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The impact of labial fixed appliance orthodontic treatment on patient expectation, experience, and satisfaction: An overview of systematic reviews

ABSTRACT

Background: Patient perception with fixed appliance orthodontic treatment is important to improve oral health-related quality of life.

Objective: To evaluate the impact of labial fixed appliance orthodontic care on patient perception before, during, and after treatment.

Search Methods: Relevant systematic reviews investigating patient perception with fixed appliance orthodontic treatment were identified by searching electronic databases: MEDLINE via OVID (1946 to 31 December 2018), EMBASE (1974 to 31 December 2018), AMED (Allied and Complementary Medicine Database) (1985 to November 2018), PubMed (inception to 31 December 2018), Web of Science (1900 to 2018) and PsychINFO (1806 to 31 December 2018). Ongoing systematic reviews were searched using Prospero and a grey literature search was undertaken using Google Scholar and OpenGrey (www.opengrey.eu/). No language restriction was applied.

Selection Criteria: Only studies investigating patient perception of fixed appliance orthodontic treatment were included.

Data Collection and Analysis: Screening, quality assessment [using the AMSTAR 2 tool (A Measurement Tool to Assess Systematic Reviews)] and data extraction were performed by two authors independently. Information was categorized and narratively synthesized for the key findings.

Results: A total of 163 articles investigating patient expectation, experience, and satisfaction with conventional ligation labial fixed orthodontic appliances were obtained. Of these, 152 observational or interventional studies were excluded, resulting in 11 eligible systematic reviews. Two were excluded as earlier reports of a Cochrane review. The quality of the reviews was variable (critically low, low, and moderate). The findings were: aesthetics represents a primary motive for orthodontic treatment; a temporary deterioration in the quality of life occurs during the initial phases of treatment; gender and ethnicity factors do not have an impact on patient perception of treatment; and a positive relationship between orthodontist-patient-parent is important to achieve patient compliance and satisfaction.

Conclusions: There is a lack of high-quality studies in terms of systematic reviews and meta-analyses for assessing patient perception with fixed appliance orthodontic treatment. The aesthetic impact of malocclusion is the main motive for seeking orthodontic treatment. Quality of life reduces during the initial stages of orthodontic treatment, but improves in the later stages of treatment. Assessment before, during and after orthodontic treatment is necessary to comprehensively assess patient perception at all stages of care.

Registration: The protocol has been registered with PROSPERO. The registration number is: CRD42019122653.

Conflict of Interest: None to declare.

Keywords: Patient perception, Fixed appliance, Overview of systematic reviews

INTRODUCTION

Accurate assessments of patient perception can lead to an improvement in the quality of orthodontic treatment by determining patient expectation and, in particular, identifying any unrealistic expectations of treatment. This is also less expensive and associated with a higher level of reliability than other methods of assessing treatment quality. This is because evaluating treatment outcome using occlusal indices provides adequate information about the quality of the final occlusion, but fails to evaluate patient experience and satisfaction with treatment.⁽¹⁾ Increasing the knowledge base relating to patient interaction with treatment can also increase patient compliance and reduce premature cessation of treatment.⁽²⁾ It has also been suggested that the informed consent process should comprise every aspect of orthodontic treatment including not only the risks and benefits but also information relating to evidence-based patient perception to provide patients with more realistic expectations about the treatment outcome and the possible experiences during the proposed treatment.⁽³⁾ Tsihklaki et al. (2018)⁽⁴⁾ reported in their scoping review that the most frequently measured outcomes during orthodontic treatment were pain (patient-reported), periodontal condition, tooth angulation and inclination changes, and treatment duration, followed by rate of tooth movement and skeletal relationship changes.

Generally, patient perception has been assessed using different methods, primarily using interviews and questionnaires. Some of these scales or questionnaires are limited to evaluating discomfort and pain using visual analogue scales (VAS)⁽⁵⁾ or The McGill Pain Questionnaire.⁽⁶⁾ Other studies have however utilised more comprehensive questionnaires to evaluate the oral health-related quality of life (OHRQoL).⁽⁷⁻¹²⁾

Experience, Impact, and Satisfaction with Orthodontic Treatment

Experience and the impact of orthodontic treatment are generally measured in terms of improvement of OHRQoL questionnaire scores.

Oral health-related quality of life (OHRQoL) can be defined as “the absence of negative impacts of oral conditions on social life and a positive sense of dentofacial self-confidence”.⁽¹³⁾ It has an important role in the outcomes of clinical trial to evaluate the consequences of preventive and therapeutic programmes and aiding specialists to improve the quality of oral health treatments.⁽¹⁴⁾ Therefore, the World Health Organisation has recommended clinical studies should include quality of life measures.^(15,16) Quality of life is difficult to assess by a single measure, but some aspects are used to evaluate this such as social, physical, functional, and psychological aspects.^(14,17,18) These aspects are directly affected by malocclusion and other dentofacial deformities.^(19,20)

In addition to the OHRQoL measures, recently developed questionnaires⁽²¹⁾ have been introduced as valid and reliable measures to be used in clinical trials for assessing expectations, experience, and satisfaction of fixed appliance orthodontic treatment.⁽²²⁾ However, no systematic review has evaluated all three aspects together. Overviews of systematic reviews have been introduced to healthcare in recent years to synthesise and combine data from existing systematic reviews (including those with a meta-analysis) to produce the highest quality of evidence to improve decision making by clinicians and provide policy makers with evidence where the increasing pace and volume of evidence being produced cannot be evaluated adequately using the rapid review method. To date, these are not common in Dentistry and Orthodontics and as limited information about patient perception or orthodontic care before, during and after treatment exists. The objective of this overview is to evaluate the impact of labial fixed appliance orthodontic care on patient perception before, during, and after treatment.

MATERIALS AND METHOD

Ethical approval was not required for this study as this was an overview of systematic reviews and no intervention, participant recruitment, or personal data collection were involved. The protocol for this review was registered with PROSPERO: CRD42019122653 (https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=122653). This overview was prepared in line with the PRISMA guideline.

Selection Criteria

The following selection criteria were applied:

Participants: patients of any age with a malocclusion either expecting or undergoing fixed appliance orthodontic treatment. Patients having undergone orthodontic treatment previously were excluded.

Intervention/exposure: Labial fixed appliance orthodontic treatment.

Comparator: Labial fixed appliance orthodontic treatment at another time-point or untreated controls.

Outcome measures: patient perception of orthodontic treatment, either assessed using OHRQoL measures or any other measure to assess expectation, experience, and satisfaction with fixed appliance orthodontic treatment.

Study design: systematic reviews with or without meta-analysis. In case of Cochrane reviews, the most recent publication was included, and all previous versions were excluded.

Search Strategy

A comprehensive literature search was carried out using the following key terms: patient expectation, patient experience, patient satisfaction, or the impact of fixed appliance orthodontic treatment. This was completed using electronic databases: MEDLINE via OVID (1946 to 31 December 2018), EMBASE (1974 to 31 December 2018), AMED (Allied and Complementary Medicine Database) (1985 to November 2018), PubMed (inception to 31 December 2018), Web of Science (1900 to 2018) and PsychINFO (1806 to 31 December 2018). Any ongoing systematic reviews were searched using Prospero and a grey literature search was undertaken using Google Scholar and OpenGrey (www.opengrey.eu/). No language restriction was applied. No restrictions were applied in terms of the date, status of publication or the age of treated patients. All the relevant articles were identified, retrieved and assessed for eligibility of inclusion by two reviewers (Y.A.Y. and G.M.). Any study that assessed patient perception of malocclusion solely was excluded. Any disagreements were resolved by discussion or alternatively by a third assessor.

Data Extraction and Synthesis

After screening the eligible systematic reviews, the following data were extracted independently and in duplicate by two reviewers (Y.A.Y and G.M): (1) year of publication; (2) study design; (3) number of studies included; (4) period of search; (5) name of journal; (6) objectives of the study; and (7) quality of evidence.

Quality Assessment

All eligible reviews were assessed independently by two reviewers (Y.A.Y and G.M) using the level of evidence of the AMSTAR 2 quality assessment tool (A Measurement Tool to Assess Systematic Reviews) (Table 1). AMSTAR 2 is a 16-item tool to assess the methodological quality of systematic reviews.⁽²³⁾ It is a modified and updated version of 11-item AMSTAR that has been internally and externally validated with good reliability.^(24,25) Any disagreements would be resolved initially by discussion or in conjunction with a third reviewer if necessary.

As the data were qualitative in nature, meta-analysis was not possible. The data were synthesized using *thematic synthesis* by identifying the important and most prominent themes with the findings summarized accordingly. Thematic analysis is a form of analysis that can be used in qualitative research,⁽²⁶⁾ by examining, emphasising, pinpointing and recording themes within data.⁽²⁷⁾ Themes are patterns within sets of data that are associated to a specific research question and are essential to the description of a phenomenon.⁽²⁸⁾ Consequently, the following thematic headings were identified: (1) quality of evidence; (2) aesthetics; (3) OHRQoL; (4) age and gender; (5) ethnicity; and (6) family relationships.

RESULTS

A total of 169 potentially eligible studies were identified, with 6 duplicates leaving 163 for screening. Of these, 152 studies were excluded because they were either observational or intervention studies (not systematic reviews). This left 11 relevant systematic reviews to be included in this study, however two were later removed^(29,30) as these were earlier versions of an updated Cochrane review.⁽³¹⁾ Therefore, nine systematic reviews^(14,31-38) published between 2007 and 2018 (Figure 1) were included. Table 2 shows the characteristics of the studies included in this review.

Quality of the Evidence

The quality of the reviews was variable (critically low, low, and medium) (Table 3). Some AMSTAR 2 items were not reported in the reviews including: (1) a protocol (reported by two reviews);^(31,38) (2) providing a list of excluded studies and justifying exclusions (reported by three reviews);^(31,32,36) and (3) reporting sources of funding for included studies (reported by one review).⁽³¹⁾ Additionally, only four meta-analyses were available^(31,33,35,38) (Table 3). As the present review is a narrative overview, all studies were included irrespective of quality. There was complete consensus between the reviewers regarding the quality assessment except for one review, which was resolved by re-assessment and discussion.

Most of the available studies assessing patient perception were observational with very limited clinical trials and systematic reviews.^(14,35,37,38)

At least three reviews highlighted that no gold standard measure was used for assessing patient perception.^(14,35,38)

Aesthetics

Perception of facial aesthetics, which in turn enhances the quality of life, was the primary motivation for seeking orthodontic treatment.^(34,37) Improvements in aesthetics at the end of treatment and a high quality of care were linked with both patient and parent satisfaction with treatment.⁽³⁶⁾

Oral Health-Related Quality of Life

Although pain experience was reported during the initial stages of treatment,⁽³³⁾ conflicting results were found.⁽³¹⁾ Pain, psychological discomfort and physical limitations (mainly during the initial stages of treatment) were associated with patient dissatisfaction with treatment and compromised OHRQoL.^(14,36)

It was found that completion of orthodontic treatment results in improvement in the OHRQoL, especially in relation to social and emotional wellbeing.^(14,35,38) One study could not draw any conclusions regarding patient satisfaction at the end of treatment,⁽³²⁾ whereas a more recent study reported that patients and parents were highly satisfied with orthodontic treatment.⁽³⁶⁾

Age and Gender

The majority of studies were conducted in a limited age range, usually involving adolescents. There was insufficient evidence to relate age to treatment satisfaction. In spite of gender not being conclusively associated with treatment satisfaction, females were reported to have greater concerns at the start, and higher expectations at the end of treatment than males.⁽³⁶⁾ It was however noted that one of the included reviews did not find this.⁽³⁷⁾

Ethnicity

There was no information regarding the influence of ethnicity on patient perception with treatment.

Family Relationships

Some differences were noted about parent and patient expectations and their motivation for treatment, as some children and adolescents were encouraged to undergo treatment by their parents.⁽³⁶⁾ Samsonyanová and Broukal (2014)⁽³⁴⁾ mentioned the importance of an adequate child-parent relationship for cooperation with orthodontic treatment.

DISCUSSION

The objective of this overview was to evaluate patient perception of labial fixed appliance orthodontic treatment. The overview method was selected in order to provide a contemporary transitive evidence-based summary of patient motivation for seeking treatment, their perceptions of the treatment process as well as determining the impact of treatment overall on psychological wellbeing. As such, synthesis was at the level of the systematic reviews rather than at the individual study level. In addition to facilitating assessment at multiple time-points throughout treatment and cross comparisons, the overview method also allowed the influence of other factors such as aesthetics, gender, age, ethnicity and family relationships on perception of labial fixed appliance treatment to be assessed. This overview also presents and evaluate all published research on this topic despite some reviews being assessed as low/critically low quality. Therefore, the findings of the overview are dictated by the quality of the earlier systematic reviews and original studies. Profile change and speech were beyond the scope of the overview.

Most of the original studies we were able to include were observational, particularly using a cross-sectional design^(14,35,37) with the longitudinal studies having a short follow up period. Only a limited number of randomised controlled trials (RCTs) and systematic reviews with meta-analysis have been undertaken in this area^(32,35,38) and the deficiency in the availability of randomised clinical trials may be related to the difficulties in designing such a study, attrition bias, or due to ethical issues such as assigning the participants randomly to “orthodontic treatment” and “no treatment” groups with long term follow-up. This in turn weakens the evidence on which systematic reviews can be based.^(14,32,38) The Cochrane review by Wang et al. (2018)⁽³¹⁾ reported that all the included RCTs had confounding variables, limitations, and whilst some were at low or high risk of bias, this was unclear for the majority of studies. This means that not only the type of study is important, but careful study design is also imperative when undertaking high quality research in this field for later synthesis as part of a systematic review and in subsequent overviews such as this study.

Moreover, inadequate information about sample size and statistical power calculations, and hence generalisability, was also noted and this also compromised the strength of the available evidence.^(35,36)

No systematic review was of high quality when assessed using the AMSTAR 2 tool, due to reasons including lack of protocol registration, rationale for excluding individual studies, conducting of meta-analysis, and assessment, and impact of publication bias. Therefore, further high-quality prospective primary research with adequate sample sizes are needed to assess patient perception before, during, and after treatment with fixed orthodontic appliances, as reported by almost all the reviews included in this study;^(14,31-38) along with further high quality and well reported systematic reviews with meta-analyses to enable further overviews.

Improving facial appearance and social attractiveness was found to be the main reason for seeking orthodontic treatment^(34,37) and this improvement in aesthetics and psychological wellbeing at the end of treatment correlated with patient and parent satisfaction. The findings of poor self-perception related to adverse dental aesthetics,⁽³⁹⁾ orthodontic treatment need and malocclusion being significantly associated with a negative impact on OHRQoL has been noted by a large number of authors.^(20,34,35,40-65) This effect could be due to teasing and bullying (among children) and the associated poor self-esteem, social, emotional and psychological well-being influence of malocclusion.⁽³⁴⁾

Whilst it was not surprising that the aesthetic impact of malocclusion is the greatest motivation for seeking orthodontic treatment as patients usually expect an improvement in dentofacial aesthetics with treatment, correcting functional aspects of malocclusion should also be explored in future reviews. Moreover, improving the aesthetics of malocclusion is likely to meet patient expectations of treatment although long treatment duration, pain, and problems with retainers were associated with clearly associated with patient dissatisfaction.^(14,36)

Orthodontic treatment can result in quality of life deteriorating in terms of pain and discomfort, functional limitation, and deterioration in psychosocial and emotional wellbeing. This principally occurs during the initial stages of treatment and reduces as treatment progresses. This can be

attributed to the fact that as treatment progresses, the causative factor of the deterioration of OHRQoL (malocclusion) fades away. Therefore, both a short term and long term evaluation of patient perception is important for successful treatment. O'Brien et al. (1998)⁽⁶⁶⁾ and Bennett and Phillips (1999)⁽⁶⁷⁾ emphasized that an objective treatment assessment should be supplemented with measures to assess health-related quality of life as determined by patients, where patient satisfaction with treatment and treatment outcomes are not related to clinician opinion or the objectivity of the findings.

The variations in the measures used to evaluate OHRQoL or the differences in the approaches for implementing the same measure restricted the standardization of the assessment method and resulted in heterogeneity.^(14,35,38) Additionally, most of the studies were observational and consequently were subject to bias and confounding that adversely affected their validity.^(14,68) As in any questionnaire study, data could be subject to different sources of bias and errors⁽⁶⁹⁾ resulting from several factors including age, gender, ethnicity, psychological status, and socio-economic status. As a result, confounding is likely to be present in studies of patient perception.⁽¹⁴⁾ To further complicate the situation, the meta-analysis by Andiappan et al. (2015)⁽³⁵⁾ identified publication bias and heterogeneity among the findings of the available studies between countries and populations.

Further revisions and refinements are also required for OHRQoL measures to become more condition specific for orthodontics and therefore increasing their validity.⁽¹⁶⁾

Adults and females are noted to be more dissatisfied with appearance and were, therefore, more motivated to undergo orthodontic treatment than younger and male patients. Similarly, adults and female patients may be more sensitive both during, and, with the outcome of treatment,⁽³⁶⁾ although this was not a consistent finding.⁽³⁷⁾ Ethnicity has not been shown to influence patient expectation, and should be investigated further due to global cultural variance. However, the majority of studies investigating the effect of orthodontic treatment on quality of life have involved children and adolescents rather than adults.^(5,26) This is most likely due to the fact that children and adolescents seek treatment more frequently than adults.⁽³⁸⁾ It should be noted studying OHRQoL in adolescent and children undergoing orthodontic treatment is complicated by the fact that the quality of life views of children and adolescents differ to those of adults⁽⁷⁰⁾ and the validity of assessments can be compromised when used for different age groups.⁽³⁸⁾ Furthermore, adults and children have different cognitive capabilities, therefore, an age-specific questionnaire should be designed to solve this problem and to follow the changes in behaviour with age.^(16,71)

Since adequate cooperation of patients with orthodontic treatment might reflect their relationship with their parents, it is necessary to examine and influence parental attitude toward treatment positively.⁽³⁴⁾ Furthermore, due to the possibility of differences in patient and parent expectations, effective communication between the orthodontist-patient-parent(s) is important. A good orthodontist-patient relationship and meeting patient expectations is necessary in order to achieve good patient compliance during treatment as well as provide satisfaction with the final treatment outcome. However, these expectations should be realistic and sufficient information about all aspects of treatment should be provided before starting treatment.

Although this overview is based on information from systematic reviews, there are some limitations. Whilst no data are retrieved from primary studies in an overview, the data were collated using thematic synthesis of the main domains reported by review authors. We used the AMSTAR 2 tool⁽²³⁾ for the assessment of systematic reviews and included both randomised and non- randomised studies along with a simpler categorical rating of study quality which was more comprehensive than the original numerical scoring version.^(24,25) Future research should include the impact of orthodontic treatment along with quantitative measures such as treatment duration, rate of tooth movement, skeletal and dental effects, and occlusal results.⁽⁴⁾

CONCLUSIONS

There is a lack of high-quality systematic reviews and meta-analyses for assessing patient perception with fixed appliance orthodontic treatment. The aesthetic impact of malocclusion is the main motive for seeking orthodontic treatment. Quality of life reduces during the initial stages of orthodontic

treatment, but improves in the later stages of treatment. Assessment before, during and after orthodontic treatment is necessary to comprehensively assess patient perception at all stages of care.

CONFLICT OF INTEREST

None of the authors have any conflict of interest to declare.

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REFERENCES

1. Rosenthal, G.E. and Shannon, S.E. (1997) The use of patient perceptions in the evaluation of health-care delivery systems. *Medical Care*, 35 (11 Suppl.), NS58-NS68.
2. Sayers, M.S. and Newton, J.T. (2007) Patients' expectations of orthodontic treatment: Part 2 – findings from a questionnaire survey. *Journal of Orthodontics*, 34 (1), 25-35.
3. El-Angbawi, A.M.F. (2013) *Is the 0.018-inch or the 0.022-inch bracket slot system more effective for the levelling and alignment stage of orthodontic treatment?* PhD Thesis. University of Dundee – School of Dentistry.
4. Tsihlaki, A., O'Brien, K., Johal, A. and Fleming, P.S. (2018) Orthodontic trial outcomes: Plentiful, inconsistent, and in need of uniformity? A scoping review. *American Journal of Orthodontics and Dentofacial Orthopedics*, 153 (6), 797-807.
5. Pringle, A.M., Petrie, A., Cunningham, S.J. and McKnight, M. (2009) Prospective randomized clinical trial to compare pain levels associated with 2 orthodontic fixed bracket systems. *American Journal of Orthodontics and Dentofacial Orthopedics*, 136 (2), 160-167.
6. Tecco, S., D'Attilio, M., Tetè, S. and Festa, F. (2009) Prevalence and type of pain during conventional and self-ligating orthodontic treatment. *European Journal of Orthodontics*, 2009, 31 (4), 380-384.
7. De Oliveira, C.M. and Sheiham, A. (2004) Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *Journal of Orthodontics*, 31 (1), 20-27.
8. Agou, S., Locker, D., Muirhead, V., Tompson, B. and Streiner, D.L. (2011) Does psychological well-being influence oral-health-related quality of life reports in children receiving orthodontic treatment? *American Journal of Orthodontics and Dentofacial Orthopedics*, 139 (3), 369-377.
9. Liu, Z., McGrath, C. and Hägg, U. (2011a) Changes in oral health-related quality of life during fixed orthodontic appliance therapy: An 18-month prospective longitudinal study. *American Journal of Orthodontics and Dentofacial Orthopedics*, 139 (2), 214-219.
10. Johal, A., Alyaqoobi, I., Patel, R. and Cox, S. (2015) The impact of orthodontic treatment on quality of life and self-esteem in adult patients. *European Journal of Orthodontics*, 37 (3), 233-237.
11. Wang, J., Tang, X., Shen, Y., Shang, G., Fang, L., Wang, R. and Xu, Y. (2015) The correlations between health-related quality of life changes and pain and anxiety in orthodontic patients in the initial stage of treatment. *BioMed Research International*, 2015, 725913.
12. Prado, R.F., Ramos-Jorge, J., Marques, L.S., de Paiva, S.M., Melgaço, C.A. and Pazzini, C.A. (2016) Prospective evaluation of the psychosocial impact of the first 6 months of orthodontic treatment with fixed appliance among young adults. *The Angle Orthodontist*, 86 (4), 644-648.
13. Inglehart, M.R. and Bagramian, R.A. (2002) *Oral health-related quality of life*. Chicago: Quintessence Publishing Co.
14. Zhou, Y., Wang, Y., Wang, X., Voliere, G. and Hu, R. (2014) The impact of orthodontic treatment on the quality of life a systematic review. *BMC Oral Health*, 14 (1), 66-72.
15. Cunningham, S.J. and Hunt, N.P. (2001) Quality of life and its importance in orthodontics. *Journal of Orthodontics*, 28 (2), 152-158.
16. Cunningham, S.J. and O'Brien, C. (2007) Quality of life and orthodontics. *Seminars in Orthodontics*, 13 (2), 96-103.
17. Bowling, A. (2005) *Measuring health: a review of quality of life measurement scales*. 3rd ed., Maidenhead, Berkshire, England and New York: Open University Press.
18. Zhang, M., McGrath, C. and Hägg, U. (2006) The impact of malocclusion and its treatment on quality of life: A literature review. *International Journal of Paediatric Dentistry*, 16 (6), 381-388.

19. Lee, S., McGrath, C. and Samman, N. (2007) Quality of life in patients with dentofacial deformity: a comparison of measurement approaches. *International Journal of Oral and Maxillofacial Surgery*, 36 (6), 488-492.
20. Rusanen, J., Lahti, S., Tolvanen, M. and Pirttiniemi, P. (2010) Quality of life in patients with severe malocclusion before treatment. *European Journal of Orthodontics*, 32 (1), 43-48.
21. Yassir, A.Y., McIntyre, G.T. and Bearn, D.R. (2017) Three questionnaires to assess the perception of fixed orthodontic therapy before, during and after treatment: validity and reliability. *European Journal of Orthodontics*, 39 (4), 402-410. <https://doi.org/10.1093/ejo/cjw076>.
22. Yassir, Y.A., El-Angbawi, A.M., McIntyre, G.T., Revie, G.F. and Bearn, D.R. (2018) A randomized clinical trial of the effectiveness of 0.018-inch and 0.022-inch slot orthodontic bracket systems: part 2: quality of treatment. *European Journal of Orthodontics*, 29, 41(2): 143-153. doi: 10.1093/ejo/cjy038.
23. Shea, B.J., Reeves, B.C., Wells, G., Thuku, M., Hamel, C., Moran, J., Moher, D., Tugwell, P., Welch, V., Kristjansson, E. and Henry, D.A. (2017) AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*, 358: j4008. doi: 10.1136/bmj.j4008.
24. Shea, B.J., Bouter, L.M., Peterson, J., Boers, M., Andersson, N., Ortiz, Z., Ramsay, T., Bai, A., Shukla, V.K. and Grimshaw, J.M. (2007) External validation of a measurement tool to assess systematic reviews (AMSTAR). *PLoS One*, 2: e1350.
25. Shea, B.J., Hamel, C., Wells, G.A., Bouter, L.M., Kristjansson, E., Grimshaw, J., Henry, D.A. and Boers, M. (2009) AMSTAR is a reliable and valid measurement tool to assess the methodological quality of systematic reviews. *Journal of Clinical Epidemiology*, 62: 1013-1020.
26. Guest, G., MacQueen, K.M. and Namey, E.E. (2012) *Applied thematic analysis*. Thousand Oaks, California: Sage, 11.
27. Braun, V. and Victoria, C. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2), 83.
28. Daly, J., Kellehear, A. and Gliksman, M. (1997) *The public health researcher: A methodological approach*. Melbourne, Australia: Oxford University Press, 611-618.
29. Wang, Y., Jian, F., Lai, W., Zhao, Z., Yang, Z., Liao, Z., Shi, Z., Wu, T., Millett, D.T., McIntyre, G.T. and Hickman, J. (2010) Initial arch wires for alignment of crooked teeth with fixed orthodontic braces. *Cochrane Database of Systematic Reviews*, 14 (4), CD007859.
30. Jian, F., Lai, W., Furness, S., McIntyre, G.T., Millett, D.T., Hickman, J. and Wang, Y. (2013) Initial arch wires for tooth alignment during orthodontic treatment with fixed appliances. *Cochrane Database of Systematic Reviews*, 30 (4), CD007859.
31. Wang, Y., Liu, C., Jian, F., McIntyre, G.T., Millett, D.T., Hickman, J. and Lai, W. (2018) Initial arch wires used in orthodontic treatment with fixed appliances. *Cochrane Database of Systematic Reviews*, 7:CD007859. doi: 10.1002/14651858.CD007859.pub4.
32. Bondemark, L., Holm, A., Hansen, K., Axelsson, S., Mohlin, B., Brattstrom, V., Paulin, G. and Pietila, T. (2007) Long-term stability of orthodontic treatment and patient satisfaction. A systematic review. *The Angle Orthodontist*, 77 (1), 181-191.
33. Fleming, P.S. and Johal, A. (2010) Self-ligating brackets in orthodontics. A systematic review. *The Angle Orthodontist*, 80 (3), 575-584.
34. Samsyanová, L. and Broukal, Z. (2014) A systematic review of individual motivational factors in orthodontic treatment: Facial attractiveness as the main motivational factor in orthodontic treatment. *International Journal of Dentistry*, 2014, 938274.
35. Andiappan, M., Gao, W., Bernabé, E., Kandala, N.B. and Donaldson, A.N. (2015) Malocclusion, orthodontic treatment, and the Oral Health Impact Profile (OHIP-14): Systematic review and meta-analysis. *The Angle Orthodontist*, 85 (3), 493-500.
36. Pachêco-Pereira, C., Pereira, J.R., Dick, B.D., Perez, A. and Flores-Mir, C. (2015) Factors associated with patient and parent satisfaction after orthodontic treatment: A systematic review. *American Journal of Orthodontics and Dentofacial Orthopedics*, 148 (4), 652-659.
37. Yao, J., Li, D.D., Yang, Y.Q., McGrath, C.P. and Mattheos, N. (2016) What are patients' expectations of orthodontic treatment: a systematic review. *BMC Oral Health*, 16 (1), 19. doi: 10.1186/s12903-016-0182-3.
38. Javidi, H., Vettore, M. and Benson, P.E. (2017) Does orthodontic treatment before the age of 18 years improve oral health-related quality of life? A systematic review and meta-analysis. *American Journal of Orthodontics and Dentofacial Orthopedics*, 151 (4): 644-655.
39. Klages, U., Bruckner, A. and Zentner, A. (2004) Dental aesthetics, self-awareness, and oral health-related quality of life in young adults. *European Journal of Orthodontics*, 26 (5), 507-514.
40. Helm, S., Kreiborg, S. and Solow, B. (1985) Psychosocial implications of malocclusion: A 15-year follow-up study in 30-year-old Danes. *American Journal of Orthodontics*, 87 (2), 110-118.

41. Mandall, N.A., Mccord, J.F., Blinkhorn, A.S., Worthington, H.V. and O'Brien, K.D. (1999) Perceived aesthetic impact of malocclusion and oral self-perceptions in 14-15-year-old Asian and Caucasian children in Greater Manchester. *European Journal of Orthodontics*, 22 (2), 175-183.
42. De Oliveira, C.M. and Sheiham, A. (2003) The relationship between normative orthodontic treatment need and oral health-related quality of life. *Community Dentistry and Oral Epidemiology*, 31 (6), 426-436.
43. Kok, Y.V., Mageson, P., Harradine, N.W.T., Sprod, A.J. and Harradine, A.J. (2004) Comparing a quality of life measure and the aesthetic component of the index of orthodontic treatment need (IOTN) in assessing orthodontic treatment need and concern. *Journal of Orthodontics*, 31 (4), 312-318.
44. Brown, A. and Al-Khayal, Z. (2006) Validity and reliability of the Arabic translation of the child oral-health-related quality of life questionnaire (CPQ11-14) in Saudi Arabia. *International Journal of Paediatric Dentistry*, 16 (6): 405-411.
45. O'Brien, K., Wright, J.L., Conboy, F., Macfarlane, T. and Mandall, N. (2006) The child perception questionnaire is valid for malocclusions in the United Kingdom. *American Journal of Orthodontics and Dentofacial Orthopedics*, 129 (4), 536-540.
46. Wong, A.T., McMillan, A.S. and McGrath, C. (2006) Oral health-related quality of life and severe hypodontia. *Journal of Oral Rehabilitation*, 33 (12): 869-873.
47. Johal, A., Cheung, M.Y. and Marcene, W. (2007) The impact of two different malocclusion traits on quality of life. *British Dental Journal*, 202 (2): E2.
48. O'Brien, C., Benson, P.E. and Marshman, Z. (2007) Evaluation of a quality of life measure for children with malocclusion. *Journal of Orthodontics*, 34 (3): 185-193.
49. Kiyak, H.A. (2008) Does orthodontic treatment affect patients' quality of life? *Journal of Dental Education*, 72 (8), 886-894.
50. Liu, Z., McGrath, C. and Hägg, U. (2009) The impact of malocclusion/orthodontic treatment need on the quality of life. A systematic review. *The Angle Orthodontist*, 79 (3), 585-591.
51. Feu, D., de Oliveira, B.H., de Oliveira Almeida, M.A., Kiyak, H.A. and Miguel, J.A.M. (2010) Oral health-related quality of life and orthodontic treatment seeking. *American Journal of Orthodontics and Dentofacial Orthopedics*, 138 (2), 152-159.
52. Hassan, A.H. and Amin, H.E-S. (2010) Association of orthodontic treatment needs and oral health-related quality of life in young adults. *American Journal of Orthodontics and Dentofacial Orthopedics*, 137 (1), 42-47.
53. Liu, Z., McGrath, C. and Hägg, U. (2011b) Associations between orthodontic treatment need and oral health-related quality of life among young adults: does it depend on how you assess them? *Community Dentistry and Oral Epidemiology*, 39 (2), 137-144.
54. De Baets, E., Lambrechts, H., Lemiére, J., Diya, L. and Willems, G. (2012) Impact of self-esteem on the relationship between orthodontic treatment need and oral health-related quality of life in 11- to 16-year-old children. *European Journal of Orthodontics*, 34 (6), 731-737.
55. Masood, Y., Masood, M., Zainul, N.N., Araby, N.B., Hussain, S.F. and Newton, T. (2013) Impact of malocclusion on oral health related quality of life in young people. *Health and Quality of Life Outcomes*, 11, 25.
56. Dawoodbhoj, I., Delgado-Angulo, E.K. and Bernabé, E. (2013) Impact of malocclusion on the quality of life of Saudi children. *The Angle Orthodontist*, 83 (6), 1043-1048.
57. Kang, J.M. and Kang, K.H. (2014) Effect of malocclusion or orthodontic treatment on oral health-related quality of life in adults. *The Korean Journal of Orthodontics*, 44 (6), 304-311.
58. Benson, P.E., Da'as, T., Johal, A., Mandall, N.A., Williams, A.C., Baker, S.R. and Marshman, Z. (2015) Relationships between dental appearance, self-esteem, socio-economic status, and oral health-related quality of life in UK schoolchildren: A 3-year cohort study. *European Journal of Orthodontics*, 37 (5): 481-490.
59. Chen, M., Feng, Z.C., Liu, X., Li, Z.M., Cai, B. and Wang, D.W. (2015) Impact of malocclusion on oral health-related quality of life in young adults. *The Angle Orthodontist*, 85 (6), 986-991.
60. Clijmans, M., Lemiére, J., Fieuws, S. and Willems, G. (2015) Impact of self-esteem and personality traits on the association between orthodontic treatment need and oral health-related quality of life in adults seeking orthodontic treatment. *European Journal of Orthodontics*, 37 (6), 643-650.
61. Dimberg, L., Arnrup, K. and Bondemark, L. (2015) The impact of malocclusion on the quality of life among children and adolescents: a systematic review of quantitative studies. *European Journal of Orthodontics*, 37 (3), 238-247.
62. Farishta, S. (2015) Patient's perceptions regarding orthodontic needs and satisfactory level with the procedure. *Journal of International Oral Health*, 7 (9), 79-82.
63. Thiruvankadam, G., Asokan, S., John, J.B., Geetha Priya, P.R. and Prathiba, J. (2015) Oral health-related quality of life of children seeking orthodontic treatment based on child oral health impact profile: A cross-sectional study. *Contemporary Clinical Dentistry*, 6 (3), 396-400.

64. Choi, S.H., Kim, J.S., Cha, J.Y. and Hwang, C.J. (2016) Effect of malocclusion severity on oral health-related quality of life and food intake ability in a Korean population. *American Journal of Orthodontics and Dentofacial Orthopedics*, 149 (3), 384-390.
65. Kragt, L., Dharmo, B., Wolvius, E.B. and Ongkosuwito, E.M. (2016) The impact of malocclusions on oral health-related quality of life in children – a systematic review and meta-analysis. *Clinical Oral Investigations*, 20 (8), 1881-1894.
66. O'Brien, K., Kay, L., Fox, D. and Mandall, N. (1998) Assessing oral health outcomes for orthodontics – measuring health status and quality of life. *Community Dental Health*, 15 (1), 22-26.
67. Bennett, M.E. 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 (1), 65-75.
68. Grimes, D.A. and Schulz, K.F. (2002) Bias and causal associations in observational research. *The Lancet*, 359 (9302), 248-252.
69. Bowling, A. (2009) *Research methods in health: Investigating health and health services*. 3rd ed., Glasgow: McGraw Hill/Open University Press.
70. Pal, D.K. (1996) Quality of life assessment in children: A review of conceptual and methodological issues in multidimensional health status measure. *Journal of Epidemiology and Community Health*, 50 (4), 391-396.
71. Jokovic, A., Locker, D., Stephens, M., Kenny, D., Tompson, B. and Guyatt, G. (2002) Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *Journal of Dental Research*, 81 (7), 459-463.

FIGURE LEGENDS

Figure 1: Flow chart of the literature selection process

LIST OF TABLES (SEE TABLES FILE):

Table 1: AMSTAR 2 categories for the level of evidence

Table 2: Systematic reviews that have assessed patient perception of orthodontic treatment

Table 3: AMSTAR 2 items