisfying the inclusion criteria and their parents were invited to take part in the study at the new patient clinic. Patients and parents were given an information sheet and verbal explanation about the content of the study on the day of their new patient appointment. Adequate time and opportunity were given to allow both parents and participants to ask questions about the study before obtaining written informed consent.

Sample size calculation

It was assumed that an effect size of 0.5 would be clinically significant. Given that the authors wished to test a number of variables, without *a priori* information on the likely variation across variables in bullied and non-bullied individuals, it was calculated that a total of 220 normal and Class II Division 1 malocclusion children would guarantee a power of 80% at the 5% significance level allowing detection of differences in the prevalence of bullying of 10% versus 20%. Assuming a prevalence of 40% normal and 30% Class II Division 1 malocclusions, a sample size of at least 300 participants was required while allowing the proposed multivariate linear regressions to be adjusted for the covariates simultaneously. The software used was G*Power 3.1.[19]

Measures

To measure the prevalence, type and severity of bullying, each participant was asked to complete the Olweus Bully/Victim Questionnaire.[20] This is an anonymous self-reporting questionnaire that measures levels of bullying. Only the section of the questionnaire relating to victims of bullying rather than that relating to the instigation of bullying was used. The Olweus Bully/Victim Questionnaire was developed in Scandinavia and is used internationally in the assessment of bullying and is proven to be reliable and valid.[1] The Harter's Self Perception Profile for Children[21] is specifically designed to measure self-esteem in children aged between 8 and 14 years of age. The profile taps five specific domains and one general domain of self-evaluation: scholastic competence, social acceptance, athletic competence, physical appearance, behavioural conduct and general domain of self-worth. Although developed in the USA, the Harter's questionnaire has been successfully used in a UK sample group aged between 11 and 16 years of age.[22]

To assess the impact on the patient's OHRQoL, each participant was asked to complete a Child Perception Questionnaire 11–14 year olds (CPQ_{11-14}).[23] This is a component of the Child Oral Health Quality of Life Questionnaire and is designed to assess the negative impact of oral and orofacial disease on the individual's quality of life. It is divided into four health domains: oral symptoms, functional limitation, emotional impact and social impact. This questionnaire has been reported to have excellent validity and reliability[23] and is a suitable measure for the assessment of the impact of malocclusion on a child's OHRQoL within the UK population.[14]

Clinical assessment

A standard orthodontic new patient clinical examination was performed by the investigators under optimal conditions. Radiographs were requested as part of the examination if indicated and in accordance with the British Orthodontic Society radiographic guidelines.[24] All investigators had been trained and calibrated to collect data on normative orthodontic treatment need in the study age range using both IOTN AC and DHC. The IOTN DHC consists of five grades ranging from grade 1, 'no need' for treatment, to grade 5, 'very great need.' A grade was allocated to the single worst occlusal trait.[25] In contrast, the IOTN AC consists of a visual 10-point scale representing a wide range of dental attractiveness, illustrated by a series of 10 front view photographs arranged from number 1, most attractive, to number 10, least attractive.[26] This was scored by the investigator. In addition to the examination, a frontal photograph of the dentition in occlusion was taken of recruited samples. The soft tissues were retracted to ensure that the dentition was clearly visible and in centric occlusion in order to allow accurate comparison to the IOTN AC scale.

Procedure

Following completion of the consent procedure, participants completed the questionnaires alone or with assistance from their caregiver. The clinical staff making the clinical assessment did not view the questionnaires until after they had made the clinical assessments. A clear protocol for intervention was adhered to where a child was identified as being subject to regular or persistent bullying as defined by the Olweus Bully/Victim Questionnaire or if the parent requested action to be taken. In this instance, participants were given an information pack with the contact details of organizations who deal with bullying in school children. At the discretion of the child, an interventional letter was sent to the child's school requesting the investigation of bullying episodes and instigation of anti-bullying polices.

Data analysis

All recruited participants completed questionnaires with a specific identification number. The data from the questionnaires were coded and entered into a Microsoft Excel (2007 version) database. Statistical analysis of the data was performed using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). The statistical analysis was conducted in three stages, as follows:

- Stage 1: descriptive statistics were calculated for all measures including socio-demographic characteristics and the study variables;
- Stage 2: the relationship between the study variables was assessed. Where the data were not normally distributed or were ordinal, the chi-squared and Fishers Exact test were used. For continuous data, the Mann–Whitney *U* test was used;
- Stage 3: a multivariate logistic regression analysis was conducted exploring the relationship between socio-demographic, self-esteem; oral health related quality of life, orthodontic status and the presence or absence of bullying. The level of significance was set at $P<0.05$.

Results

Reproducibility

The reproducibility of IOTN DHC was determined from study models of participants recruited into the

study who had subsequently commenced orthodontic treatment. Forty photographs and study models were chosen at random. Both were examined and re-examined by the investigators following a 2-week interval. Both intra- and inter- examiner reliability was measured using weighted kappa[27] for the principal investigators (JS and ATD). Values of weighted kappa for intra-examiner IOTN AC were as follows: ATD (0.78; 95% CI: 0.58–0.98), JS (0.88; 95% CI: 0.68–1.0), and for IOTN DHC: ATD (0.79; 95% CI: 0.59–0.99), JS (0.83; 95% CI: 0.61–1.0). Weighted kappa for inter-examiner IOTN AC reliability was: JS and ATD (0.69; 95% CI: 0.55–0.83) and for IOTN DHC: JS and ATD (0.64; 95% CI: 0.48–0.80).

Descriptive statistics

Descriptive statistics of socio-demographic variables are summarized in Table 1. Three hundred and thirty-six patients aged between 10 and 14 years were consented and recruited into the study. The participation rate was 98.5%. The largest recruitment centre was the Orthodontic Department at Kent and Canterbury Hospital (79.5%), followed by the department at William Harvey Hospital (14.2%). The majority ethnic group was Caucasian (95.5%), with over half the total sample consisting of male participants (60.2%). The major source of referral was general dental practitioners (99.4%) and the stated main household earner was usually the father of the participant (72.4%). The mean age of the sample was 12.2 years (SD: 1.3). Treatment need of the sample as measured from IOTN DHC was as follows: grade 5 (49%), grade 4 (38.3%), grade 3 (7.7%) and grade 2 (3.6%). The most frequent DHC scores were as follows: 5i (24.0%), 5a (22.6%), 4d (18.1%), 4a (11.3%) and 4h (5.9%). Similarly, the most frequent AC scores were: 7 (28.3%), 9 (24.8%) and 8 (23.9%). Both findings can be attributed to the fact that all data were collected from secondary care referral sites, which accept and treat patients with complex malocclusions. The most frequent incisor relationship was Class II Division 1 incisor (47.5%) with an increased overbite in 43.3% of cases and a mean overjet for the total sample of 5.25 mm (SD: 3.96). The most common skeletal pattern was Class II (56.6%) with average Frankfort mandibular plane angle (50.3%) and lower face height (49.5%).

Table 1 Sociodemographic characteristics of participants (N=336).

Characteristic	Total N in group (%)
Gender	
Female	133 (39.6%)
Male	201 (59.8%)
Missing	2 (0.6%)
Age (years)	
10	47 (13.9%)
11	52 (15.4%)
12	87 (25.9%)
13	98 (29.1%)
14	49 (14.5%)
Missing	3 (1.1%)
Ethnicity	
Caucasian	320 (95.5%)
Asian	4 (1.2%)
African	2 (0.6%)
Afro-Caribbean	1 (0.3%)
Missing	9 (2.7%)
Bullying status	
Bullied	43 (12.8%)
Not bullied	291 (86.4%)
Missing	2 (0.8%)

Comparison of bullied and non-bullied participants

Forty-three participants (12.8%) identified that they had been bullied at school, two or three times a month or more in the last 2 months (Question 4 of the Olweus questionnaire), and were therefore classified in the context of this study as being bullied. Table 2 compares the socio-demographic characteristics of participants who were bullied and those who did not report being bullied. There were no significant differences between the two groups.

Bullied participants (Table 3) were significantly more likely to have a Class II Division 1 incisor relationship (P=0.041) with an increased overjet (>4 mm) (P=0.001), increased overbite (P=0.023), and a higher need for orthodontic treatment when assessed using the

Table 2 Comparison of socio-demographic characteristics of bullied and non-bullied participants.

Variable	Total N in group	N (%) bullied	P value
Gender			
Male	201	22 (10.9%)	
Female	133	21 (15.7%)	0.240
Ethnicity			
Caucasian	320	42 (13.1%)	
Other	7	1 (14.3%)	0.770
Age (years)			
10	47	7 (13.9%)	
11	52	8 (15.4%)	
12	87	7 (8.2%)	
13	98	18 (18.6%)	0.650
14	49	3 (6.1%)	
Missing	3		

AC of IOTN (P=0.014).

Table 4 also compares the mean scores for individual subscales of $CPQ_{11–14}$, between a normal sample, non-bullied and bullied participants with a malocclusion. The normative data were derived from a sample recruited from both orthodontic and paediatric examination clinics.[28] Similar mean subscale scores were noted between the normal sample and the non-bullied participants. However, a considerable difference in mean subscale scores is apparent between bullied participants and non-bullied or normal samples. Bullied participants report higher levels of oral symptoms (P=0.032), functional limitations (P<0.001), emotional (P<0.001) and social impact (P<0.001) from their oral condition, resulting in negative impact on overall OHRQoL (P<0.001).

Table 3 Comparison of clinical characteristics of participants that had been bullied with those that did not report being bullied. Some missing data.

Variable	Total *N* in group	*N* (%) bullied	*P* value
Incisor relationship			
I	97	9 (9.3%)	
IIDiv1	156	29 (18.6%)	
IIDiv2	28	2 (7.1%)	0.041
III	48	3 (6.3%)	
DHC			
2	12	0 (0.0%)	
3	25	2 (8%)	
4	27	15 (55.6%)	0.310
5	165	26 (15.8%)	
AC			
2	1	0 (0.0%)	
3	1	0 (0.0%)	
4	6	0 (0.0%)	
5	16	1 (6.3%)	
6	50	1 (2.0%)	0.014
7	91	12 (13.2%)	
8	79	8 (10.1%)	
9	82	21 (25.6%)	
10	1	0 (0.0%)	
Skeletal pattern			
I	101	9 (8.9%)	
II	186	30 (16.1%)	0.170
III	42	4 (9.5%)	
FMPA			
Average	166	24 (14.5%)	
Increased	82	8 (9.8%)	0.580
Decreased	81	11 (13.6%)	
LFH			
Average	163	19 (11.7%)	
Increased	88	11 (12.5%)	0.520
Decreased	77	13 (16.9%)	
Overbite			
Average	89	14 (15.7%)	
Increased	142	24 (16.9%)	0.023
Decreased	96	5 (5.2%)	
Overjet			
<2 mm	42	2 (4.8%)	
2–4 mm	121	12 (9.95)	0.001
>4 mm	165	29 (17.6%)	
Missing	8		

Individual self-esteem subscales between normal samples, non-bullied and bullied participants with a malocclusion are compared in Table 5. The normal data were derived again from a non-orthodontic sample.[22] Similar mean subscale scores were noted between the normal sample and the non-bullied participants. However, a considerable difference of the mean subscale scores is evident between bullied participants and non-bullied or normal samples. Bullied participants report lower levels of social competence (P<0.001), athletic competence (P<0.001), physical appearance-related self-esteem (P<0.001) and general self-esteem (P<0.001) compared to non-bullied participants.

Regression analysis

A logistic regression analysis with the outcome variable bullied (yes versus no) and predictor variables gender, age (coded as five variables for ages 10, 11, 12, 13 and 14), IOTN AC (1–7 versus 8–10),[29] IOTN DHC (coded as separate variables for values 4 and 5) and the continuous variables from the self-esteem and quality of life measures was performed (Table 6). Being bullied is age-related: 10 years (P=0.003), 11 years (P=0.005) and 13 years (P=0.002), and predicated by low athletic competence (P=0.019) and elevated emotional impact (P<0.001). All variables were entered into a single model (Table 6). The goodness of fit was tested using the Hosmer–Lemeshow statistical analysis (chi-square= 9.51, df=8, P=0.030).

Discussion

This cross-sectional study involving an adolescent group referred for orthodontic assessment has found that the prevalence of peer victimization in orthodontic patients with an untreated malocclusion aged between 10 and 14 years was 12.8%. Both an increased overjet (>4 mm) and overbite were significantly associated with being bullied. Both features are commonly found in a Class II Division 1 incisor relationship, which was also significantly associated with being bullied.

IOTN AC and DHC were used to assess the need for treatment in our participants. Good intra- and inter-examiner reliability was reported. Bullied individuals have a higher need for orthodontic treatment as assessed

Table 4 Comparison of CPQ scores of participants that had been bullied with those that did not report being bullied.

Variable	Normative sample[28] (mean)	Non-bullied (mean)	Bullied (mean)	*P* value
Oral symptoms	5.4	4.7 (n=321)	5.7 (n=41)	0.032
Functional limitations	5.4	5.8 (n=322)	9.2 (n=42)	<0.001
Emotional impact	4.2	5.3 (n=329)	15.7 (n=43)	<0.001
Social impact	3.1	4.3 (n=326)	13.6 (n=40)	<0.001
Global view of oral health (1)		3.1 (n=333)	3.1 (n=43)	0.990
Global view of oral health on overall QoL (2)		2.2 (n=334)	3.3 (n=43)	<0.001

(1) Refers to single-item measure, range 1 'Poor' to 5 'Very good'.
(2) Refers to single-item measure, range 1 'Not at all' to 5 'Very much'.

by the AC of IOTN. Bullied children with a malocclusion also appear to report significantly lower levels of social competence, athletic competence, physical appearance related to self-esteem and general self-esteem compared to non-bullied individuals. Within this sample, bullied participants with a malocclusion reported significantly higher levels of oral symptoms, functional limitations, emotional and social impact from their oral condition and overall negative impact on OHRQoL compared to both non-bullied participants and a normal sample. In particular, logistic regression analyses reveal a significant correlation between emotional impact and being bullied.

The incidence reported in this study is comparable to non-orthodontic patients within the UK.[4] In non-orthodontic patients, the prevalence of bullying in orthodontic patients reduces with increasing age.[1,4] Logistic regression analyses confirmed a significant association between age and being bullied. It is well established that younger children are more vulnerable to bullying by older peers.[4] No correlation was detected between being bullied and social-demographic variables including gender, source of referral and ethnicity. Regarding gender, the findings of this study are consistent with previous research.[4,5] A binary coding for IOTN AC (1–7 versus 8–10)[29] was chosen to allow assessment of two levels of outcome variables in the regression model. Logistic regression analyses failed to reveal a significant association between dentofacial aesthetics or treatment need assessed using IOTN AC/DHC and being bullied. This may suggest that both IOTN AC and DHC are poor predictors of peer victimization. Low ratings of dental attractiveness have been previously reported to be associated with a negative impact of self-esteem.[12,26] It may be that factors other than a malocclusion have a greater influence on whether a child is bullied, e.g. age of the child, social and physical competence. Another consideration is that the aesthetic component of IOTN although validated among professionals, correlates poorly with lay opinion as to what constitutes a need for treatment.[29]

The relationship between self-esteem, OHRQoL and malocclusion is complex. It has been reported that there is no apparent association between self-esteem and the presence or absence of treatment for a malocclusion in a longitudinal cohort study.[13] However, a relationship can exist on an individual basis.[30] Agou *et al.*[18] suggested that the relationship between self-esteem, OHRQoL and malocclusion could be affected by other factors. However, gender, social class and ethnicity have been reported to have no significant impact on self perception of malocclusion.[12] Conversely, the primary aims for seeking treatment should be considered. External factors such as peer acceptance, parental wishes and status seeking could play a role in the motivating factor for treatment, but also influence self-esteem and OHRQoL of an individual.

Table 5 Comparison of Harter's self-esteem characteristics of participants that had been bullied with those that did not report being bullied.

Variable	Normative sample[22] (mean)	Non-bullied (mean)	Bullied (mean)	*P* value
Scholastic competence	2.62	2.85 (n=309)	2.67 (n=35)	0.075
Social competence	2.96	3.01 (n=307)	2.36 (n=37)	<0.001
Athletic competence	2.64	2.78 (n=310)	2.34 (n=36)	<0.001
Physical appearance	2.32	2.66 (n=308)	2.38 (n=37)	<0.001
Behavioural conduct	2.76	2.98 (n=313)	2.85 (n=37)	0.190
General mean	2.86	3.00 (n=307)	2.57 (n=35)	<0.001

Table 6 Results of logistic regression with a dependent variable of whether or not the participant reported being bullied.

Factor	Odds ratio	95% CI (lower–upper)	*P* value
IOTN AC			
Two groups: 1–7 and 8–10	0.758	0.214–2.690	0.668
Age			
10	0.006	<0.001–0.128	0.001
11	0.015	<0.001–0.258	0.005
12	0.078	0.006–1.086	0.058
13	0.012	0.001–0.192	0.002
IOTN DHC			
DHC4	0.462	0.045–4.802	0.518
DHC5	0.444	0.041–4.762	0.503
Gender			
Male Female	1.940	0.588–6.403	0.277
Harter's			
Harter scholastic competence	0.841	0.256–2.769	0.776
Harter social competence	0.488	0.190–1.256	0.137
Harter athletic competence	0.027	0.088–0.827	0.022
Harter physical appearance	0.867	0.190–3.4955	0.854
Harter behavioural conduct	0.746	0.250–2.226	0.599
Harter general mean	1.816	0.411–8.025	0.431
Child Perceptions Questionnaire			
Oral symptoms	0.845	0.681–1.049	0.126
Functional limitations	0.894	0.762–1.049	0.170
Emotional impact	1.253	1.115–1.409	<0.001
Social impact	1.101	0.976–1.241	0.117
Constant	<0.001		0.003

Model chi-square=95.80, R^2=0.31.

The findings of this study report a global negative impact on a bullied individual's self-esteem. This is consistent with the previously described traits or personalities of victims of bullying. Victims are portrayed as anxious, insecure, cautious, sensitive, quiet and withdrawn. Within social interactions, victims often take up a submissive role and show a lack of assertiveness.[31] The presence of poor dentofacial aesthetics could further influence the physical appearance domain resulting in low self-esteem. The severity and importance of bullying of children with a malocclusion and self-esteem is highlighted by the fact that four of six domains are negatively affected reflecting the widespread effect on an individual's 'self-worth'. Logistic regression analyses reveal a significant association between low athletic competence and being bullied. Interestingly, bullying has been associated with victims who are perceived as smaller and weaker than their peers.[32,33] Although not demonstrated by the regression analysis, it is reasonable to assume that perceived low athletic competence could be influenced by physical appearance including facial disharmony. The self-perception of dentofacial aesthetics as opposed to the severity of the malocclusion has been reported to have a greater effect on self-esteem and self-concept.[34] This raises an interesting issue: is it the presence and severity of the malocclusion or peer victimization that has a negative effect on self-esteem? Our results show that extremes of overjet, overbite and incisor relationship are significantly associated with bullying and negative impact of self-esteem; hence, it is reasonable to conclude that a synergistic effect occurs.

The presence of a malocclusion has been reported to have a negative impact on a child's OHRQoL.[14,15] It has previously been reported that malocclusion has a significant impact on both emotional and social domains, suggesting that the presence of a malocclusion primarily has a psycho-social effect.[14,15] It is not surprising that bullying affects a child both emotionally and socially as comments regarding dental appearance have been reported to be more hurtful and upsetting in comparison to other physical features.[8] It is unclear whether higher levels of oral symptoms and functional limitations are directly related to the malocclusion or amplified by low levels of self-esteem or peer victimization. This is highlighted by the case of a child with Class

II Division 1 incisor relationship with increased overjet and overbite. These traits are correlated with bullying, but the child may also experience oral symptoms due to the malocclusion itself such as trauma to the palatal mucosa due to the increased overbite or trauma to the upper incisors as a result of the increased overjet. A functional limitation could arise due to the failure to create an oral seal due to lip incompetency. In addition, males are often subjected to direct (physical) forms of bullying including kicking and punching, which could result in trauma to the dentition. In our sample, an increased overjet is associated with bullying. Interestingly, Johal *et al.*[16] reported a negative impact on OHRQoL when an overjet of greater than 6 mm was present. Again, it remains unclear whether the negative impact on OHRQoL is due to the presence of the malocclusion or to peer victimization. It is therefore not unreasonable to suggest that both factors may again have a synergistic effect resulting in low self-esteem and a negative impact on OHRQoL. It is clear from the present study that the presence of a malocclusion coupled with peer victimization results in a negative impact on OHRQoL.

The age range of the participants was specifically chosen on the basis that a high prevalence of bullying has been reported within this age group and this is the age when the majority of orthodontics is started on adolescents in the UK.[4,5] Both factors enhance the validity of the results reported in this study. Three methods have previously been used to report the prevalence of peer victimization in school-aged children: direct interviews, peer nomination and self-report questionnaires. However, interviews have poor reliability for the study of peer victimization due to the possibility of participants to choose not to disclose painful events and denial of bullying during direct questioning.[5] Questionnaires have been commonly used to investigate teasing and bullying in cross-sectional studies. Potential limitations include: bias, differences in participant's interpretation of teasing or bullying, difficulty in recalling events and failure to clearly differentiate between victims and bullies.[35,36] The Olweus Bully/Victim Questionnaire[19] was specifically used in this study to reduce these limitations and enhance the validity of the results. This questionnaire is separated into two distinct components: one related to victims of bullying and the other related to bullies. Despite only using the former component, none of the questions were modified to ensure that validity was maintained. Reported benefits include: a clear definition of bullying which is emphasized at the beginning of the questionnaire, a specific reference period is used for participants to recall bullying events, questions are specific for bullying events occurring at school and responses to key questions are clear and allow the use of a coded five-point scale during interpretation of the questionnaire.[1,35] A further major advantage of this questionnaire is that a specific response has been deemed as a meaningful and useful lower-bound cutoff point for identifying victims or bullies in 10–16 year olds.[35] This was adhered to in this study. All participants were instructed to complete the questionnaires in a separate room away from the clinics without the assistance of parents or guardians in order to eliminate further sources of bias.

The Harter's Self Perception profile for Children measures competence in five domains, but also the individual's global 'self-worth'. This is important as it is commonly recognized that self-esteem cannot be gauged from a single domain alone and should be considered as multi-dimensional concept. In addition, an individual may feel that a particular domain has a greater effect on their self-esteem compared with other domains. This may be particularly relevant in individuals who are bullied due to the presence of a malocclusion. This questionnaire has been reported to have good validity and reliability.[21]

A small amount of socio-demographic and clinical data was absent from the complete dataset. However, this was unlikely to influence the findings of the study as this was accounted for during the statistical analysis.

Despite a significant relationship between being bullied and a higher need of treatment assessed using IOTN AC (>7) reported, a relationship was not detected in the regression analysis. This may appear contradictory but is due to the arbitrary division of IOTN AC into a binary outcome. Therefore, this is a weakness in the analysis as opposed to a lack of patients with high AC.

A potential source of bias in this study is that all participants were recruited from a population referred to hospital for orthodontic treatment. This explains the high-number IOTN grades 4 and 5 malocclusions within this sample. Future investigations may be considered in a primary care setting to determine the incidence of bullying and subsequent impact on self-esteem and OHRQoL in less severe malocclusions. However, it is interesting to note that teasing related to occlusal features such as prominent teeth[8] and deep overbite[10] has been reported in children recruited in non-secondary care environments such as schools.

The use of the CPQ_{11-14}[23] may be considered inappropriate in children aged 10 years. However, the level of comprehension and understanding of 10 and 11 year olds is likely to be similar. No issues were raised regarding the understanding of the questionnaires by

10-year-old participants recruited into the study. Furthermore, the Child Perception Questionnaire 8–10 year olds ($CPQ_{8–10}$) was developed directly from the questions used in the $CPQ_{11–14}$.[37]

Direct comparison to previous research conducted using orthodontic patients is difficult. A fundamental difference is the definition of peer victimization that has been used. The term 'teasing' is commonly used and has been defined as 'repeated comments made about one or more physical or social characteristic of a child in order to make fun of him or her'.[8] A comparison with the Olweus bullying definition[1] reveals significant differences including the lack of distinction between direct or indirect forms of aggression and the intention of the comments, i.e. to cause harm; hence, the results of the previous studies may not fully highlight the severity of bullying in orthodontic patients.[8,10,11]

Conclusions

- A significant relationship exists between an individual being bullied, the presence of malocclusion and poor self-esteem and OHRQoL.
- Occlusal traits associated with being bullied are: Class II Division 1 incisor relationship and an increased overjet and overbite.
- Individuals who are bullied due to the presence of a malocclusion have a higher need for orthodontic treatment as assessed by the AC of IOTN.

Contributors

Jadbinder Seehra was responsible for ethical approval, questionnaire design, patient recruitment, data collection and drafting of the manuscript. Padhraig Fleming was responsible for data collection. Andrew DiBiase was responsible for study design, ethical approval, patient recruitment, critical revision and final approval of manuscript. Tim Newton was responsible for ethical approval, data analysis and interpretation and final approval of manuscript. Andrew DiBiase is the guarantor.

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