

# Relationship Between Personality Factors and Cooperation Level of Adult Patients During Invisalign Treatment: a Pilot Study

Dāniels Beļajevs<sup>1</sup>, Assoc. Prof. Gundega Jākobsone<sup>1</sup>

**Affiliation:** <sup>1</sup> Rīga Stradiņš University, Latvia

**E-mail:** 031593@rsu.edu.lv

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## Introduction

Esthetic standards have been changing rapidly during the last few decades. Nowadays patients demand more esthetic orthodontic solutions with same or even better clinical outcomes. However, in orthodontic clinical practice success of the treatment not only depends on adequate diagnosis, used biomechanical system and biological tissue response, but also on patients' inner motivation, which indicates patients' cooperation level during the orthodontic treatment<sup>1,2</sup>.

Most orthodontic treatments occur between the ages of 11 and 16 years. Nevertheless, adolescence is the period of life where most physical, social and emotional changes appear. Therefore, information about the adult part of the population undergoing Invisalign orthodontic treatment, was observed, in order to exclude most extrinsic motivational factors (family, socio-economical, educational level etc.). Intrinsic factors, on the other hand, are dependent on patients' personality and temperament<sup>3,4</sup>.

One of the ways to investigate adult personality is through psychometric tests, which classify personality structure in factors or traits. One of them is Big Five Inventory psychometric test, which consists of 44 items, and divides personality structure into five main factors: extraversion, agreeableness, conscientiousness, neuroticism, and openness. Of which, every personality structure is connected to certain behavior models. 'Conscientiousness' assesses organization and goal-directed behavior, 'Agreeableness' assesses the tendency to be kind and cooperative, 'Neuroticism' assesses the degree to which individuals are prone to emotional instability, 'Openness' to experience is characterized by imaginative and broad interests, and 'Extraversion' assesses the need for stimulation<sup>4</sup>.

The aim of this study is to assess the relationship between the personality traits of an adult patient and cooperation level for treatment with clear removable aligners.

## Materials and methods

**Statement of informed consent and ethical board approval.** This investigation is made by prospective cohort study model. The study was approved by the ethics committee of the Riga Stradins university, and all patients gave their signed informed consent. Patient data was collected at Riga Stradins Institute of Stomatology and SIA "Molārs MG" clinics.

**Inclusion criteria.** Adult patients of both genders, who have reached 18 years of age; patients who are 6 months in active Invisalign orthodontic treatment with aligners "Comprehensive package" and who provided signed informed consent, were included in the study.

**Exclusion criteria.** Patient is under age 18; patient did not sign agreement to participate in the study; other orthodontic system has been chosen; patient has psychological deviations in anamnesis.

The first assessment was made 6 months after start of the treatment, where patient general data and personality structure was gathered through patient questionnaire. Validated Latvian Big Five Inventory analogue test was used in the current study<sup>3</sup>. Among 44 elements, validated Latvian version of Big Five Inventory test, has 10 items for openness, 9 items for conscientiousness, 8 items for extraversion, 9 items for agreeableness and 8 items for neuroticism. The subjective degree of cooperation was evaluated by the treating orthodontist by modified OPCS cooperation questionnaire, where clinical fitting of the both aligners was also evaluated<sup>5</sup>. Objective motivation evaluation was performed by measuring current maxillary first premolar teeth expansion and comparing to Invisalign “Clincheck” planned expansion. Premolar expansion was measured using iTero Element Flex™ scan models, MyCadent v.1.23.0.2. and 3D Slicer 5.0.3. programs.

At 12 months assessment the degree of cooperation was evaluated by the treating orthodontist once again.

Received scores in each personality trait, were compared with extrinsic motivation factors (p.e. feeling of pressure from family or orthodontist), clinically realized premolar expansion (%) and clinical fitting of the aligners.

Patients were divided into two groups. Where patients with premolar expansion less or equal to 60% and/or aligner did not fit in more than one sextant were considered as patients with insufficient motivation level. Patients with premolar expansion more than 60% and/or aligner fits well or partially fits in one sextant, considered as patient with sufficient motivation level.

**Statistical analysis.** The SPSS statistical program version 27.0 (IBM, USA) was used for data analysis. Test of normality showed that data is not normally distributed (Shapiro–Wilk test  $p < 0.05$ ), therefore non-parametric statistic tests were used for further data analysis. Kruskal–Wallis test was used to explore statistically significant difference between 5 personality factors and how well aligner is being fitted. Non-parametric Spearman test was used to explore correlation between personality factors and realized maxillary first premolar expansion (%) between aligner number 20 to 30, as well as other motivation factors.

## Results

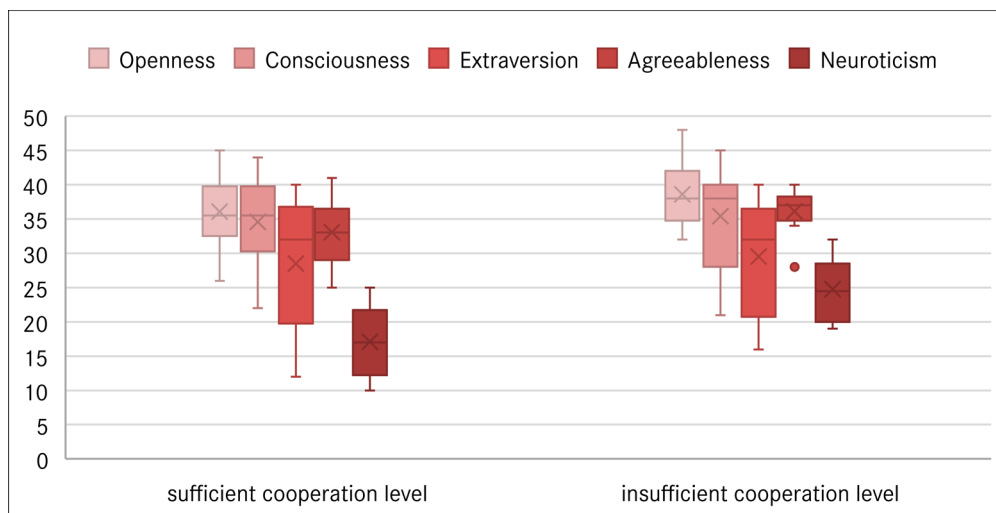
Out of 35 patients, who were in active Invisalign treatment, only 22 met all the inclusion criteria and took part in the study (3 males, 19 females). 12 patients (55%) were cooperative, and 10 patients (45%) compliance level was considered insufficient. Both groups had similar IOTN DH ( $p = 0.228$ ) and IOTN AH ( $p = 0.346$ ) values.

Noncompliant patients had higher scores for neuroticism ( $p = 0.04$ ). Neuroticism was also associated with increased number of missed appointments, non-correspondence of the actual aligner number and planned aligner number (at 6 months;  $p = 0.002$ ), inability to control the financial level ( $r = -0.484$ ;  $p = 0.002$ ). The neuroticism level negatively correlated with the achieved movements of the upper premolars ( $r = -0.49$ ,  $p < 0.05$ ).

Higher scores in extraversion were associated with complaining about treatment process ( $r = 0.603$ ;  $p = 0.003$ ) and worse hygiene scores ( $r = 0.531$ ;  $p = 0.011$ ) at 12-month assessment.

Higher scores in conscientiousness were associated with ability to control financial level ( $r = 0.493$ ;  $p = 0.02$ ) and parents' participation in treatment process ( $r = 0.522$ ;  $p = 0.013$ ), at 6- and 12-month assessments.

Openness was positively correlated with desire to inform family about the start of the treatment ( $r = 0.478$ ;  $p = 0.024$ ).



**Figure 1.** Personality assessment scores and patient cooperation level

## Discussion

Several studies, have shown, that orthodontic treatment results can be affected by patients' cooperation level. Some authors have established relationships between extrinsic motivation factors (gender, educational level and family) and patient cooperation level during orthodontic treatment 6, 7, 8. However, the exact relation between personality traits and patient cooperation during treatment with clear removable aligners, is little known.

Similar studies in orthodontics do not show similar results, claiming that patient cooperation cannot be predicted based on personality traits<sup>4</sup>. However, results of the current study cannot be fully compared to studies, which were held with fixed orthodontic appliances, due to potential difference of motivation level in achieving same treatment results. Related studies in general medicine, where patient long-term compliance is also principal in achieving certain treatment results, have shown similar results 9, 10. However, results of these studies, cannot be fully compared with the present study, due to difference of the effect of general health status and orthodontic status, on quality of life of the patient.

Consistent with previous literature, Neuroticism predicts a wide range of negative outcomes, such as low self-esteem, easily distracted and nervous behavior. In the present study Neuroticism scores were higher in the non-compliant patient group. Other personality traits showed no statistically significant difference between two groups. There was no statistically significant difference in IOTN index between groups, which means that patient motivation level was not associated with primary dental health and esthetic status. Neuroticism was also associated with frequently missed appointments, non-correspondence of aligner number and inability to control financial level.

The results from this study have several implications for clinicians in designing a personalized treatment plan. Clinicians should pay more attention to patients with high Neuroticism scores for timely psychological intervention or planning non-removable appliance therapy.

Outcomes of the present study should be interpreted carefully due to multiple limitations of the study: small patient sample (power of the study analysis considered sample of 40 patients, for present correlation rates), patients from one orthodontic practitioner took part in the study (treatment results could be strongly affected by practitioner experience); there is a conflict of interests in the study (orthodontic practitioner is Invisalign promoter in Latvia and author of the study is SIA "Molārs MG" employee).

## Conclusions

Increased levels of neuroticism were more often seen in non-compliant patients. Assessment of the personality traits by the Big Five Personality Inventory could be used for prediction of the patient's cooperation during treatment with clear aligners.

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