The impact of fixed orthodontic appliances on daily life

N A Mandall, S Vine, R Hulland and H V Worthington

Orthodontic Department, University Dental Hospital of Manchester, Manchester, UK.

Objective: i) To develop a measure of the impact of fixed orthodontic appliances on daily life. ii) To assess the impact of fixed appliances over time after initial appliance placement. iii) To investigate factors that may influence the impact of fixed appliances (age, gender and socioeconomic status).   ***Research design:*** Questionnaire. ***Clinical setting:*** University Dental Hospital and Hope Hospital, Manchester. S***ample:*** Sixty-six patients, whose orthodontic appliances had just been placed. Twenty-eight patients whose orthodontic appliances were in place for at least six months were used for the reliability study.   ***Method:*** The Impact of Fixed Appliances Questionnaire was developed using standard qualitative methods and pre-tested on 10 patients. This resulted in a questionnaire with nine conceptual impact sub-scales: aesthetic, functional limitation, dietary, oral hygiene, maintenance, physical, social, time constraints and travel/cost. The questionnaire was piloted on 66 patients, at the first, second and third visits after their fixed appliance had been placed, to assess the impact of fixed appliances over time. Questionnaire reliability, over a one-month time interval, was assessed on 40 patients who had been in treatment for at least six months.   ***Main outcome measure:*** Impact of fixed appliances on daily life.   ***Results:*** The internal reliability of the questionnaire ranged from moderate to very good (Cronbach's alpha 0.56-0.89).   Test-retest reliability was stable for most subscales (intra-class correlation coefficient 0.26-0.65). The questionnaire was said to have face validity and also content validity because of the method of questionnaire development through interviewing children with fixed appliances. None of the subscales scores reduced over time except aesthetic impact ($p < 0.05$) but this was probably not a clinically significant change. Age was the predominant variable to influence the impact of fixed appliances with younger children being less affected during their daily life ($p < 0.05$).   ***Conclusions:*** The questionnaire developed in this study is a reliable tool for assessing the impact of fixed appliances on the daily life of children. It is unlikely that the impact of fixed appliances on daily life reduces as the patient progresses through treatment. Younger patients are probably more adaptable to treatment with fixed appliances, in terms of reduced impact on daily life, so arguably treatment should be started as early as possible. This information could also be used to educate, reassure and motivate patients at the start of treatment.

Key words: Aesthetics, fixed appliances, function, oral impact

Introduction

The purpose of this study was to develop a measure of the impact of fixed orthodontic appliances on daily life. This was then used to assess any change in impact of fixed appliances over time and factors that may influence that impact.

Recently, more emphasis has been placed on new measures of social, psychological, biological and functional impact of dental disease on daily life. This is in addition to measurement of oral health purely from a clinician's viewpoint (Cushing, *et al.*, 1986; Locker and Miller, 1994; Slade and Spencer, 1994; Kressin, *et al*., 1996). There are many reasons for studying a sub-population and the perception of their dentition on daily life (Nikias, 1985; Strauss and Hunt, 1993; Slade and Spencer, 1994;). It:
- improves assessment for priorities of care
- helps in understanding motives for care-seeking behaviour
- enables better evaluation of dental treatment
- increases the ability to educate effectively
- enhances patient motivation
- enables marketing of health services.

To this end, a number of questionnaires have been developed that measure the impact of dental disease (Cushing *et al.,* 1986; Gooch *et al.,* 1989; Reisine *et al.,* 1989; Atchison and Dolan, 1990; Strauss and Hunt, 1993; Slade and Spencer, 1994; Locker and Miller, 1994; Saunders *et al.,* 1995; Leao and Sheiham, 1995, 1996; Kressin *et al.,* 1996; Adulyanon and Sheiham, 1996). Generally, pain/discomfort, oral function and psychological issues have been measured. Importantly, they have been developed and piloted on older populations where oral impact is likely to be higher because of dental disease and tooth loss.

In orthodontics, health related quality of life issues have been developed (Ronis, *et al*., 1994; Cunningham, *et al.*, 2000) and discussed (Bennett and Phillips, 1999) in relation to adults undergoing orthognathic surgery. Short term outcomes have suggested that improvements occur in self esteem, body image, confidence, mood states and the ability to mix socially, secondary to facial surgery (Cunningham, *et al.*, 1996; Bertolini, *et al.*, 2000). Hatch, *et al.*, (1998) compared patient experiences with wire versus rigid fixation and found that quality of life improved post surgery regardless of the type of fixation used.

Correspondence to: Dr N A Mandall, Orthodontic Department, University Dental Hospital of Manchester, Higher Cambridge Street, Manchester M15 6FH. E-mail: Nicky@fs1.den.man.ac.uk

Although an important development, such measures are not suitable for younger subjects because perceptions of quality of life are likely to differ with age. Additionally, children are likely to be relatively free from dental disease and although they wear fixed appliances will not generally receive orthognathic surgery.

A measure of the impact of fixed appliances on daily life would be a useful way of highlighting problems that patients experience. This is particularly since Stewart, *et al.*, (1997) conclude that there is a lack of information on patient experiences and if patients were armed with adequate knowledge, this may possibly reduce some anxiety.

In turn, we should be able to identify areas where patients may be pre-warned of specific potential problems as patients generally felt that they had a lack of satisfactory information prior to fitting their appliances (Oliver and Knapman, 1985). In addition, Sergi and Zentner (1997) found that patients who had been comprehensively informed about their treatment had greatest levels of satisfaction and compliance with treatment. Patient information, leading to better compliance, is important because a significant number (20%) will not complete orthodontic treatment (Haynes, 1991).

Therefore, the null hypotheses to be tested were:
1. The impact of fixed appliances on daily life does not change with time
2. There is no effect of age, gender or socioeconomic status on the impact of fixed appliances on daily life.

Method

Development of the impact of fixed appliances measure

i) Semi-structured interviews

A qualitative study method was used whereby 30 patients between 10-18 years old (mean 14 years 6 months, SD 2 years 4 months), who had fixed appliances in place, were interviewed regarding the impact of fixed appliances on their daily life. Patients were selected from orthodontic clinics at the University Dental Hospital of Manchester as they completed an adjustment appointment. They, thus, gave viewpoints relevant to all stages of fixed appliance treatment. They were asked a series of open-ended questions about their thoughts, experiences and feelings about fixed appliances. The responses were recorded verbatim and then studied for repeat phrases that were grouped into common categories. Therefore, the sub-groups occurred as a result of placing the verbatim responses into subject groupings. An initial questionnaire was developed based on these key phrases which fell into the following conceptual subscales (number of statements in brackets)(Appendix 1)

- Aesthetics (5)
- Functional limitation (3)
- Dietary impact (6)
- Oral hygiene impact (3)
- Maintenance impact (2)
- Physical impact (9)
- Social impact (5)
- Time constraints (5)
- Travel/cost/inconvenience implications (5)

The response options for the questions were on a Likert scale of 1-5 where 1= strongly disagree, 2= disagree, 3= neither agree nor disagree, 4= agree, 5= strongly agree.

ii) Pre-piloting

The questionnaire development was explained to five fixed appliance patients (age range 10-16 years) who commented on clarity, phrasing, simplicity and understanding of the questionnaire. Relevant changes were made to some questions and wording and the questionnaire was then pre-piloted on a further five patients. This helped to ensure that the questionnaire was not too long and patients did not have difficulty with any sections. To further ensure easy understanding, a readability formula was applied to the questions (SMOG grading, McLaughlin, 1969). The SMOG grading is explained in more detail in Appendix 2.

iii) Development of subscales

Principal component factor analysis was carried out to determine whether the instrument was made up of subscales (Cunningham, *et al.,* 2000). However, many of the questions were identified into two subscales which did not correspond well to any of the original conceptual subscales suggested by the interview data. Therefore, the questions were left in their conceptual groups.

iv) Pilot

Sixty-six patients (mean age 14.5 years SD 1.9 years) completed the questionnaire at the first three adjustment appointments after their fixed appliances were placed. The children were unaided by parents or clinician, except where time and travel costs were questioned. Additional postcode data were collected and a Townsend score measure of social deprivation calculated (Townsend, 1987).

Reliability of Impact of Fixed Appliances Questionnaire

The reliability of the questionnaire was tested on a sample of 40 patients who had been wearing fixed appliances for at least six months (mean age 14.1 years SD 1.9 years). A six-month cut off point was chosen in case appliance impact changed over the first few months of treatment as the patients acclimatised to the appliance. Changes in impact of appliances during this time would invalidate attempts to assess questionnaire reliability. The repeat questionnaire was carried out at least four weeks after it was initially completed.

Validity of the impact of fixed appliances questionnaire

The question of validity is important and should show that the questionnaire developed does measure what it purports to measure. It could be argued that the questionnaire has face validity since the sub-scale headings reflect clinical opinion of the problems experienced with fixed appliances. In addition, because the subscales were developed as a result of statements from children who were already wearing fixed appliances, the questionnaire should have content validity.

Statistics

Questionnaire development

Internal consistency of the questionnaire was assessed using Cronbach's alpha (Cronbach, 1951). Test-retest reliability was assessed using intra-class correlation coefficients.

Pilot study

The responses of the 66 patients in the pilot study were evaluated using the Friedman test to compare the impact of fixed appliances over time. Multiple stepwise linear regression analysis was used to evaluate the influence of age, gender and socioeconomic status on the impact of fixed appliances.

Results

The internal consistency of the questionnaire was assessed for each of the nine sub-scales and mostly ranged from moderate to very good (Cronbach's alpha ≥ 0.75 for all subscales except dietary impact (0.62) and travel/cost implications (0.56)). Test-retest reliability ranged from an intra-class correlation coefficient 0.26 to 0.65 (Table 1).

Table 2 shows the mean responses and standard deviations, over time, for the pilot study. Generally the impact of fixed appliances was fairly low (the lower the score the lower the impact). The only subscales to change with time were aesthetic and functional impact ($p<0.05$); however, this was unlikely to be clinically significant.

Table 3 shows the influence of age, gender and socioeconomic status on the impact of fixed appliances on daily life. As the subscales did not change over time, this analysis was carried out only on the data for the first adjustment following fixed appliance placement. Generally, age was the only independent variable to influence the impact of fixed appliances, with younger patients being less affected by their appliances.

Discussion

The questionnaire developed in this study was the first to assess the impact of fixed appliances on a child's daily life. The age range of the children in this study was fairly wide and spans a difficult period of social psychological adjustment. However, previously in orthodontics, the impact or effect of fixed appliances has only been measured from a clinician's viewpoint using occlusal indices usually concentrating on treatment outcome (Richmond, *et al*., 1992a, 1992b).

When measuring outcome, the failure to complete treatment poses difficulties particularly if the outcome is measured using occlusal indices alone. There is anecdotal evidence that aesthetic, social, functional or oral hygiene factors are important in the decision to discontinue treatment. Thus, it was surprising that the reported patient impact of these factors was fairly low.

A possible explanation for this, in terms of discomfort, is that patients may expect some degree of pain from their appliance and can therefore cope with it more effectively. Alternatively, since post-adjustment pain is relatively short-lived, between four and 24 hours depending on patient age (Ngan, *et al*., 1989), the overall impact on daily life in-between appointments may be lower than expected.

The impact on daily life in relation to sports, leisure activities and socialising did not emerge as a theme during the open-ended questioning used to develop the questionnaire. Possibly this type of social impact is minimal and therefore not reported by patients. Alternatively, the interview process was not effective in detecting these problems as efforts were made to keep opening questions general so as not to guide patients.

The subscales identified in the study

Although this questionnaire did not measure the impact of dental disease, the domains or subsets of questions emerging were similar to previously published literature. For example, Slade and Spencer (1994) evaluated oral health impact on people over 60 years old but their main subscales were also based around pain and discomfort, functional limitation, eating, physical impact and social impact. Other studies of the oral impact of dental disease have also identified some of these domains, but their questionnaires have not always been developed through patient interviews.

The method of questionnaire development used in this study was similar to Slade and Spencer (1994) where patient opinion was elicited through interviews and this may explain why the identified subscales were similar. The views of health professionals are likely to differ from the patients' experiences and thus should not be used to develop socio-psychological questionnaires relating to health care.

The validity of the questionnaire

Since the questionnaire was developed through patient interviewing and piloting, it can be assumed that it has face/content validity. It would be possible to further validate the questionnaire against a visual analogue scale and this will be carried out in a further study.

The reliability of the questionnaire

The internal consistency and test-retest reliability of the questionnaire were generally fairly good and the range of values was comparable with previous studies (Table 4). The notable exception was a low Cronbach's alpha and low test-retest intra-class correlation coefficient for travel/cost implications and time constraints. It is suspected that where the child filled this section in unaided, that they reported no travel or cost problems which tended to be reported by the parent. The reliability of these subscales may be potentially improved by asking for parent/guardian input.

A low test-retest correlation coefficient for the dietary impact subset could be because, even at the six-month stage, children are still getting used to diet modifications from fixed appliances.

Lastly, maintenance impact of broken appliances had a low test-retest correlation coefficient and this is likely to be because of the relatively low appliance fracture rate in the sample. Patients found these questions difficult if they had not experienced a broken appliance.

Table 1. The reliability of the questionnaire subscales to assess the impact of fixed appliances on daily life.

Subscale	Cronbach's alpha (internal consistency)	Test-retest (intraclass correlation coefficient)
Aesthetic impact	0.83	0.65
Functional limitation	0.75	0.52
Dietary impact	0.62	0.46
Oral hygiene impact	0.82	0.54
Maintenance impact	0.89	0.42
Physical impact	0.87	0.57
Social impact	0.76	0.62
Time constraints	0.79	0.44
Travel/cost implications	0.56	0.26

Table 2. Mean responses of the pilot study and the impact of fixed appliances on daily life over time.*

Subscale	Time 1 mean rank	Time 2 mean rank	Time 3 mean rank	Chi square value	P value
Aesthetic impact	2.2	2.1	1.8	6.5	0.04
Functional limitation	2.2	1.9	1.8	7.7	0.02
Dietary impact	2.0	2.0	2.0	0.1	0.93
Oral hygiene impact	1.8	2.1	2.1	4.0	0.14
Maintenance impact	2.1	2.1	1.8	5.1	0.08
Physical impact	2.2	2.0	1.8	4.8	0.09
Social impact	2.0	2.1	1.9	2.1	0.35
Time constraints	1.9	2.2	2.0	2.9	0.23
Travel/cost inconvenience	2.0	2.1	1.9	2.1	0.34

* The higher the score the greater the impact on daily life. Likert scale 1-5.

Table 3. Multiple linear regression analysis investigating any influence of age, gender and socioeconomic status on the impact of fixed appliances on daily life.

Dependent variable	Independent variable	Beta	Standard error beta	p value	95% confidence interval	R^2
Aesthetics	Age	9.1×10^{-2}	0.03	0.001	0.04-0.15	0.16
Function	Age	3.5×10^{-2}	0.01	0.004	0.01-0.06	0.13
Physical	Townsend*	-0.46	0.23	0.05	-0.92--0.003	0.07
Social	Age	0.33	0.02	0.002	0.024-0.11	0.11
Time	Age	0.29	0.02	0.01	0.014-0.2	0.08
Diet	No variable	-	-	-	-	-
Oral Hygiene	Age	0.32	0.02	0.003	0.02-0.095	0.10
Maintenance	No variable	-	-	-	-	-
Travel and cost	Age	0.24	0.02	0.03	0.004-0.089	0.06

*Increasing Townsend score indicates increasing social deprivation
For all dependent variables, increased score = increased impact of fixed appliance on daily life.
Note: Gender did not influence any of the dependent variables.

Table 4. Internal consistency and test-retest values from previous studies investigating oral health impact.

Author	Cronbach's alpha (range)	Intra-class correlation coefficients (range)
Atchison and Dolan (1990)	0.79	-
Weiler et al., (1993)	0.76, 0.92	-
Slade and Spencer (1994)	0.37, 0.83	0.08, 0.77
Locker and Miller (1994)	0.70, 0.86	-
Ronis et al., (1994)	0.74, 0.91	-
Leao and Sheiham (1996)	0.50, 0.89	-
Kressin et al., (1996)	0.83	-
Tickle and Craven (1997)	0.74, 0.79	0.56, 0.99
This study	0.34, 0.87	0.26-0.65

Alternatively, if they had broken their appliance only at the second repeat questionnaire, their response would be unreliable, compared with their first questionnaire.

Dietary impact also had a fairly low Cronbach's alpha and the reasons for this are less clear. It is possible that a low internal consistency may be explained by:

- Some children eating softer diets than others, even before the appliance fitting. They, therefore, do not miss the hard foods listed in the questionnaire.
- Clinical experience suggests that some children ignore advice about avoiding hard foods and the impact on their dietary habits may be lower.
- Some patients may simply carry on eating the harder foods but modify their methods, for example cutting food up into smaller pieces. In contrast, other children may simply avoid the harder foods but miss them more.

Maintenance impact or problems with broken appliances also had fairly low intra-class correlation coefficient (0.42) but this may be explained by the low incidence of breakages, thus, many patients were answering this question from a theoretical or imaginary viewpoint.

The impact of fixed appliances on daily life, over time

Although statistical analysis suggested that aesthetic impact and functional limitation reduced over time, a change in Likert score of 2.2 to 1.8 is unlikely to be clinically significant. It was also surprising that impact such as diet and oral hygiene did not reduce over time as we might expect patients to become used to the appliance. Conversely, it may be expected that pain and discomfort do not diminish with time as the appliance is being regularly adjusted. An alternative explanation could be that the 1-5 Likert scale was not sensitive enough to detect changes in impact over time. Thus, consideration may be given to using a 7 or 9-point scale.

The effect of age, gender and socioeconomic status on impact of fixed appliances on daily life.

Generally, age was an influential variable on the daily impact of fixed appliances with younger patients appearing to cope better with their appliance. There is no literature with which to compare the effect of age on fixed appliance impact. However, younger patients have lower treatment discontinuation rates (Haynes, 1991) and it may be hypothesized that this is because the impact of fixed appliances is lower in younger children, who may then co-operate better with treatment.

As there was no influence of gender on impact of fixed appliances, the above argument cannot be used to explain higher discontinuation rates for girls (Murray, 1989). Lastly, the data suggested socioeconomic background generally did not influence the impact of fixed appliances on daily life. It is surprising that the impact of fixed appliances on travel and cost of attending was not affected by social deprivation. This may be due to the cost of attendance being spread over 1-2 years and is not perceived as a burden.

Conclusions

The questionnaire developed in this study is a reliable tool for assessing the impact of fixed appliances on the daily life of children. It is unlikely that the impact of fixed appliances reduces as the patient progresses through treatment. Younger patients are probably more adaptable to treatment with fixed appliances in terms of reduced impact on daily life so, arguably, treatment should be started as early as possible. This information could also be used to educate, reassure and motivate patients at the start of treatment.

References

Adulyanon, S. and Sheiham, A. (1996): A new socio-dental indicator of oral impacts on daily performances. *Journal of Dental Research* **75,** (IADR abstracts), 231 (Abstract #1711).

Atchison, K. A. and Dolan, T. A. (1990): Development of the geriatric oral health assessment index. *Journal of Dental Education* **54,** 680-687.

Bennett, E. M. and Phillips, C. L. (1999): Assessment of health-related quality of life for patients with severe skeletal disharmony. A review of the issues. *International Journal of Adult Orthodontics and Orthognathic Surgery* **14,** 65-75.

Bertolini, F., Russo, V. and Sansebastiano, G. (2000): Pre- and post-surgical psycho-emotional aspects of orthognathic surgery patients. . *International Journal of Adult Orthodontics and Orthognathic Surgery* **15,** 16-23.

Cronbach, L. J. (1951): Coefficient alpha and the internal reliability of tests. *Psychometrika* **16,** 297-334.

Cunningham, S. J., Hunt, N. P. and Feinmann, C. (1996): Perceptions of outcome following orthognathic surgery. *British Journal of Oral and Maxillofacial Surgery.* **34,** 210-213.

Cunningham, S. J., Garratt, A.M. and Hunt, N. P. (2000): Development of a condition-specific quality of life measure for patients with dentofacial deformity: I. Reliability of the instrument. *Community Dentistry and Oral Epidemiology* **28,** 195-201.

Cushing, A. M., Sheiham, A. and Maizels, J. (1986): Developing sociodental indicators – the social impact of dental disease. *Community Dental Health* **3**, 3-17.

Gooch, B. F., Dolan, T. A. and Bourque, L. B. (1989): Correlates of self-reported dental health status upon enrolment in the Rand Health Insurance Experiment. *Journal of Dental Education* **53**, 629-637.

Hatch, J. P., Rugh, J.D., Clark, G. M., Keeling, S.D., Tiner, B. D. and Bays, R.A. (1998): Health related quality of life following orthognathic surgery. *International Journal of Adult Orthodontics and Orthognathic Surgery* **13**, 67-77.

Haynes, S. (1991): Trends in the numbers of active and discontinued orthodontic treatments in the General Dental Service 1964-1986/7. *British Journal of Orthodontics* **18**, 9-14.

Kressin, N., Spiro, A., Bosse, R., Garcia, R. and Kazis, L. (1996): Assessing oral health related quality of life. *Medical Care* **34**, 416-427.

Leao, A. and Sheiham, A. (1995): Relation between clinical dental status and subjective impacts on daily living. *Journal of Dental Research* **74**, 1408-1413.

Leao, A. and Sheiham, A. (1996): The development of a socio-dental measure of dental impacts on daily living. *Community Dental Health*. **13**, 22-26.

Locker, D. and Miller, Y. (1994): Evaluation of subjective oral health status indicators. *Journal of Public Health Dentistry*. **54**, 167-176.

McLaughlin, G. H. (1969): SMOG Grading – a new readability formula. *Journal of Reading.* **12**, 639-646.

Nikias, M. (1985): Oral disease and quality of life. *American Journal of Public Health*. **54**, 11-12.

Murray, A M. (1989): Discontinuation of orthodontic treatment: A study of contributing factors. *British Journal of Orthodontics*. **16**, 1-7.

Ngan, P., Kess, B., Wilson, S. (1989): Perception of discomfort by patients undergoing orthodontic treatment. *American Journal of Orthodontics and Dentofacial Orthopedics* **96**, 47-53.

Oliver, R. G. and Knapman, Y. M. (1985): Attitudes to orthodontic treatment. *British Journal of Orthodontics*. **12**, 179-188.

Reisine, S. T., Fertig, J., Weber, J. and Leder, S. (1989): Impact of dental conditions on patient's quality of life. *Community Dentistry and Oral Epidemiology*. **17,** 7-10.

Richmond, S., Shaw, W. C., O'Brien, K. D., Buchanan, I. B., Jones, R., Stephens, C. D, Roberts, C. T. and Andrews, M. (1992a): The development of the PAR index (Peer Assessment Rating): Reliability and Validity. *European Journal of Orthodontics*. **14**, 125-139.

Richmond, S., Shaw, W. C., Andrews, M., and Roberts, C. T. (1992b): The PAR index (Peer Assessment Rating): Methods to determine outcome of orthodontic treatment in terms of improvement and standards. *European Journal of Orthodontics* **14**, 180-187.

Ronis, D. L., Callan, M. A., Vig, K. W., Vig, P. S. and Mc-Namara, J. A. Jr. (1994): Developing measures of patients' perceptions of orthognathic surgery. *International Journal of Adult Orthodontics and Orthognathic Surgery.* **9,** 87-94.

Saunders, M. J., Paunovich, J. E. and Cornell, J. (1995): Oral health quality of life inventory: development and validation. *Journal of Dental Research* **74**, (AADR abstracts), 168 (Abstract #1253).

Sergi, H. G. and Zentner, A. (1997): Study of psychosocial aspects of adult orthodontic treatment. *International Journal of Adult Orthodontics and Orthognathic Surgery.* **12**, 17-22.

Slade, G. D. and Spencer, A. J. (1994): Development and evaluation of the oral health impact profile. *Community Dental Health*. **11**, 3-11.

Stewart, F. G., John, W., Kerr, S. and Taylor, P. J. S. (1997): Appliance wear: the patient's point of view. *European Journal of Orthodontics*. **19**, 377-382.

Strauss, R. P. and Hunt, R. J. (1993): Understanding the value of teeth to older adults: influences on the quality of life. *Journal of the American Dental Association*. **124, 1**05-110.

Tickle, M., Craven, R. and Blinkhorn, A. S. (1997): An evaluation of a measure of subjective oral health status in the U.K. *Community Dental Health*. **14**, 175-180.

Townsend, P. (1987): Deprivation. *Journal of Social Policy*. **16,** 125-146.

Weiler, R. M., Sliepcevich, E. M. and Sarvela, P. D. (1993): Development of the Adolescent Health Concerns Inventory. *Health Education Quarterly*. **20**, 569-583.

Appendix 1. The impact of fixed appliances on daily life

Aesthetic impact: what do you think about the look of your brace ?
The look of the brace worries me
It makes me self – conscious
I smile less
I avoid showing my teeth
I don't like my brace
Functional impact: When eating with your brace it is difficult to:
Eat food
Chew food
Swallow food
Dietary impact: I miss the following foods:
Sweets/toffees
Chocolate
Sugary foods
Hard food
Apples/carrots
Chewing gum
Oral Hygiene impact: With my brace it is difficult to:
Clean my teeth
Get my toothbrush round the wires
Clean food off my brace
Maintenance impact: When my brace breaks I feel:
Annoyed
Unhappy
Physical impact: How does your brace feel?
Painful
Uncomfortable
Sore
Aching
Hurts my teeth
Cuts my mouth
Rubs my mouth

Catches the inside of my mouth
Feels weird
Social impact:
It is difficult at my age to wear a brace
I feel embarrassed about my brace
I dislike wearing my brace
I find wearing my brace annoying
I get upset because I am teased about my brace
Time constraints: When you come to have your brace tightened:
It's annoying
I have to miss school/college
It's difficult to get time off school/college
My teacher is not understanding
It's a pain
Travel/cost/inconvenience impact: Do you have difficulty with any of the following:
Distance to travel
Time getting here
Cost of getting here
Parking
Waiting a long time in the waiting room

Appendix 2. SMOG grading for readability (McLaughlin, 1969)

SMOG grading is calculated by counting how many words of 3 syllables there are in 30 sentences. The sentences are usually taken from the beginning, middle and end of the text or, in our case, the questionnaire. The square root of the polysyllabic word count is calculated to the nearest perfect square. The SMOG grade is the square root plus 3. The SMOG grading for our questionnaire was 6 which is very low.