sciendo

DOI: 10.2478/aoj-2005-0010

Personality traits in adolescence and satisfaction with orthodontic treatment in young adulthood

Matthew J. Barker,* W. Murray Thomson* and Richie Poulton†

Departments of Oral Sciences* and Preventive and Social Medicine,† University of Otago, New Zealand

Objective: This study aimed to determine whether personality traits are associated with satisfaction with orthodontic treatment by age 26.

Methods: A prospective observational cohort study was conducted with 1,037 individuals, one-third of whom had received orthodontic treatment by age 26. A comprehensive personality assessment was conducted at age 18 using the multidimensional personality questionnaire. At age 26, orthodontic outcome was rated as either 'Excellent', 'Pretty good', 'Fair' or 'Poor'.

Results: Those who were less satisfied (rating their treatment outcome as 'Fair' or 'Poor') scored lower on the personality traits of control and social closeness, and higher on stress reactivity. Individuals with low scores on social closeness were twice as likely (Odds ratio: 2.07) to be less satisfied with their orthodontic result.

Conclusions: Individuals who are impulsive, stress-reactive or socially isolated are more likely to be disappointed with their orthodontic outcome. Pretreatment knowledge about certain aspects of personality might be useful to practising orthodontists.

(Aust Orthod J 2005; 21: 87–93)

Received for publication: May 2005

Accepted: September 2005

Introduction

Patient satisfaction is a key indicator of treatment quality,[1] but questions remain about satisfaction with orthodontic treatment. For example, what psychological attributes or specific personality traits influence satisfaction with treatment? If it is possible to identify a personality type that predicts dissatisfaction with orthodontic outcome, then its recognition at the initiation of treatment might enable better outcomes, partly through anticipation of the likelihood of later problems.

Personality traits describe styles of relating to the world,[2] and represent tendencies to behave, think, and feel in consistent ways.[3–5] Their development can be observed by age 3,[6] and traits are reasonably stable from childhood through adulthood,[5,7,8] and during adult life.[9] They can be conceptualised hierarchically,[5,10,11] with broad traits ('superfactors') representing general dimensions of personality, and more specific traits (e.g. sociability) in turn comprising more specific characteristics (e.g. talkativeness). These can be related in a coherent taxonomic framework such as the multidimensional personality questionnaire (MPQ),[12] a measure providing a comprehensive profile based on 10 distinct personality traits (Table I).

Previous studies[13–22] of personality characteristics and psychosocial outcomes have involved orthodontics combined with orthognathic surgery, and have had methodological limitations. One study[13] identified a group whose members were consistently hostile towards orthodontic treatment, while Hutton[14] suggested that approximately half of orthognathic surgery recipients had desirable 'personality' changes as a result. However, both these studies were retrospective, and failed to use standardised personality measures. Kiyak *et al.* found neuroticism (which shares important features with negative emotionality, the tendency to depression, anxiety and poor reaction to stress)[17] to predict early post-surgical dissatisfaction, and be inversely correlated with satisfaction.[18] Zhou *et al.*[16] reported patient satisfaction to increase over time, with personality positively affected in 50 per cent; however, retrospective reporting and non-standard measures limit the data's usefulness. Another study[21] found that neurotic adults seeking treatment were more stringent in their judgement of malocclusion. Varela and Garcia-Camba[15] reported that adult

Table I. Multidimensional personality questionnaire (MPQ) scale descriptions.

Superfactor	Personality traits	Description of a high scorer
Constraint	Traditionalism	Desires a conservative social environment; endorses high moral standards.
	Harm avoidance	Avoids excitement and danger; prefers safe activities even if they are tedious.
	Control	Is reflective, cautious, careful, and rational.
Negative emotionality	Aggression	Hurts others for own advantage; will frighten and cause discomfort for others.
	Alienation	Feels mistreated, victimised, betrayed, and the target of false rumours.
	Stress reaction	Nervous, vulnerable, sensitive, prone to worry.
Positive emotionality	Achievement	Works hard; enjoys demanding projects and working long hours.
	Social potency	Forceful and decisive, fond of influencing others; fond of leadership roles.
	Well-being	Has a happy, cheerful disposition; feels good about self and sees a bright future.
	Social closeness	Sociable; likes people and turns to others for comfort.

From Caspi *et al.*, 1997.[13]

orthodontic treatment and orthognathic surgery enhanced body image and self-esteem, whereas orthodontic treatment alone did not. Finally, Scott *et al.*[22] found that neuroticism did not predict orthodontic patient satisfaction.

To our knowledge, no studies have used a prospective design and standardised personality measures to examine orthodontic treatment satisfaction in a young adult population. The aim of this study was to determine whether there are specific personality traits associated with ratings of orthodontic treatment satisfaction.

Materials and methods

Sample

The Dunedin Multidisciplinary Health and Development Study[23] is a longitudinal birth cohort study of 1,037 children born at Queen Mary Hospital, Dunedin, New Zealand, between 1 April 1972 and 31 March 1973. Study participants were first examined at age 3. The children are representative of those born in New Zealand's South Island at that time. The cohort has been reassessed at ages 5, 7, 9, 11, 13, 15, 18, 21 and 26. Ethical approval was given by the Otago Ethics Committee.

Measures

Orthodontic satisfaction

At ages 15, 18 and 26, participants were asked whether they had previously received orthodontic treatment (using either fixed or removable appliances). At age 26, they were asked to rate the result of that orthodontic treatment as either: Excellent; Pretty good; Fair; or Poor. Age 26 was chosen because of the likelihood that most of those who were going to have orthodontic treatment would have had it by that age.

Malocclusion data

At age 12, a dental sub-study was conducted on only those 493 cohort members who were living in the greater Dunedin area at that time (during 1984 and 1985, two years before publication of the Dental Aesthetic Index).[24] Six of the ten DAI items were used at age 12 (Table II); of the four not collected, only two have DAI weightings greater than 1.0; one of these (the diastema) is relatively common, and the other (mandibular overjet) is not. Calculation of a 'mini-DAI' for this specific sample has been reported previously.[25] For the current study, the mini-DAI score was used to allocate each member of the age 12 group to a treatment need category, employing the same category description used with the DAI (Table III).

Personality

At age 18, participants completed a 177 item modified version (Form NZ) of the multidimensional personality questionnaire (MPQ), a self-report personality instrument examining a broad range of individual differences in emotional and behavioural style (Table I).[12,26] The relative independence of the 10 MPQ subscales has been previously reported.[27] The subscales define the three superfactors of constraint, negative emotionality and positive emotionality. The constraint factor comprises the traditionalism, harm

Table II. The Dental Aesthetic Index: its components, and age 12 'mini-DAI'.

DAI components	Regression coefficients		Collected at age 12?
	Actual weight	Rounded weight	
Visibly missing incisor, canine, or premolar	5.76	6	Yes
Crowding in the incisor segment	1.15	1	Yes
Spacing in the incisor segments	1.31	1	Yes
Diastema (mm)	3.13	3	No
Largest maxillary anterior irregularity (mm)	1.34	1	No
Largest mandibular anterior irregularity (mm)	0.75	1	No
Anterior maxillary overjet (mm)	1.62	2	Yes
Anterior mandibular overjet (mm)	3.68	4	No
Vertical anterior open bite (mm)	3.69	4	Yes
Anteroposterior molar relation	2.69	3	Yes

Table III. Categorisation of treatment need, using the mini-DAI and DAI scales (From Thomson, 2002).

Mini-DAI score range	Description of severity level*	DAI score range equivalent
< 11	Minor or no anomaly; no treatment indicated	< 26
11–15	Definite malocclusion, treatment elective	26–31
19+	Handicapping malocclusion; treatment mandatory	36+

* After Estioko *et al.*, 1994.[31]

avoidance and control subscales. Individuals scoring highly within those tend to be restrained, cautious, and conventional, while low scorers are impulsive, fearless and sensation-seeking, and reject conventional strictures on their behaviour. The positive emotionality factor comprises the wellbeing, social potency, achievement and social closeness subscales: individuals scoring highly within those tend to interact positively with their environment, and are ready to experience the positive emotions which arise from those interactions. Low scorers report fear of these pleasurable transactions, a low degree of self-efficacy (the belief that they can influence their environment), and are less likely to be happy. The negative emotionality factor comprises the aggression, alienation and stress reaction subscales: high scorers tend to be easily stressed and harassed, and are prone to experiencing strong negative emotions (such as anxiety or anger).[27]

Socioeconomic status

Parental socioeconomic status (SES) data used standard New Zealand occupationally-based indices[28,29] employing a 6-interval classification assigning individuals to one of three early childhood SES groups: scorers of '1' or '2' were allocated to the 'high SES' group; scorers of '3' or '4' were 'medium SES'; and those remaining were 'low SES'. Parental SES was used as a proxy for the SES of the household in which each study member grew up, as this was more likely to have determined access to orthodontic care than the individual's adult SES.

Statistical analysis

We investigated the MPQ scores of two groups: all recipients of orthodontic treatment; and a subset of those for whom there was a recording of malocclusion at age 12. Treatment recipients were grouped according to the rating of their orthodontic result ('Excellent', 'Pretty good', 'Fair', or 'Poor') to enable comparison of those clearly satisfied ('Excellent' or 'Pretty good') with those who were not ('Fair' or 'Poor'). ANOVA was used to test differences between group means. Logistic regression was used to identify orthodontic dissatisfaction predictors after scores for personality traits showing significant bivariate associations were collapsed into quintiles (and dummy variables) for multivariate analysis, which also controlled for gender. Where appropriate (see above), the mini-DAI was used to control for initial malocclusion.

Results

Of the 1,019 living study members at age 26, 974 (95.6 per cent) responded to the orthodontic treatment satisfaction question; 937 (92.0 per cent) had completed the MPQ at age 18. Complete data

Table IV. Mean MPQ scores by orthodontic treatment rating, for all recipients of orthodontic treatment (N = 294).

Rating of treatment	Constraint	Negative emotionality	Positive emotionality
Excellent	192.6 (37.1)	86.8 (52.9)	499.8 (95.7)
Pretty good	187.6 (40.1)	96.6 (46.9)	516.2 (96.7)
Fair	183.1 (39.6)	103.8 (46.9)	498.1 (107.7)
Poor	173.6 (47.5)	107.5 (54.2)	505.8 (122.0)
F value	4.567	4.894	0.015
Significance†	0.033*	0.028*	0.902
Satisfied	189.3 (39.1)	93.3 (49.1)	510.7 (96.4)
Less satisfied	180.6 (41.1)	104.8 (52.8)	500.2 (111.2)
Significance	0.083	0.071	0.410

	Traditionalism	Harm avoidance	Control	Aggression	Alienation	Stress reaction	Achievement	Social potency	Wellbeing	Social closeness
Excellent	66.8 (14.0)	63.7 (19.0)	62.0 (22.0)	30.3 (21.7)	16.9 (20.2)	39.6 (28.7)	54.1 (19.6)	36.5 (21.9)	76.5 (22.0)	82.8 (14.9)
Pretty good	64.8 (15.6)	65.0 (19.3)	57.8 (21.4)	34.3 (21.9)	19.3 (17.5)	43.0 (27.3)	54.1 (20.6)	40.7 (25.1)	81.5 (18.2)	81.9 (15.8)
Fair	67.1 (14.9)	61.7 (19.0)	54.4 (22.5)	33.2 (25.0)	22.2 (22.2)	48.4 (27.7)	55.6 (21.8)	39.3 (24.6)	78.3 (21.2)	75.9 (20.0)
Poor	62.3 (16.2)	61.8 (20.2)	49.5 (22.5)	36.3 (22.2)	21.3 (20.9)	49.8 (32.2)	59.3 (24.4)	41.8 (29.3)	80.1 (25.6)	71.7 (20.7)
F value	0.426	0.644	7.531	1.058	2.255	4.330	1.010	0.679	0.247	11.442
Significance†	0.514	0.423	0.006**	0.304	0.134	0.038*	0.316	0.410	0.620	0.001**
Satisfied	65.5 (15.1)	64.6 (19.1)	59.2 (21.7)	33.0 (21.9)	18.5 (18.5)	41.8 (27.7)	54.1 (20.3)	39.3 (24.1)	79.8 (19.6)	82.2 (15.5)
Less satisfied	65.8 (15.3)	61.7 (19.2)	53.1 (22.5)	34.1 (24.2)	22.0 (21.7)	48.8 (28.8)	56.6 (22.5)	40.0 (25.8)	78.8 (22.3)	74.7 (20.2)
Significance	0.875	0.233	0.026*	0.700	0.160	0.051	0.349	0.812	0.690	0.001**

Standard deviations in brackets

† *p* values for linear trend

*$p < 0.05$; ** $p < 0.01$

Table V. Logistic regression models for satisfied ('Excellent' or 'Pretty good') versus less satisfied ('Fair' or 'Poor') ratings of orthodontic treatment by age 26.

Predictor	Odds ratio	95 per cent CI	*p*
All recipients of orthodontic treatment (N = 294)			
Social closeness[a]	2.07	(1.15, 3.75)	0.02
Female	1.59	(0.96, 2.62)	0.07
SES High[b]	0.73	(0.35, 1.51)	0.39
SES Low[b]	1.63	(0.87, 3.06)	0.13
Recipients of orthodontic treatment who were dentally examined at age 12 (N = 157), using age 12 DAI treatment need categories.			
Social closeness[a]	1.42	(0.59, 3.42)	0.44
DAI moderate	1.14	(0.52, 2.48)	0.74
DAI severe	0.74	(0.24, 2.30)	0.61
DAI handicapping	0.43	(0.11, 1.68)	0.23
Female	1.42	(0.69, 2.91)	0.34
SES High[b]	1.02	(0.40, 2.62)	0.97
SES Low[b]	0.74	(0.40, 2.62)	0.57

[a] Lowest quintile

[b] Reference category - medium SES

(individuals who had MPQ data at age 18 and age 26 orthodontic treatment data) were available for 920 (90.3 per cent), of whom 148 (16.2 per cent) were classified as high SES, 585 (63.9 per cent) as medium SES, and 182 (19.8 per cent) as low SES. Approximately half (454 or 49.3 per cent) were female.

Orthodontic treatment by age 26 was reported by 294 (32 per cent) participants, of whom 154 (52.4 per cent) were female. Orthodontic treatment ratings were: 68 (23.1 per cent) rated it 'Excellent'; 134 (45.6 per cent) rated it 'Pretty good'; 67 (22.8 per cent) rated it 'Fair'; and 25 (8.5 per cent) rated it 'Poor'. Of the orthodontic treatment recipients, 45 (15.3 per cent) were high SES, 196 (66.7 per cent) medium SES, and 53 (18.0 per cent) low SES. There were no significant differences between males and females with respect to orthodontic dissatisfaction (27.3 per cent and 35.7 per cent respectively; $p = 0.12$).

Of the 920 with complete data, 493 (53.6 per cent) were dentally examined at age 12. Among this subsample, orthodontic treatment had been received by 157 (31.8 per cent, of whom just under half were female) by age 26. Their treatment ratings were similar to the full sample.

Personality traits and ratings of orthodontic success

MPQ scores and orthodontic treatment ratings are presented in Table IV for the 294 study members who had had orthodontic treatment by age 26. Two significant linear trends were observed at the superfactor level. Negative emotionality (p for linear trend = 0.028) and constraint (p for linear trend = 0.033) were associated with satisfaction ratings (that is, as satisfaction decreased, negative emotionality scores increased; the reverse applied to the constraint scores). Dichotomising satisfaction ratings (high versus low) gave the same pattern, but the differences became statistically marginal (Negative emotionality: $p = 0.071$; Constraint: $p = 0.083$).

Among the subscales, linear trends were evident for control (p for linear trend = 0.006), stress reaction (p for linear trend = 0.038) and social closeness (p for linear trend = 0.001). Dichotomised satisfaction ratings showed differences for control ($p = 0.026$), stress reaction ($p = 0.051$) and social closeness ($p = 0.001$): those who were less satisfied scored lower on control and social closeness, and higher on stress reaction. No other personality differences were observed. A similar general pattern was observed among the 157 for whom DAI data were available from age 12.

All personality traits showing bivariate associations at the $p < 0.1$ level became covariates in logistic regression models predicting satisfaction (Table V). After controlling for gender and SES, individuals in the lowest quintile of social closeness scores were twice as likely to be unhappy with their orthodontic outcome. When backwards stepwise regression was used, social closeness was the only predictor to remain in the model. There were no significant associations when modelling was repeated for only those who were dentally assessed at age 12.

Discussion

We investigated whether personality traits measured in late adolescence were associated with orthodontic dissatisfaction in young adulthood. Almost one-third of the cohort had received orthodontic treatment; of those, nearly one-third were not satisfied with the outcome. They scored lower on the personality traits of control and social closeness, and higher on stress reaction. After adjusting for gender, SES and the relevant personality traits, only social closeness

remained significantly and independently associated with satisfaction ratings.

This study's limitations should be considered. We assumed that the DAI is a valid and reliable index for assessing treatment need, and that all the orthodontic treatment was of a satisfactory standard. The latter may be contentious, but there was no detailed information on the nature of the treatment. The absence of information from treating clinicians means that there is no way around this particular problem. Thus, the possibility of poor treatment confounding the observed associations must be acknowledged. Moreover, cohort studies are limited by time and place, and one study's findings do not necessarily hold elsewhere. Unfortunately, clinical time constraints meant that no malocclusion data were recorded at age 26, thus precluding comparison of recipient and clinician assessments. There was a risk of type II error, especially with the half of the cohort who had been assessed at age 12. The age 12 data were recorded one year prior to the publication of the DAI,[24] and, while the mini-DAI appeared useful, the original measure would have been better.

Notwithstanding these limitations, this study also had a number of strengths, including its high retention rate. Moreover, the personality traits measure had been developed and standardised with non-clinical populations; its reliability and validity are well established in this New Zealand sample.[26] Previous developmental studies have shown that the personality traits measured using the MPQ are predictable from childhood, and reasonably stable from adolescence to adulthood.[2,27,30]

Previous research has found associations between dissatisfaction with combined orthodontic/orthognathic treatment and high neuroticism scores.[13,17,21] Our findings replicate and extend these findings by suggesting that the stress reaction facet of negative emotionality/neuroticism is important. We also found that individuals who were less satisfied with their orthodontic treatment outcomes were more likely to score lower on social closeness, one facet of positive emotionality. They also scored lower on control (part of the constraint superfactor).

The lack of statistically significant findings in the sub-sample who were dentally assessed at age 12 may have been due to type II error, as the pattern of findings was very similar to the full sample. For example, after controlling for gender, SES and malocclusion, individuals in the lowest quintile of social closeness were 40 per cent more likely to be less satisfied with their orthodontic outcome than those in the other quintiles. There was also an interesting gradient with the odds ratios for the different DAI categories: the more severe the initial malocclusion, the smaller the odds ratio for orthodontic dissatisfaction, suggesting perhaps that those who were more severely affected prior to treatment were more likely to be happy with the final outcome. However, that gradient was not statistically significant, and so this association should be replicated in other research before final conclusions can be drawn.

It is important to acknowledge that we cannot tell from these data whether personality had a direct causal influence on orthodontic dissatisfaction. To establish this, one would need good, age-appropriate measures of personality obtained prior to treatment, as well as good measures of baseline treatment need and close control of the quality of intervention over time. On balance, however, and given the relative stability of personality traits through life,[5] it seems likely that certain adolescent personality traits can predispose to dissatisfaction with orthodontic treatment in young adulthood.

Conclusions

These findings suggest that individuals who score highly in the MPQ on impulsivity, stress-reaction or social isolation are more likely to be disappointed with their orthodontic outcome. Pretreatment knowledge about certain aspects of personality might be useful to practising orthodontists. Those seeking orthodontic treatment for relatively minor malocclusions may be more likely to be dissatisfied with their orthodontic result. Individuals seeking orthodontic treatment should be encouraged to consider and discuss treatment goals with their orthodontist in order to reduce the likelihood of later dissatisfaction.

Acknowledgments

We are grateful to the study members, and to Drs P.A. Silva and R.H. Brown. The Dunedin Multidisciplinary Health and Development Research Unit is supported by the Health Research Council of New Zealand. Data collection was partially supported by National Institute of Mental Health Grants MH 45070 and MH 49414.

Corresponding author

W. M. Thomson
University of Otago Department of Oral Sciences
PO Box 647
Dunedin
New Zealand
Tel: (+64 3) 479 7116
Fax: (+64 3) 479 7113
Email: murray.thomson@stonebow.otago.ac.nz

References

1. Donabedian A. The quality of care: how can it be assessed? JAMA 1988;260:1743–8.
2. McGue M, Bacon S, Lykken DT. Personality stability and changes in early adulthood: a behavioural genetic analysis. Development Psychol 1993;29:96–109.
3. Kendrick DT, Funder DC. Profiting from controversy: Lessons from the person-situation debate. American Psychologist 1988;43:23–34.
4. Tellegen A. Personality traits: Issues of definition, evidence, and assessment. In WM Grove & D Cicchetti (Eds), Thinking clearly about psychology: Vol 2. Personality and psychopathology (pp. 10–35). Minneapolis, MN: University of Minnesota, 1991.
5. Caspi A, Harrington H, Milne B, Amell JW, Theodore RF, Moffit TE. Children's behavioural styles at age 3 are linked to their adult personality traits at age 26. J Pers 2003;71: 495–513.
6. Buss A, Plomin R. Temperament: early developing personality traits. Hillsdale, NJ: Erlbaum, 1984;1–185.
7. Caspi A. Personality development across the life course. In W. Damon & N. Eisenberg (Vol. Ed.), Handbook of child psychology, Volume 3: Social, emotional, and personality development. New York: Wiley. 1998;311–88.
8. Shiner R. How shall we speak of children's personalities in middle childhood? A preliminary taxonomy. Psychol Bull 1998;124:308–32.
9. Roberts BW, DelVecchio WF. The rank-order consistency of personality traits from childhood to old age: a quantitative review of longitudinal studies. Psychol Bull 2000;126:3–25.
10. Paunonen SV. Hierarchical organisation of personality and prediction of behaviour. J Pers Soc Psychol 1998;74:538–56.
11. Shiner R, Caspi A. Personality differences in childhood and adolescence: measurement, development, and consequences. J Child Psychol Psychiatry 2003;44:2–32.
12. Tellegen A. Brief manual for the Multidimensional Personality Questionnaire. University of Minnesota, 1982.
13. Allan TK, Hodgson EW. The use of personality measurements as a determinant of patient cooperation in an orthodontic practice. Am J Orthodont 1968;54:433–40.
14. Hutton CE. Patients' evaluation of surgical correction of prognathism: survey of 32 patients. J Oral Surg 1967;25: 225–8.
15. Varela M, Garcia-Camba JE. Impact of orthodontics on the psychological profile of adult patients: a prospective study. Am J Orthod Dentofacial Orthop 1995;108:142–8.
16. Zhou YH, Hagg U, Rabie ABM. Patient satisfaction following orthognathic surgical correction of skeletal Class III malocclusion. Int J Adult Orthod Orthog Surg 2001;16: 99–107.
17. Kiyak HA, West RA, Hohl T, McNeill RW. The psychological impact of orthognathic surgery: a 9–month follow-up. Am J Orthod 1982;81:404–12.
18. Kiyak HA, McNeil RW, West RA, Hohl T, Bucher F, Sherrick P. Predicting psychological responses to orthognathic surgery. J Oral Maxillofac Surg 1982;40:150–5.
19. Kiyak HA, Hohl T, West RA, McNeill RW. Psychologic changes in orthognathic surgery patients; a 24-month follow up. J Oral Maxillofac Surg 1984;42:506–12.
20. Kiyak HA, McNeill RW, West RA, Hohl T, Heaton PJ. Personality characteristics as predictors and sequelae of surgical and conventional orthodontics. Am J Orthod 1986;89: 383–92.
21. McKiernan EXF, McKiernan F, Jones ML. Psychological profiles and motives of adults seeking orthodontic treatment. Int J Adult Orthod Orthog Surg 1992;7:187–98.
22. Scott AA, Hatch JP, Rugh JD, *et al.* Psychosocial predictors of satisfaction among orthognathic surgery patients. Int J Orthod Orthognath Surg 2000;15:7–15
23. Silva PA, Stanton W. From Child to Adult: the Dunedin Multidisciplinary Child Development Study. Auckland: Oxford University Press, 1996.
24. Cons NC, Jenny J, Kohout FJ. DAI: the Dental Aesthetic Index. Iowa City, Iowa: College of Dentistry, The University of Iowa, 1986.
25. Thomson WM. Orthodontic outcomes in the long term: findings from a longitudinal study of New Zealanders. Angle Orthod 2002;72:449–55.
26. Krueger RF, Caspi A, Moffitt TE, *et al.* Personality traits are differentially linked to mental disorders: a multitrait-multidiagnosis study of an adolescent birth cohort. J Abnorm Psychol 1996;105,299–312.
27. Tellegen A, Lykken DT, Bouchard TJ, Wilcox KJ, Segal NL, Rich S. Personality similarity in twins reared apart and together. J Pers Soc Psychol 1988;6:1031–9.
28. Irving JC, Elley WB. A socio-economic index for the female labour force in New Zealand. NZ J Educ Stud 1977;12: 154–63.
29. Elley WB, Irving JC. The Elley-Irving socio-economic index 1981 Census revision. NZ J Educ Stud 1985;20:115–28.
30. Caspi A, Silva PA. Temperamental qualities at age three predict personality traits in young adulthood: longitudinal evidence from a birth cohort. Child Dev 1995;66:486–98.
31. Estioko LJ, Wright FAC, Morgan MV. Orthodontic treatment need of secondary school children in Heidelberg, Victoria: an epidemiologic study using the Dental Aesthetic Index. Community Dent Health 1994;11:147–51.