Evidence about the physical, psychological and social consequences of malocclusion as they relate to quality of life is still conflicting. Although studies generally report an association between malocclusion and quality of life scores, the strength of evidence is relatively low and there is a need for using standardised methods to enhance comparability. Unsurprisingly, most evidence comes from studies in children and adolescents, as they represent the largest groups seeking orthodontic treatment. However, the number of adults demanding orthodontic care has grown rapidly over recent years. Adult patients are concerned with improving their appearance and social acceptance more often than they are with improving their oral function or health. Whether malocclusion has similar psychosocial impacts on quality of life in adults as in younger age groups still remains uncertain.

To date, few studies have assessed the effects of malocclusion on quality of life among adults, and almost all of them have focussed on young adults (i.e. usually between the ages of 16 and 25 years). Furthermore, these studies have used indices of orthodontic treatment need to assess malocclusion. The use of epidemiological indices makes the translation of findings to the clinical context difficult, as they are not routinely used by clinicians. The Angle classification, which is based on the anteroposterior relationship of the maxillary to the mandibular first molars, remains the most commonly used classification of malocclusions, and its universal acceptance by the dental
profession is evidence of its practicality. The only previous study among adults showed that patients with malocclusion Class II or III (combined in a single group) had poorer quality of life, as measured by the short form of the Oral Health Impact Profile (OHIP-14), than those with Class I malocclusion or normocclusion (combined in a single group). No information on which OHIP-14 domains were most affected by malocclusion was reported by the authors.

Therefore, the purpose of this study was to compare the social impact of malocclusion on quality of life between adult patients with Angle Class I, II and III malocclusion.

MATERIALS AND METHODS

Participants

This cross-sectional study was based on a convenience sample of hospital volunteers. A total of 222 patients were consecutively recruited from those attending the Orthodontic Clinic of Khyber College of Dentistry in Peshawar (Pakistan) between June and September 2012. All adults aged 16 years old or older, who understood Urdu (national language) and who attended the Orthodontic Clinic for the first time were invited to participate. Those with cleft lip and palate, incomplete dental treatment, periodontal diseases, untreated dental caries or any other systemic illness were excluded. A minimum sample size of 120 adults (40 in each of the three Angle malocclusion groups) was required to estimate a mean difference in the OHIP-14 total score equal to or greater than 5 units between two of those groups (based on the minimally important difference for the OHIP-14), with an 80% statistical power and 95% confidence level and a common standard deviation. Patient recruitment stopped when the minimum sample size required for all groups was achieved.

The study protocol was approved by the King’s College London Research Ethics Committee (BDM/11/12-100) and the Ethics Research Committee of Khyber College of Dentistry, Peshawar, Pakistan (KCD/Ortho/2255). Written informed consent from participants was obtained before participation.

Data collection

Data were collected through self-administered questionnaires and directly from clinical records. The questionnaire collected data on OHRQoL and demographic characteristics. OHRQoL was measured using the OHIP-14, which contains 14 questions on the frequency of adverse impacts caused by oral conditions during the preceding 12 months in seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap. Respondents were asked to rate each item on a 5-point ordinal scale coded 0 ‘never’, 1 ‘hardly ever’, 2 ‘occasionally’, 3 ‘fairly often’ and 4 ‘very often’. The OHIP-14 score is the sum of responses and ranges from 0 to 56, with higher scores indicating poorer OHRQoL. Domain scores are also calculated by summing up the two corresponding items in that domain, with scores ranging from 0 to 8. The OHIP-14 was cross-culturally adapted to the Urdu language using the backward translation method. For validity assessment, the OHIP-14 was significantly correlated with other perceived measures, including self-rated oral health, satisfaction with dental appearance and perceived need for orthodontic need (Spearman correlation coefficients of 0.49, 0.45 and 0.24, respectively, all p < 0.05). The reliability of the OHIP-14 was assessed in terms of internal consistency and test-retest reliability. Cronbach’s alpha for the full instrument was 0.889, while the intraclass correlation coefficient (ICC) for duplicate administrations of the OHIP-14 on 30 patients one week apart from each other was 0.964 for the full instrument and ranged between 0.655 and 0.977 for specific domains.

Clinical measurements were obtained from the patients’ records after obtaining informed consent. Patients’ type of malocclusion was classified according to Angle’s classification, which is based on the position of the mandible in relation to the maxilla during clinical examination: having Class I (both maxilla and mandible have a good antero-posterior relation), Class II (maxilla is advanced) or Class III malocclusion (mandible is advanced).

Statistical analysis

Domain and total scores were positively skewed, suggesting the use of nonparametric tests. However, we used the multivariante analysis of variance (MANOVA) to compare, first jointly and then individually, the seven domains and the total score for OHIP-14. Post-hoc comparisons between pairs of malocclusion groups were conducted using Scheffe’s test and only when omnibus tests were statistically significant.
RESULTS

This study included 222 adults (134 men and 88 women). Participants had a mean age of 28.8 years (± 9.9), with most of them (79.2%) aged between 18 and 34 years. The distribution of the sample by Angle malocclusion groups is reported in Table 1. Forty-two (18.9%) and 41 (18.5%) participants were classified as having Class II and III malocclusion, respectively.

The mean OHIP-14 total score was 12.84 units (SD: 9.89; range: 0–41). There were 17 participants (7.7%) with floor effects (i.e. zero total score) but no participants with ceiling effects (i.e. maximum total score). The domains with the highest mean scores were physical pain (2.82 ± 2.15), psychological discomfort (2.27 ± 2.03) and psychological disability (2.14 ± 2.00), whereas the domains with the lowest mean scores were functional limitation (1.25 ± 1.58), social disability (125 ± 1.70) and handicap (1.27 ± 1.66) (Table 2).

The omnibus test for the joint comparison was significant (Wilks’ Lambda test, p = 0.010), indicating that at least one of the eight outcome measures differed between malocclusion groups. Individual ANOVA tests showed that the OHIP-14 total score and the domain scores for physical disability, psychological disability and social disability were significantly different between malocclusion groups (all p < 0.014). In subsequent comparisons by pairs, it was found that adults with Class III malocclusion had significantly higher OHIP-14 total and domain scores than those with Class I malocclusion, but there were no differences between other malocclusion groups. Differences of around 1 unit in domain scores and 5 units in the total score were found between Class I and III malocclusion groups (Table 4). There were no differences in OHIP-14 domain and total scores by sex (Wilks’ Lambda test, p = 0.155), but higher scores were found in older groups (Wilks’ Lambda test, p = 0.020). The interaction term of malocclusion group, sex and age was not significant (Wilks’ Lambda test, p = 0.105).

DISCUSSION

This study shows that adults’ perceptions of quality of life vary according to their type of malocclusion. This was particularly relevant for patients with Class III malocclusion who reported poorer quality of life.
of life than those with Class I malocclusion. Although this finding is in line with those from the only previous study among adults, a smaller difference in the OHIP-14 total score between groups was found in our sample (5 vs 13 units, respectively). It is worth noting that Frejman et al combined patients with normocclusion and malocclusion Class I in their ‘control’ group and patients with malocclusion Class II and III in their ‘experimental’ group. More importantly, our difference of 5 units in the OHIP-14 total score corresponds to the minimally important difference for this instrument, which suggests that such a difference might be clinically meaningful.

Patients with Class III malocclusion reported greater impacts on three OHIP-14 domains compared to those with Class I malocclusion. Those domains were physical (unsatisfactory diet and interrupted meals), psychological (difficulty relaxing and embarrassment) and social disability (irritability and difficulty doing usual jobs). These findings are an indication of how malocclusion Class III may affect the life of adults seeking orthodontic care. The fact that oral impacts on other OHIP-14 domains were not significantly different between patients with Class I and III malocclusion may reflect the adaptation process of individuals who have lived with the latter condition for a long time and have thus adjusted to the limitations it places on their activities, thereby reducing impacts. An alternative explanation could be that those domains are simply not relevant to patients with Class III malocclusion. As this is the first study reporting significant differences in some but not all OHIP-14 domains between these two malocclusion groups, further research is needed to corroborate the present findings.

On the other hand, no differences in OHIP-14 scores were found between the other malocclusion groups. A first explanation relates to sample size. However, sample size was based on conventional calculations and was as such adequate for the study aim. We used the minimally importance difference for the OHIP-14 score, which has been set at 5 units, for sample size estimation. Thus, even if statistically significant differences are found with larger samples, they may not be regarded as clinically important. A second explanation relates to the questionnaire itself, as the OHIP-14 was not been developed specifically with malocclusion in mind, and symptoms such as sense of taste and painful aching in the mouth are irrelevant to malocclusion and more related to other oral conditions. A third explanation relates to the composition of the malocclusion groups in terms of their clinical characteristics. It is therefore possible that severe cases of Class II malocclusion or even divisions 1 and 2 may cause impacts on quality of life. A final explanation is that only patients with Class III malocclusion may really differ in their perceptions of quality of life from other malocclusion groups.

The present findings have some implications for research and practice. More attention must be paid to understanding the physical, psychological and social impacts of malocclusion on quality of life, because it would shed light on the effects of malocclusion.

### Table 3 Comparison of OHIP-14 domain and total scores by Angle malocclusion groups (N = 222)

<table>
<thead>
<tr>
<th>Scores</th>
<th>Class I (n = 139)</th>
<th>Class II (n = 42)</th>
<th>Class III (n = 41)</th>
<th>p*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional limitation</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>0.459</td>
</tr>
<tr>
<td>Physical pain</td>
<td>1.24 (1.58)</td>
<td>1.26 (1.59)</td>
<td>1.24 (1.59)</td>
<td></td>
</tr>
<tr>
<td>Psychological discomfort</td>
<td>2.04 (2.04)</td>
<td>2.67 (1.73)</td>
<td>2.63 (2.21)</td>
<td>0.092</td>
</tr>
<tr>
<td>Physical disability</td>
<td>1.72 (2.04)</td>
<td>1.55 (1.84)</td>
<td>2.61 (1.95)</td>
<td>0.014</td>
</tr>
<tr>
<td>Psychological disability</td>
<td>1.91 (1.93)</td>
<td>2.10 (1.87)</td>
<td>2.95 (2.17)</td>
<td>0.001</td>
</tr>
<tr>
<td>Social disability</td>
<td>1.02 (1.58)</td>
<td>1.31 (1.65)</td>
<td>1.95 (1.99)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Handicap</td>
<td>1.18 (1.67)</td>
<td>1.05 (1.34)</td>
<td>1.80 (1.82)</td>
<td>0.059</td>
</tr>
<tr>
<td>OHIP-14 total score</td>
<td>11.76 (10.09)</td>
<td>12.60 (8.33)</td>
<td>16.76 (9.91)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* MANOVA was used for combined and individual comparisons (Wilks’ Lambda test, p = 0.010). p-values were obtained from individual three-way ANOVA tests controlling for participants’ demographic characteristics (sex and age group). Superscript letters indicate which pairs of Angle malocclusion groups were statistically different for a particular domain score.
clusion on people’s daily lives and provide a better understanding of the demand for orthodontic treatment beyond clinical parameters.\textsuperscript{9,13} Furthermore, since the psychological and social effects of malocclusion are the key reasons for seeking orthodontic treatment, the use of quality of life measures as a part of the diagnostic procedure could provide valuable information on priorities for treatment in order to maximise patient satisfaction.\textsuperscript{18}

Some limitations of this study need to be addressed. First, the study was based on a convenience sample and does not represent the general adult population of Pakistan. However, we preferred using a hospital-based rather than a population-based sample as the latter could have not provided sufficient cases with Class II and III malocclusion for a meaningful comparison. Second, instead of using nonparametric tests, MANOVA was employed. MANOVA has several advantages over nonparametric tests.\textsuperscript{12} It allows the comparison of multiple and inter-correlated outcome measures (8 in this study, i.e. the 7 domain scores and the total score), compensating for multiple comparisons by using omnibus tests for multiple outcomes and multiple groups, controlling for confounders (sex and age in this study, both treated as categorical) and testing for interactions between explanatory variables.\textsuperscript{12,14} Third, we used the Angle classification for the assessment of malocclusion, which is based on the anteroposterior relationship of the maxillary to the mandibular first molars. As such, the impact on quality of life of other malocclusion traits was not assessed in this study. Fourth, the OHIP-14 instrument used in this study is a generic OHRQoL measure, and as such, it captures impacts on quality of life attributed not only to malocclusion but to all oral conditions. The use of condition-specific OHRQoL measures is therefore encouraged in further studies, as they can help distinguish the impacts attributed to malocclusion from those caused by other oral conditions.\textsuperscript{3-6} However, the present findings are still valid, as patients at this hospital are referred to the orthodontic clinic once they have completed their treatment for other oral conditions. A final limitation relates to the role of potential confounders, particularly socioeconomic factors, which are known to be related to both malocclusion and OHRQoL. However, most patients attending the selected hospital had a high socioeconomic status, which may have provided a way to control for socioeconomic characteristics (i.e. by sample restriction). Nevertheless, new studies may benefit from taking into consideration some other factors when exploring the association between malocclusion and quality of life.

**CONCLUSION**

This study showed that adult patients with Class III malocclusion had a poorer quality of life than those with Class I malocclusion. These differences were found in the physical, psychological and social disability domains of the OHIP-14 instrument. In contrast, no differences were found between other Angle malocclusion groups.

**REFERENCES**


