Impact of socioeconomic status on patient non-attendance and orthodontic treatment duration in patients with severe malocclusions

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Abstract

Purpose: The relationship between socioeconomic status (SES) and orthodontic treatment duration is unclear. The aim of this study was to investigate the impact of socioeconomic status on patient non-attendance and orthodontic treatment duration in patients with severe malocclusions.

Method: A retrospective observational study of 94 orthodontic patients divided into three different treatment groups treated consecutively with full fixed appliances from 2008-2011 in a hospital setting was carried out. Patients' residential addresses were used to determine their socioeconomic status using the New Zealand Deprivation Index 2013. Outcome variables included treatment duration and patient non-attendance, including the number of cancelled appointments and number of failed appointments.

Results: There was no significant difference in patient non-attendance nor orthodontic treatment duration for patients of low, medium and high SES. Those patients requiring orthognathic surgery took significantly longer to complete (27.1 months) compared to standard patients (24.1 months) and cleft patients (20.2 months).

Conclusion: Using an area-based index, socioeconomic status of patients appears to have no significant impact on patient non-attendance nor the duration of orthodontic treatment in patients with severe malocclusions. Orthodontists could expect similar treatment durations and non-attendance rates among patients with severe malocclusions and regardless of SES. Establishing a means for children from lower SES families to access specialist private orthodontic care is crucial in reducing oral health inequalities.

Introduction

One of the first questions that orthodontists are often asked by their patients before embarking upon fixed appliance treatment is "*how long will my braces be on for*?" Although a very reasonable question, current research struggles to provide an accurate, patient-specific method of predicting treatment duration, leaving orthodontists to respond with generalised estimates based on clinical experience (Tsichlaki *et al.*, 2016). From a clinical perspective, treatment duration is particularly important in orthodontics because of the greater risk of white spot lesion formation and patient burnout associated with longer treatments (Brezniak & Ben-Ya'ir, 1989; Chapman *et al.*, 2010).

Current research has shown that a number of factors influence treatment duration including patient demographics (gender, age), malocclusion severity (crowding, skeletal and dental relationships), clinical treatment decisions (extraction, anchorage control, osteogenic procedures), delivery systems (private, teaching, institutional practices) and patient co-operation as measured by patient attendance and treatment compliance. (Fisher *et al.*, 2010). Patient attendance and co-operation are critical factors in the success of orthodontic treatment as well as influencing treatment duration (Starnbach & Kaplan, 1975; Turbill *et al.*, 2001). It is unclear what influence socioeconomic status (SES) has on patient non-attendance and treatment duration and whether a lower socioeconomic status is associated with a shorter or longer treatment time (Germa *et al.*, 2010), particularly in New Zealand.

So far, two studies have investigated factors influencing the duration of fixed appliance therapy in New Zealand (Skidmore *et al.*, 2006; Healey *et al.*, 2016). In both of these studies, patients were recruited from specialist orthodontic practices in the private sector, and as such, likely represent families who have the means to pay for private orthodontic treatment (Skidmore *et al.*, 2006; Healey *et al.*, 2016). A reason for utilising private-based samples is that specialist orthodontic care is limited in the public health sector. While most District Health Boards in New Zealand restrict orthodontic care to patients with craniofacial anomalies, a limited number do accept a small number of patients with severe malocclusions and who have a limited income. For instance, the eligibility criteria for accessing specialist orthodontic treatment at the Canterbury District Health Board (CDHB) include (1) an orofacial cleft or other craniofacial anomaly; (2) a severe skeletal discrepancy that requires both orthodontic and orthognathic surgery; (3) a severe malocclusion which is accompanied by the supporting family receiving a government benefit[1]. The CDHB eligibility criteria therefore gives rise to the opportunity to investigate the association of patient attendance and orthodontic treatment duration in a group of patients from a range of SES.

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[1]   Canterbury Community Health Pathways. Website: https://www. healthpathways.org.nz/index.htm. Accessed 31 March 2017.

The New Zealand Association of Orthodontists has formed a charitable trust, *Wish For A Smile Charitable Trust* (*WFAST*), to assist children whose parents or caregivers may not have the financial means to access specialist orthodontic treatment privately or who do not meet the public health system criteria for specialist orthodontic treatment. The aim of this new initiative is to provide specialist orthodontic treatment to such patients with severe malocclusions who would normally be unable to access this care, either privately or through the public health system.

Whether children from low-income families seek treatment through the public health system or initiatives like the WFAST, there are several clinical benefits for completing treatment in a timely manner. For instance, iatrogenic damage (such as white spot lesion formation) is associated with longer treatment times (Srivastava, 2013). The development of enamel demineralisation during orthodontic treatment is a major concern in patients, particularly thoses from low SES backgrounds (Poulton *et al.*, 2013). A key reason enamel demineralisation is a concern for more deprived children receiving orthodontic treatment is because of the social inequalities that drive their behaviours and risk factors for demineralisation, including poor oral hygiene practices, which may be due to a lack of oral heal care education, poorer access to oral health services, discrimination or a lack of financial means to purchase tooth brushes and tooth paste (Poulton *et al.*, 2013). If children of lower socioeconomic status tend to have longer treatment durations, a greater emphasis may be needed on preventive measures and education. In addition, access to care may be restricted for this patient group due to transportation costs and difficulty with parents taking time off work resulting in greater patient non-attendances which can further extend treatment duration and their risk of white spot lesion development.

Accordingly, it is important to determine the impact of socioeconomic status on patient non-attendance and on the duration of orthodontic treatment, particularly for those patients from a low socioeconomic status in New Zealand. The aim of this study was to assess the relationship between socioeconomic status and orthodontic treatment duration in patients treated at a public hospital facility.

Method

The study sample consisted of 94 consecutively treated patients who commenced full upper and/or lower fixed appliance treatment between 2008-2011 at the Oral Health Centre, Christchurch Hospital. Treatment was provided by two registered specialist orthodontists employed by the CDHB. The study sample was divided into three distinct patient groups based on strict eligibility criteria: (1) Orofacial cleft or other craniofacial anomalies requiring orthodontic treatment as part of their multidisciplinary management (cleft n=17); (2) severe skeletal discrepancies requiring both orthodontic treatment and orthognathic surgery (orthoganthic n=28);

and, (3) severe malocclusions with supporting families who received a government subsidy (standard n=49). Receipt of a government subsidy was not considered an exclusion criteria for the 'orthognathic' and 'cleft' groups.

Patients' residential addresses recorded at the commencement of treatment were used to determine their SES using the New Zealand Deprivation Index 2013 (NZDep2013) (Salmond & Crampton, 2012). The NZDep2013 index of deprivation incorporates eight dimensions of material and social deprivation including; lack of income, employment, communication, transport, support, qualifications, owned home and living space (Atkinson *et al.*, 2014). It is an area-based measure created from data collected in the New Zealand Census (Atkinson *et al.*, 2014). According to the index, "high deprivation" is defined as having a score between 8-10, "medium deprivation" is a score between 4-7, while "low deprivation" is a score between 1-3 (Atkinson *et al.*, 2014). For the purposes of this study "high deprivation" and "low deprivation" will be referred to as "low SES" and "high SES", respectively.

Prior to commencing treatment, the severity of each patient's malocclusion was assessed using the Dental Aesthetic Index (DAI). The DAI is a common epidemiologic index used to classify the severity of a malocclusion into four distinct categories: minor (equal or less than 25), definite (26-30), severe (31-35), and handicapping (equal or greater than 36) (Jenny & Cons, 1996). The DAI consists of 10 intraoral measurements, which are multiplied by a regression coefficient to produce a weighted score for each component (Jenny & Cons, 1996). The overall DAI score is calculated by adding the scores of the 10 weighted components and summing with a constant of 13 (Jenny & Cons, 1996). The DAI score was determined for patients when their eligibility to receive treatment at the hospital was assessed.

Data were collected for the sample's sociodemographic characteristics, number of months in treatment, number of failed/cancelled appointments, and the number of adjustment appointments required during the course of treatment. This data was collected from the hospital's patient management system. This information was obtained as part of a quality assurance audit designed to evaluate the quality of care delivered by our orthodontic unit. All study participants provided consent and data were collected in accordance with the Helsinki Declaration of 1975.

Data were analysed using the Statistical Package for the Social Sciences (SPSS V22.0, SPSS Inc, Chicago, IL, USA). Bivariate analysis was carried out using the Chi-square test with the alpha level set at 0.05. Non-parametric tests (such as Kruskal Wallis and Mann-Whitney U) were used whenever a continuous dependent variable was not normally distributed. A general linear model was used to evaluate the length of treatment between the three patient groups after adjusting for the effect of sex and area-based deprivation.

Results

The sociodemographic characteristics of the study sample are presented in Table 1. The sample had a fairly even distribution of high, medium and low SES. All the patients were defined as having "handing-capping malocclusions" (DAI score equal or greater than 36). There was no significant difference in levels of deprivation between standard treatment, cleft and orthognathic patients. The mean treatment duration for the entire sample was 24.9 months.

Patient attendance, treatment duration and socioeconomic status

The relationship between SES and several treatment-related factors is presented in Table 2. There was no significant difference in treatment duration between patients of low, medium or high SES. The number of adjustments and the number of cancellations were also not significantly different between the study groups. Although higher failure and cancellation rates were noted in the low and high SES groups respectively, these did not reach statistical significance.

Patient attendance, treatment duration and patient group

The relationship between patient type and several treatment-related factors is presented in Table 3. Patients undergoing orthognathic surgery took significantly longer to complete their treatment (27.1 months) compared with standard treatment patients (24.1 months) and cleft patients (20.2 months). There was a significant association between patient type and duration of orthodontic treatment (F = 4.89, p = 0.01), after adjusting for the effect of area-based deprivation (F = 2.21, p = 0.141) and sex (F = 0.32, p = 0.57).

Orthognathic patients attended significantly more adjustments than cleft and standard patients (18.7 for surgical compared with 14.0 for standard treatment patients and 10.5 for cleft). The number of cancellations was significantly more for orthognathic patients.

Discussion

Predicting treatment duration in orthodontics is challenging due to its multifactorial nature. Most ortho-dontic treatment in New Zealand is privately funded so there is limited capacity to assess the impact of low socioeconomic status on treatment duration. This study was designed to assess the impact of socioeconomic status on patient attendance and orthodontic treatment duration in a cohort of patients with severe malocclusions treated through the public system and was an opportunity to work with a sample of children from a broad range of socioeconomic backgrounds.

Table I. Area-based SES by patient type (parentheses contain percentages)

	NZDep2013 Deprivation Category					
	High SES (1-3) n = 31		Medium SES (4-7) n = 35		Low SES (8-10) n = 28	
Patient Type (%)						
Standard	14	(28.6)	16	(32.7)	19	(38.8)
Orthognathic	8	(28.6)	14	(50.0)	6	(21.4)
Cleft	9	(52.9)	5	(29.4)	3	(17.6)

Table 2. Area-based SES by treatment-related features (parentheses contain standard deviations)

	NZDep2013 Deprivation Category						P-value
	High SES (1-3) n = 31		Medium SES (4-7) n = 35		Low SES (8-10) n = 28		
Treatment duration in *months (SD)*	25.9	(9.7)	24.8	(7.7)	22.4	(8.6)	0.280
Mean number Adjustments *(SD)*	15.5	(6.9)	15.6	(7.9)	13.3	(5.4)	0.356
Mean number of FTAs *(SD)*	0.6	(1.7)	0.6	(1.6)	1.0	(1.5)	0.579
Mean number of Cancellations *(SD)*	0.4	(0.8)	0.3	(0.7)	0.2	(0.4)	0.559

Table 3. Patient type by treatment-related features (parentheses contain standard deviations)

	Patient Group						P-value
	Standard (n = 49)		Orthognathic (n =28)		Cleft (n = 17)		
Treatment Duration in *months (SD)*	24.1	(8.2)	27.1	(8.6)	20.2	(9.1)	0.030
No. Adjustments	14.0	(5.8)	18.7	(7.7)	10.5	(5.1)	0.001
No. Failed Appointments	0.9	(1.8)	0.6	(1.2)	0.5	(1.5)	0.558
No. Cancellations	0.2	(0.4)	0.6	(0.9)	0.1	(0.2)	0.011

To the best of our knowledge, this study is one of the first to investigate the impact of socioeconomic status on treatment duration. This study is a good starting point for further research which could aim to use a multivariate analysis. Further research that investigates barriers to orthodontic treatment for children from low income families would also be useful.

Our findings suggest that SES, measured using an area-based index, is not associated with patient non-attendance nor with treatment duration. This was somewhat unexpected as SES has been reported to be associated with patient compliance, a strong predictor of treatment duration (Starnbach & Kaplan, 1975; Turbill et al., 2001). Research suggests that patients of a higher socioeconomic group tend to cooperate more than those of low socioeconomic groups during their orthodontic treatment (Nanda, 1992). Such differences in treatment compliance between socioeconomic levels have been attributed to intrinsic motivational factors with higher socioeconomic groups having a stronger belief that facial aesthetics can have a positive effect on social status, and hence the potential for success (Graber 1975; Nanda, 1992). Although not statistically significant, patients of lower socioeconomic status in this study tended to have the shortest treatment duration. This is an important consideration for selection of patients for the *Wish for a Smile Trust* charitable trust since most of the patients applying for this scheme reside in areas of high deprivation.

The mean treatment duration in this study was similar to those reported previously in a sample of patients treated by private orthodontists in New Zealand (Healey et al., 2016). In that study, some 16% of the sample were classified as low SES and had a significantly higher pre-treatment DAI than other SES groups. However, the assessment of SES was undertaken using parental occupations (New Zealand Socio-Economic Index of Occupational Status). Skidmore et al. (2006) also found a similar mean treatment duration of 23.5 ± 4.7 months in a sample of 366 patients treated in a single private practice located on the North Shore, Auckland. In that study it was reported that one failed appointment was associated with an increase of treatment time by 1.4 months, whereas two or more failed appointments on average increased treatment time by three months. The mean number of visits was 19.7 ± 4.4, with almost half the patients failing to attend one or more appointments. The authors did not assess the impact of SES on treatment duration or number of non-attendance appointments.

Our study has a number of weaknesses that deserve some consideration. Our study sample was small and this may have resulted in a lack of statistical power and increased risk of type II error (false negative). In addition, we did not assess treatment outcomes using an objective clinical based instrument, such as the Peer Assessment Rating (PAR). However, it was assumed that all patients were treated to a minimum standard that satisfied the two treating orthodontists. Socioeconomic status was only assessed using an area-based measure. Although the NZDep2013 is a widely used instrument in public health research (Salmond and Crampton, 2012), it is an area level measure and as such has limitations, particularly as it is possible that the Christchurch earthquake may have led to some patients being temporarily displaced and therefore classified incorrectly. The use of different SES measures, such as the New Zealand Index of Socioeconomic Deprivation for Individuals (NZiDep) which is non-occupational or the New Zealand Socio-Economic Index of Occupational Status could have resulted in different findings (Davis et al., 1999; Salmond et al., 2006). However these SES measures would have required the administration of questionnaires to the parents of the presenting patients prior to treatment and due to the retrospective nature of the study this was not possible. Our measure of treatment compliance was limited to non-attendance through assessing the number of failed or cancelled appointments.; however, in the future it would be useful to have assessed the number of breakages, standard of oral hygiene and wear of elastics in order to evaluate treatment compliance more objectively. Finally, our study assessed patients with severe (handicapping) malocclusions, as defined by the Dental Aesthetic Index. Accordingly, our findings may not be generalisable to patients with less severe malocclusions. It is plausible that the motivation to comply with orthodontic treatment may be higher in patients with severe malocclusions regardless of their socioeconomic backgrounds and this could influence the external validity of our findings.

Despite these limitations, the findings of this study should be valuable for orthodontists providing private specialist treatment through the *WFAST* initiative, as well as for general dentists and other specialists who are requested to provide additional services such as extractions or surgical exposures for these patients. The cohort of patients selected for treatment by the *WFAST* are likely to have a similarly severe malocclusion to that the standard group in this study[2]. Moreover, all patients selected by this initiative will come from families with a low SES background. Orthodontists can expect similar patient attendance and treatment durations regardless of socioeconomic status.

Conclusion

Patients' socioeconomic status, as assessed by area-based measures, appears to have no significant impact on the patient non-attendance nor duration of orthodontic treatment in patients with severe malocclusions. Orthodontists could expect similar treatment durations among patients with severe malocclusions, and possibly among all their patients, regardless of socioeconomic status. Differences in treatment duration are more likely to be related to the type of patient being treated (standard, surgical or cleft). Establishing a means for children from lower SES families to access specialist private orthodontic care, like the *WFAST,* is crucial in reducing oral health inequalities.

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