Original Article

Bullying in schoolchildren and its relationship to malocclusion accounting for demographic and psychosocial factors: a cross-sectional study of 10- to 14-year-olds in the United Kingdom

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ABSTRACT

Objectives: To investigate the prevalence of bullying in schoolchildren and its relationship with malocclusion, accounting for demographic and psychosocial factors.

Materials and Methods: This was a cross-sectional study on 10–14-year-old schoolchildren in the United Kingdom. Clinical examination was undertaken measuring Index of Orthodontic Treatment Need (IOTN), overjet, overbite, and crowding or spacing. Questionnaires were used to measure bullying, oral health-related quality of life (OHRQoL), self-esteem (SE), loneliness, and behavioral and emotional difficulties.

Results: Of 698 participants, 68 reported being bullied (9.7%). No difference was found in prevalence for gender, ethnicity, or age. Increased prevalence was found in participants with overjet $>$ 6 mm ($P = .02$) and great need for treatment (IOTN Dental Health Component 5 $P < .001$, Aesthetic Component 9–10 $P = .008$). Bullied participants reported lower OHRQoL ($P < .001$) and SE ($P < .001$) and higher levels of loneliness ($P < .001$), emotional symptoms ($P < .001$), conduct problems ($P = .002$), and peer problems ($P < .001$). Multivariate analysis showed that being bullied was related to higher levels of loneliness ($P = .007$), poor peer relations ($P < .001$), and increased overjet ($P = .032$).

Conclusions: Accounting for psychosocial factors, risk of being a victim of bullying was related to malocclusion, specifically an increased overjet. (*Angle Orthod*. 0000;00:000–000.)

KEY WORDS: Bullying; Malocclusion

INTRODUCTION

Appearance is one of the most common reasons for being bullied, and a large proportion of children and adolescents reporting being bullied as a motivating factor for seeking orthodontic treatment.[1,2] Bullying has been defined as the systematic abuse of power and is characterized by a power imbalance, repetition, and an intention to cause harm.[3] Despite greater awareness and prevention programs, bullying remains a global problem.[4] In the United Kingdom, 17% of 10- to 15-year-olds report being bullied,[5] while globally, the prevalence is 7% to 74%.[4]

The risk of being bullied is related to many factors, both individual and contextual.[6] Individual factors include ethnicity, age, and gender and behavioral factors including social competence, externalizing or internalizing behavior, and academic performance, while contextual factors relate to the family or home environment and income, school climate, peer relationships, and prior victimization.[7–9] Being bullied

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results in psychosomatic symptoms, depression and anxiety, loneliness and isolation, self-harm and suicidality, low self-esteem (SE), absenteeism from school, and poor academic achievement.[10–13] The effects of bullying extend into adulthood, resulting in higher levels of loneliness, depression, anxiety, and suicidality.[14]

Features of malocclusion that have been associated with bullying are increased overjet, deep overbite, a severe or esthetically handicapping malocclusion, spacing or missing teeth, and crowding.[15,16] The bullying is usually verbal and associated with lower oral health-related quality of life (OHRQoL) and SE.[15,17] However, the heterogeneous nature of the methodologies used makes the quality of this evidence very low.[16,18] Different definitions and measurements of bullying have been used, often using unvalidated questionnaires. The features of malocclusion are often self-reported without clinical assessment. Where clinical examination has been carried out, different measures of malocclusion have been used, or it was carried out on a sample referred for treatment, potentially leading to selection bias. Statistical analyses often report simple univariate analysis without accounting for confounding factors.[19] Therefore, to date, evidence that having a malocclusion makes an individual more susceptible to being bullied is lacking.

The aims of this study were to investigate:

(1) the relationship between malocclusion and bullying in a sample of schoolchildren and
(2) whether this relationship remains, accounting for other variables including gender, age, ethnicity, SE, OHRQoL, peer relationships, and behavioral or emotional issues.

MATERIALS AND METHODS

This was a cross-sectional study. Ethical approval was obtained from the London-Surrey Research Ethics Committee (17/LO/0791).

Participants

The study was carried out on 10–14-year-old schoolchildren, the age group with the highest rates of bullying and the age when most seek treatment.[5,20] The sample was collected from schools in the Southeast of the United Kingdom that agreed to participate, based on location for practicality of data collection and sociodemographics aiming at making the sample as representative as possible.

Data Collection

Data were collected on two separate occasions. Initially, the psychosocial data were collected via a series of questionnaires administered in paper form or online via Qualtrics (Qualtric XM, Provo, Utah) by a team of psychologists (Z.C. and M.R.). The clinical data were collected at a subsequent visit (A.D.).

Measure of Bullying

To measure the prevalence of bullying, a shortened version of the Olweus bullying questionnaire was used.[21] This starts with a definition of bullying followed by a series of questions on the frequency and nature of bullying set within a timescale of 2 months. Based on the question, "How often have you been bullied at school in the past couple of months?" the sample was dichotomized into nonbullied or bullied, the latter having been defined as a frequency of being bullied of 2 or 3 times a month or greater.[22]

Measurement of OHRQoL

Two measures of OHRQoL were used, one generic and one trait specific. The generic measure used was the Child Oral Health Impact Profile (COHIP) short form.[23] This provides an overall score and scores for the domains of oral health, functional well-being, and socioemotional well-being. The trait-specific measure used was the Malocclusion Impact Questionnaire (MIQ).[24,25]

Self-esteem

SE was measured using the Rosenberg scale.[26] This is a 10-item scale using a Likert scale format from *strongly disagree* to *strongly agree* that measured global self-worth by measuring both positive and negative feelings about self.

Peer Relationships

This measure was based on the Cassidy and Asher Loneliness and School Dissatisfaction Questionnaire.[27] A shortened version that has previously been described was used.[28] It gives an overall cumulative score with lower scores indicating higher levels of loneliness.

Behavior and Emotional Difficulties

This was measured using the Strengths and Difficulties Questionnaire (SDQ).[29] It consists of 25 items, covering five domains: emotional symptoms, conduct problems, hyperactivity or inattention, peer relationship problems, and prosocial behavior. The first four of these are added together to give a total score based on 20 items.

Clinical Examination

Clinical examination was carried out by a consultant orthodontist (A.D.). This was undertaken with the participant seated and illuminated with an angle posed

light, using a dental mirror and a ruler. The clinical data collected included:

- Index of Orthodontic Treatment Need (IOTN) Dental Health and Aesthetic components (DHC and AC),
- Incisor relationship,
- Overjet,
- Overbite,
- Crowding or spacing, and
- Orthodontic treatment status.

Approximately 10% of the sample were re-examined on a separate occasion by the same examiner to test for intraexaminer reproducibility.

All data were anonymized and coded and entered into a spreadsheet in SPSS version 26.0 (SPSS Inc., Chicago, Ill).

Sample Size Calculation

The percentage of schoolchildren that have reported bullying varies across sources from 5% to 20%.[30] In the United Kingdom, 44% of 12-year-olds have been found to a have a need for orthodontic treatment or are undergoing treatment.[20] The aim was to ensure enough participants were recruited who reported being bullied for comparison between those with or without a malocclusion using χ^2 analysis. Based on the consensus that, for a 2×2 contingency table (bullying: yes or no, malocclusion: yes or no), when testing using χ^2 analysis of independence, at least 80% of the expected cell values should be at least 5 or higher, recruitment of 1000 participants was planned, aiming at identifying at least 50 cases of bullying.

Statistical Analysis

Descriptive statistics were calculated for all measures. The sample was dichotomized into bullied or nonbullied.[22] Shapiro-Wilks testing found the sample was not normally distributed. Therefore, for nominal and ordinal data, χ^2 tests were used to investigate whether bullying and other variables were independent. Where the expected cell frequencies were less than 5, the Fisher exact test was used. For continuous data, the Mann-Whitney *U*-test was used.

From this, factors that were found to be statistically significantly related to bullying were entered into a multivariate logistic regression model. Testing for multicollinearity was undertaken using a variance inflation factor, and the model was fit using a likelihood of ratio test and Nagelkerke's R^2. All statistical testing was undertaken using JAMOVI (Version 2.3.21.0).

RESULTS

Participants

Initial exploratory results were reported previously and are summarized here.[17] Fifty-three schools were contacted; 16 agreed to take part. These were all state-funded schools: 8 primary (aged 4 to 11 years old) and 8 secondary (aged 11 to 18 years old). All the primary schools were mixed schools, ie, no selection criteria were based on gender or academic achievement. Two of the secondary schools were selective based on an entrance examination, one mixed and one single sex (girls only). The other six were nonselective, five being mixed sex and one single sex (girls only). *Single sex* is the term used by the Local Education Authority to refer to schools that educate either male or female pupils.

Data were collected between December 2017 and December 2019, concluding early due to the COVID-19 pandemic. Nine hundred forty-eight students consented to take part, 768 completing questionnaires and 755 undergoing clinical examination, resulting in complete datasets for 698 participants, out of a potential recruitment of 3750, a 25% recruitment rate.

Reproducibility and Reliability

Weighted κ was 0.953 for IOTN DHC and 0.903 for IOTN AC (almost perfect agreement). Internal reliabilities were measured using Cronbach's α coefficients: SE = 0.871, SDQ = 0.814, loneliness = 0.847, MIQ = 0.905, and COHIP = 0.871, indicating good or excellent internal reliability for all measures.

Social Demographics and Bullying

The overall prevalence of bullying was 9.7%. Its relationship to age, gender, and ethnicity is shown in Table 1. No relationship was found for any of the variables (*P* values > 0.14).

Malocclusion and Bullying

The relationship between bullying and malocclusion is shown in Table 2. A significant relationship was found between bullying and overjet of greater than 6 mm (χ^2[df = 1, $N = 693$] = 5.66, $P = .02$), IOTN AC 9–10 (χ^2[df = 1, $N = 695$] = 7.13, $P = .008$), and IOTN DHC 5 (χ^2[df = 1, $N = 696$] = 12.0, $P < .001$). No relationship was found for incisor relationship, overbite, crowding or spacing, or orthodontic treatment (all *P* values $> .23$).

OHRQoL and Bullying

The relationship between bullying and OHRQoL is shown in Table 3. A significant difference in the

Table 1. Comparison of the Sociodemographic Characteristics in the Bullied and Nonbullied Groups

Variable	Total in Group, No.	Bullied, No. (%)	*P* Value
Age			.17
10	94	14 (14.9%)	
11	118	11 (9.3%)	
12	241	26 (10.8%)	
13	150	8 (5.3%)	
14	75	6 (8.0%)	
15	14	2 (14.3%)	
Gender			.34
Male	275	32 (11.6%)	
Female	421	36 (8.6%)	
Other	2	0 (0%)	
Ethnicity			.14
White	490	53 (10.8%)	
Asian	63	1 (1.6%)	
Black, African, or Caribbean	46	5 (10.9%)	
Mixed or multiple	55	7 (12.7%)	
Other ethnic group	18	1 (5.6%)	
Rather not say	26	1 (3.8%)	

COHIP scores was found between the bullied and nonbullied groups for oral health ($U = 13{,}832$; $P < .001$), functional well-being ($U = 13{,}178$; $P < .001$), social and emotional well-being ($U = 12{,}221$; $P < .001$), and overall ($U = 11{,}484$; $P < .001$), and for MIQ ($U = 12{,}628$; $P < .001$).

Psychosocial Factors and Bullying

The relationship between bullying, SE, behavior or emotional symptoms, and peer relationships is shown in Table 4. A significant difference was found between the bullied and nonbullied groups for SE ($U = 13{,}998$; $P < .001$), loneliness ($U = 9472$, $P < .001$), emotional symptoms ($U = 15{,}086$; $P < .001$), conduct problems ($U = 16{,}231$; $P = .002$), peer problems ($U = 80{,}827$; $P < .001$), and total ($U = 12{,}155$; $P < .001$), but not for prosocial behavior ($U = 20{,}827$; $P = .94$) or hyperactivity ($U = 18{,}465$; $P = .11$).

Logistic Regression

Table 5 shows the multivariate logistic regression analysis. Due to high levels of multicollinearity for total COHIP and SDQ and their subgroups (Variance Inflation Factor > 5), the overall scores were not entered into the model. The only variables that were statistically significantly related to being bullied were overjet (odds ratio [OR] $= 1.15$, $P = .032$), peer problems (OR $= 1.47$, $P < .001$), and loneliness (OR $= .40$, $P = .007$). The likelihood ratio test was significant ($\chi^2 = 101$, df $= 12$, $P < .001$), and the Nagelkerke's R^2 (0.30) showed a moderate relationship between the predictors and bullying.

Table 2. Comparison of Clinical Characteristics in the Bullied and Nonbullied Groups[a]

Variable	Total in Group, No.	Bullied, No. (%)	*P* Value
Incisor relationship			.23
I	358	33 (9.2%)	
II Div1	175	23 (13.1%)	
II Div2	87	7 (8.0%)	
III	74	4 (5.4%)	
Overjet			.02
≤6 mm	618	54 (8.7%)	
>6 mm	75	13 (17.3%)	
Overbite			.70
Average	320	27 (8.4%)	
Increased	238	27 (11.3%)	
Reduced	137	13 (9.5%)	
Anterior openbite	1	0 (0.0%)	
Crowding or spacing			.39
Aligned	175	11 (6.3%)	
Mild crowding	304	35 (11.5%)	
Moderate crowding	34	3 (8.8%)	
Severe crowding	38	5 (13.2%)	
Spacing	145	13 (9.0%)	
IOTN DHC			<.001
IOTN DHC 1–4	611	50 (8.2%)	
IOTN DHC 5	85	17 (20.0 %)	
IOTN AC			.008
IOTN AC 1–8	653	58 (8.9%)	
IOTN AC 9–10	42	9 (21.4%)	
Orthodontic treatment			.30
Not in treatment	537	54 (9.1%)	
In treatment	92	13 (12.4%)	

[a] AC indicates Aesthetic Component; DHC, Dental Health Component; and IOTN, Index of Orthodontic Treatment Need.

DISCUSSION

In this study, we found a prevalence of bullying of 9.7% and a relationship between being bullied and increased overjet (>6 mm) and a severe, esthetically handicapping malocclusion (IOTN DHC 5, AC 9–10). We showed that being bullied was associated with lower OHRQoL and SE; greater loneliness; and higher behavioral, emotional, and peer problems. Logistic regression confirmed that having an increased overjet, greater loneliness, and higher levels of peer problems were associated with being bullied. No association was found for age, gender, or ethnicity.

The COVID-19 pandemic impacted this study, meaning recruitment had to be stopped before the ideal sample size was obtained. However, the estimation of the prevalence of bullying used was conservative, and more than the minimal number of bullied participants were recruited. As participation in this study was voluntary at both the school and individual level, due to nature of the research and the topic being investigated, this may have discouraged participation, leading to selection bias. Although the sample overall was large, a greater number of females was recruited

Table 3. Comparison of Oral Health-Related Quality of Life Scores for the Bullied and Nonbullied Groups

Variable	Mann-Whitney *U*-Test	Nonbullied, Mean	Bullied, Mean	*P* Value
COHIP oral health	13,832	14.43 (n = 622)	11.88 (n = 67)	<.001
COHIP functional well-being	13,178	13.45 (n = 621)	10.95 (n = 67)	<.001
COHIP socioemotional well-being	12,221	29.08 (n = 622)	23.20 (n = 67)	<.001
COHIP overall	11,484	57.01 (n = 621)	46.02 (n = 67)	<.001
MIQ	12,628	6.79 (n = 622)	11.58 (n = 67)	<.001

[a] COHIP indicates Child Oral Health Impact Profile; MIQ, Malocclusion Impact Questionnaire.

than males, which may have impacted findings. This was due to the schools that agreed to participate in the study, and while similar bullying rates were reported between genders, future research is needed on the role of gender in the relationship between bullying and malocclusion.

In this study, we focused primarily on the relationship between bullying and malocclusion, although it included other potential predictive factors. Nagelkerke's R^2 was 0.3, showing a moderate relationship. This would suggest other factors are involved that were not identified or measured, the risk of being bullied being complex and multifactorial.[6,8] The results of this study, therefore, need to be viewed with a degree of caution. Finally, as this was a cross-sectional study, while we could test for relationships, we could not draw any conclusions about causality.

The results of this study supported previous research in which an association between malocclusion and bullying was shown, specifically an increased overjet and a severe, esthetically handicapping malocclusion.[15,16,18] Using multivariate testing, only increased overjet remained. This may have been, in part, due to a high degree of multicollinearity between IOTN and overjet, indicating that an increased overjet is the trait of malocclusion that has greatest association with bullying.

Being bullied was associated with poorer OHRQoL and lower SE, as has previously been reported.[11,15,31–33] The relationship with SE has been described as transactional, whereby there is interaction over time with victimization, leading to lower levels of SE, which in turn leads to greater risk of victimization.[34] This may help explain why, in this study, while low SE was related to being bullied, it was not predictive when other factors were considered. A negative relationship between behavioral or emotion difficulties, peer problems, and bullying was found. Similar relationships have previously been reported.[8] Loneliness in adolescence has also been found to be a predictor of bullying victimization, again supported by the findings in the current study.[35]

Overall, the model presented supports the previously described relationship between bullying and malocclusion, particularly an increased overjet. The sample used was nonclinical and could be expected to be more representative, giving it greater ecological validity. Other potential predictors were also investigated that have been linked to bullying but have not been previously reported in relation to malocclusion. Even with their inclusion, increased overjet remained a risk factor for being bullied.

CONCLUSIONS

- A bullying rate of 9.7% was found in a sample of 10–14-year-old schoolchildren.
- Higher prevalence of bullying was found in individuals with a severe, esthetically handicapping malocclusion with an increased overjet (IOTN DC 5 AC 9–10, overjet > 6 mm).
- Bullied individuals had lower OHRQoL and SE, higher levels of loneliness, greater emotional or behavioral problems, and poorer peer relationships.
- Having an increased overjet, poor peer relationships, and being lonely are all risk factors for being bullied.

Table 4. Comparison of Self-Esteem, Loneliness, and Strength and Difficulties Scores for the Bullied and Nonbullied Groups[a]

Variable	Mann-Whitney	Nonbullied, Mean	Bullied, Mean	*P* Value
Self-esteem	13,998	3.71 (n = 624)	3.18 (n = 66)	<.001
Loneliness	9472	3.49 (n = 621)	2.92 (n = 68)	<.001
SDQ emotional symptoms	15,086	3.21 (n = 624)	4.46 (n = 67)	<.001
SDQ conduct problems	16,231	1.86 (n = 624)	2.70 (n = 67)	.002
SDQ hyperactivity	18,465	3.93 (n = 624)	4.52 (n = 67	.11
SDQ peer problems	8087	1.60 (n = 624)	3.63 (n = 67)	<.001
SDQ prosocial behavior	20,827	7.93 (n = 625)	7.75 (n = 67)	.943
SDQ total	12,155	10.60 (n = 624)	15.32 (n = 67)	<.001

[a] SDQ indicates Strengths and Difficulties Questionnaire.

Table 5. Multivariate Logistic Regression Analysis With the Dependent Variable Whether a Participant Reported Being Bullied (Yes/No)[a]

Factor	Adjusted OR (95% CI)	*P* Value
IOTN AC		
Two groups: 1–8 and 9–10	1.54 (0.51, 4.16)	.44
IOTN DHC		
Two groups: 1–4 and 5	1.77 (0.79, 3.94)	.16
Overjet	1.15 (1.01, 1.3)	.032
COHIP		
Oral health	0.98 (0.89, 1.07)	.61
Functional well-being	0.92 (0.82, 1.03)	.14
Social or emotional	0.96 (0.90, 1.02)	.67
MIQ	0.98 (0.92, 1.04)	.47
Self-esteem	1.14 (0.73, 1.75)	.56
Loneliness	0.40 (0.21, 0.78)	.007
SDQ		
Emotional symptoms	0.98 (0.85, 1.14)	.81
Conduct problems	0.97 (0.82, 1.15)	.72
Peer problems	1.47 (1.22, 1.78)	$<$.001

[a] AC indicates Aesthetic Component; CI, confidence interval; COHIP, Child Oral Health Impact Profile; DHC, Dental Health Component; IOTN, Index of Orthodontic Treatment Need; MIQ, Malocclusion Impact Questionnaire; OR, odds ratio; and SDQ, Strengths and Difficulties Questionnaire.

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