Original Article

Differences in the cooperation of teenagers for orthodontic treatment: Z Generation versus Y Generation

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ABSTRACT

Objectives: To compare orthodontic treatment cooperation between Generation Y and Generation Z teenagers and evaluate influence of age on compliance.

Materials and Methods: This was a retrospective cohort study analyzing records of 124 patients (62 from each generation) treated at Tel Aviv University Dental School between 2007 and 2021. Patient cooperation was assessed through weighted noncompliance scores incorporating elastic or headgear wear, oral hygiene, appointment attendance, appliance breakage, and new caries development. Each noncompliance incident was weighted (1.0 point for major incidents, 0.5 for minor) and standardized by treatment duration. Multiple regression analysis accounted for age differences.

Results: Mean age differed significantly between Generation Y (15.5 ± 1.7 years) and Generation Z (13.1 ± 1.6 years; $P < .001$). Initial noncooperation scores were similar (Generation Y: $36.8\% \pm 16.4\%$; Generation Z: $35.8\% \pm 15.8\%$; $P = .732$). After age adjustment, regression analysis revealed significantly higher noncooperation in Generation Y ($B = 8.29$; $P = .014$). Age independently influenced cooperation, with each year increase associated with a 3% decrease in noncooperation scores ($B = -3.04$; $P < .001$).

Conclusions: Generation Z teenagers exhibited better orthodontic treatment cooperation than Generation Y after age adjustment. Age independently predicted cooperation, with older teenagers showing better compliance regardless of generation. Treatment planning should consider both generational differences and individual patient factors when selecting compliance-dependent treatment options. (*Angle Orthod.* 2025;95:538–543.)

KEY WORDS: Orthodontics; Corrective; Patient compliance; Adolescent behavior; Age factors; Generation

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INTRODUCTION

Orthodontic treatment success heavily relies on patient cooperation, a critical factor every orthodontist must contend with to achieve optimal results.[1] Patient compliance encompasses various aspects, including keeping appointments, wearing removable appliances, avoiding chewing sticky and hard substances, maintaining oral hygiene, and more.[2] Authors of recent studies have emphasized that compliance is particularly crucial during the treatment of adolescents, who make up the majority of orthodontic patients.[3,4] However, patient cooperation may be influenced by generational characteristics, a factor that has become increasingly relevant in recent years.

Assessment of patient compliance has evolved significantly with the introduction of microsensors and digital monitoring systems.[3,4] However, the relationship between generational characteristics and treatment adherence

remains poorly understood, particularly in the context of modern orthodontic practice.

A generation is defined as a group of people born within a specific time interval, who share similar life events, values, behaviors, and significant reactions at critical developmental stages.[5] For the purposes of this study, the focus was on two recent generations: Generation Y ("millennium generation," born 1980–1995) and Generation Z (born 1995–2010).[6]

Generation Z, often characterized as "digital natives," demonstrates significantly higher social media engagement than Generation Y.[7] This increased engagement has been shown to influence health care behaviors; it was found that younger generations demonstrated better compliance with preventive dental care,[8] and significant improvements in orthodontic compliance through digital engagement were reported.[4] While Generation Z is sometimes characterized as having shorter attention spans due to their digital upbringing,[9] they also demonstrated increased health consciousness and engagement with health care providers.[10] This generation's heightened awareness of appearance and health-related issues may serve as important motivating factors for seeking and maintaining orthodontic treatment.[11]

These generational characteristics have significant implications for orthodontic treatment outcomes. Patient compliance remains a cornerstone of successful orthodontic treatment,[12] with adherence rates significantly impacting treatment duration and results.[13] Authors of studies have shown that understanding generational attitudes toward health care can improve treatment planning and patient engagement.[14] While orthodontic techniques have evolved, patient cooperation continues to be the primary determinant of treatment success, with nonadherence leading to extended treatment times and compromised results.[15]

Patient motivation for treatment must be determined and monitored by the orthodontist throughout the treatment process to prevent disruptions and enhance compliance.[1,16] This monitoring process should consider contemporary social and technological influences on patient behavior and treatment expectations.[17] The ability to predict noncooperative patients could reduce treatment discontinuation rates, with clear implications for saving resources.[18] Additionally, identifying generational changes in cooperation could help orthodontists adapt their treatment approaches, methods, and communication strategies.[19]

Previous researchers have explored various factors as potential predictors of compliance, including age and gender.[20] However, the influence of generational characteristics on orthodontic cooperation patterns requires further investigation, particularly given the rapid social changes affecting health care attitudes of newer generations.[19]

In this novel retrospective study, we aimed to compare orthodontic treatment cooperation between Generation Y and Generation Z teenagers (ages 10–18). In this study, we examined multiple aspects of compliance, including appointment attendance, appliance wear, oral hygiene maintenance, and treatment adherence.[16] Understanding these generational differences in cooperation may help inform treatment planning decisions and improve orthodontic care delivery.[19,20]

MATERIALS AND METHODS

In this retrospective cohort study, we compared orthodontic treatment cooperation between two generational groups: Generation Y (born 1980–1995) and Generation Z (born 1995–2010). The study protocol was approved by the Ethics Committee of Tel Aviv University (0007048-2). Written informed consent for using treatment records for research purposes was obtained from all patients or guardians at treatment initiation.

Sample size calculation determined that 62 patients per group would provide sufficient power (0.80) to detect a 20% difference in cooperation between generations at a significance level of 0.05. To achieve this sample size, files from the Tel Aviv University Dental School orthodontic archive (2007–2021) were systematically reviewed. These electronic patient files had no predetermined organizational structure, providing a naturally randomized selection pool. Sequential screening continued until the required 62 cases meeting all inclusion criteria were identified for each generation (requiring review of 294 files for Generation Y [2007–2016] and 305 files for Generation Z [2010–2021]).

Inclusion criteria were (1) healthy teenagers aged 10–18 years at treatment initiation, (2) completion of full orthodontic treatment achieving all set goals, (3) full treatment documentation in medical files, and (4) first-time orthodontic treatment. Cases were excluded if patients had systemic diseases, syndromic conditions, previous orthodontic treatment, discontinued treatment, were outside the specified age range, or had incomplete documentation.

Treatment modalities involved conventional fixed orthodontic appliances for all patients in both groups. Treatment protocols included standard edgewise mechanics, with no temporary anchorage devices (TADs) or orthognathic surgery preparation. The proportions of patients requiring auxiliaries (elastics, headgear) and treatment mechanics were documented as part of the compliance assessment scoring system.

The department maintained rigorous documentation standardization throughout the study period (2007–2021). All residents used a structured electronic medical record template specifically designed for orthodontic

treatment documentation. This template included mandatory fields for recording any compliance-related events. Documentation quality and completeness were regularly reviewed by supervising faculty as part of the residency program requirements. Routine case presentations incorporated systematic reporting of compliance-related events, ensuring consistent documentation practices across all treating residents. This standardized approach to documentation, combined with the structured compliance scoring system, helped maintain consistency in recording and evaluating patient cooperation throughout the study period.

For each patient, in this study, we collected demographic and clinical data including age, gender, treatment duration, number of permanent teeth extracted (excluding wisdom teeth), number of impacted teeth (excluding wisdom teeth), initial overbite (OB) and overjet (OJ), and initial Dental Angle Classification.

Patient cooperation was assessed through a standardized weighted scoring system of documented noncompliance events in the medical records.[16] Treatment compliance was evaluated based on two categories of incidents: major and minor noncompliance events. Major incidents, weighted as 1.0 point, included failure to wear elastics or headgear as prescribed, documented poor oral hygiene, missed appointments without notice, and development of new caries lesions, as these directly impacted treatment progress. Minor incidents, weighted as 0.5 point, included emergency visits, appliance breakage noted during routine appointments, and appointments canceled with advance notice, reflecting their lesser impact on overall treatment success.[21] To enable standardized comparison among patients with different treatment lengths, each patient's cumulative weighted score was divided by their treatment duration and expressed as a percentage, where lower percentages indicated better compliance with treatment protocols.[3] This hierarchical scoring approach allowed quantification of the relative impact of different compliance issues on treatment progression while accounting for varying treatment duration.

Sample size determination indicated that 62 patients per group would provide sufficient power (0.80) to detect a 20% difference in cooperation between generations at a significance level of 0.05. Data were organized in Excel and analyzed using IBM SPSS version 23.0 (SPSS, Chicago, IL). Initial comparisons between generations used χ^2 tests for categorical variables (or Fisher's exact test when appropriate) and t-tests for continuous variables. For ordinal data, Pearson or Spearman correlations were employed as appropriate for the data distribution. To account for potential confounding factors, particularly age differences between generations, multivariate analysis was conducted using a general linear model. Generation Y was set as the reference category for calculating odds ratios in categorical variables. All statistical tests used a significance level of 0.05.

RESULTS

The study included 124 patients, with an equal distribution between Generation Y (n = 62) and Generation Z (n = 62). Gender distribution was similar between groups (Generation Y: 58.1% male; Generation Z: 51.6% male; P = .474). Mean age differed significantly between generations, with Generation Y participants being older (15.5 ± 1.7 years) than Generation Z (13.1 ± 1.6 years; P < .001).

Comparison of initial orthodontic characteristics (Table 1) revealed that most parameters were similar between groups. Mean OB showed a significant difference (Generation Y: 0.9 ± 1.1 mm; Generation Z: 2.64 ± 1.3 mm; P = .004). Treatment duration averaged 3.01 ± 0.8 years for Generation Y and 2.65 ± 0.7 years for Generation Z (P = .074). Other clinical parameters, including OJ, number of impacted teeth, and extraction frequency, showed no significant differences between generations (Table 1).

Initial comparison of specific cooperation measures (headgear or elastic wear, appointment attendance, oral hygiene, and caries incidence) showed no significant differences between generations (Table 1). The mean noncooperation score, calculated as a percentage and adjusted for treatment duration, was similar between Generation Y (36.8% ± 12.4%) and Generation Z (35.8% ± 11.9%; P = .732).

Data distribution analysis using Kolmogorov-Smirnov and Shapiro-Wilk tests confirmed normality, allowing for parametric statistical analysis. After controlling for age in the regression analysis (Table 2), significant generational differences emerged. Generation Y showed higher noncooperation scores than Generation Z (B = 8.289; P = .014). Age independently influenced cooperation, with each year increase in age associated with a 3% decrease in noncooperation scores (B = −3.036; P < .001).

DISCUSSION

In this study, we investigated intergenerational differences in orthodontic treatment cooperation between Generation Y and Generation Z teenagers. After controlling for age, analysis revealed that Generation Z demonstrated significantly better cooperation than Generation Y patients, challenging some existing assumptions about generational differences in health care engagement.

The regression analysis showed that Generation Y patients had significantly higher noncooperation scores than Generation Z, after age adjustment. This finding was consistent with observed trends in health

Table 1. Comparison of Clinical Characteristics and Cooperation Measures Between Generation Y and Z Patients[a]

Variable	Generation	Mean	95% CI	P Value
Clinical characteristics				
Age (y)b	Y	15.5 ± 1.7	15.11, 15.53	<.001*
	Z	13.1 ± 1.6	12.72, 13.13	
Overjet (mm)[b]	Y	3.45	2.80, 5.15	.868
	Z	3.38	2.83, 3.38	
Overbite (mm)[b]	Y	0.9 ± 1.1	−0.08, 0.91	.004*
	Z	2.64 ± 1.3	2.08, 2.64	
Percentile overbite[b]	Y	0.38	0.30, 1.28	.463
	Z	0.34	0.27, 0.34	
Treatment length (y)[b]	Y	3.01 ± 0.8	2.73, 3.15	.074
	Z	2.65 ± 0.7	2.38, 2.65	
Treatment length (percentile)[b]	Y	0.49	0.45, 0.64	.074
	Z	0.44	0.39, 0.44	
No. impacted teeth[c]	Y	0.35	0.13, 1.79	.732
	Z	0.40	0.24, 0.40	
No. extracted teeth[c]	Y	0.58	0.27, 2.43	.942
	Z	0.56	0.26, 0.56	
Compliance measures				
Need to wear bands[d]	Y	0.81	0.71, 2.77	1.000
	Z	0.81	0.71, 0.81	
Not wearing bands (%)[d]	Y	3.96	–	.257
	Z	1.62	–	
Need to wear headgear (%)[d]	Y	5.91	–	.838
	Z	5.38	–	
Not wearing headgear (%)[d]	Y	3.23	–	.196
	Z	0.54	–	
Faults discovered (%)[c]	Y	11.96	–	.255
	Z	8.59	–	
First aid appointments (%)[c]	Y	3.19	–	.270
	Z	5.94	–	
Cancellations (%)[c]	Y	1.80	–	.268
	Z	3.78	–	
Missed appointments (%)[c]	Y	20.38	–	.891
	Z	20.96	–	
Bad oral hygiene comments (%)[c]	Y	7.49	–	.768
	Z	6.73	–	
Caries (%)[c]	Y	6.78	–	.710
	Z	8.13	–	
Sum of lack of cooperation (%)[b]	Y	36.8 ± 12.4	–	.732
	Z	35.8 ± 11.9	–	

[a] CI indicates confidence interval; Y, Generation Y (born 1980–1995); and Z, Generation Z (born 1995–2010).
[b] Independent *t*-test.
[c] Chi-square test.
[d] Fisher's exact test.
* $P < .05$.

care appointment attendance[22] and may reflect Generation Z's increased engagement with health care, possibly influenced by greater access to health information and heightened appearance awareness.[11,17] Additionally, it was found that age independently influenced cooperation, with older teenagers showing better compliance regardless of generational group.

The improved cooperation of Generation Z may also reflect changing attitudes toward orthodontic treatment. Barbosa et al. (2018)[21] found that adult patients and those who sought treatment on their own initiative demonstrated significantly better compliance. This was consistent with the findings that Generation Z patients, who often actively participate in treatment decisions, showed better cooperation levels.

The importance of patient cooperation in orthodontic treatment success is well established.[1,2] The findings suggest that orthodontists may need to reevaluate their expectations and treatment approaches for Generation Z patients.

The findings suggest several considerations for contemporary orthodontic practice:

(1) Treatment Planning: The better cooperation observed in Generation Z patients, after age adjustment, might influence appliance selection decisions. While clear

Table 2. Multiple Regression Analysis of Factors Affecting Patient Noncooperation Scores

Variable	B	SE	P Value	95% CI
(Intercept)	75.61	12.43	<.001*	51.12, 100.10
Generation Y vs Z	8.29	3.32	.014*	1.74, 14.84
Age (per year increase)	−3.04	0.82	<.001*	−4.66, −1.42

[a] B indicates unstandardized regression coefficient; SE, standard error; and CI, confidence interval.

* $P < .05$.

aligners offer advantages in terms of esthetics and oral hygiene,[23,24] their successful use depends heavily on patient compliance. The findings suggest that Generation Z patients might be good candidates for compliance-dependent appliances, though individual assessment remains crucial.

(2) Retention Protocol: The higher cooperation levels observed in Generation Z might be relevant when choosing retention strategies. Removable retainers, while requiring consistent patient compliance, have shown benefits for periodontal health compared with fixed retainers.[25] However, retention decisions should still be based on individual patient factors rather than generational membership alone.

(3) Treatment Timing: The data showed that Generation Z patients began treatment significantly earlier (13.1 ± 1.6 years) than Generation Y (15.5 ± 1.7 years; $P < .001$). This earlier initiation coincides with the age range within which growth modification is often possible, potentially offering additional treatment options. The reasons for this earlier start may be multifactorial, including increased awareness of orthodontic treatment options.[11]

Interestingly, in this study, we found an inverse relationship between age and lack of cooperation across both generations. For every year of increase in age, a 3% decrease in uncooperativeness was found. This finding suggests that older teenagers, regardless of generation, tend to be more cooperative during their orthodontic treatment.

Recent technological advances have improved the ability to measure and understand compliance. Authors of studies using microsensors demonstrated that actual wear times are significantly lower than previously estimated through self-reporting. This technology allows for more accurate assessment of treatment effectiveness and could help identify patients who may benefit most from compliance-dependent appliances.[4,8,26]

Limitations

Several limitations should be considered when interpreting the findings. First, the retrospective design relied on documented compliance incidents, which may not capture all aspects of patient cooperation. Second, the single-center sample from a university clinic setting may not represent the broader patient population. Third, the subjective nature of some compliance measures, such as oral hygiene assessment, could introduce observer bias despite standardized documentation protocols. While we employed standardized electronic documentation protocols throughout the study period, challenges inherent in retrospective data collection should be acknowledged. Although the department maintained consistent documentation requirements through structured templates and faculty oversight, some variation in recording detail among residents and across years may exist. This potential limitation was mitigated by using standardized compliance scoring criteria and regular documentation review processes but cannot be eliminated in a retrospective study design. The structured electronic medical record system helped maintain consistency, but authors of future prospective studies might benefit from real-time standardization of compliance documentation.

Additionally, patient motivation and self-initiated treatment seeking are important factors in compliance. Authors of future studies should consider incorporating these variables into the analysis of generational differences in cooperation.

Age differences between the generations presented a significant confounding factor, which was addressed through regression analysis. However, other unmeasured variables, such as socioeconomic status and parental influence, might also affect cooperation patterns.

Additional potential confounding factors should be acknowledged. The evolution of orthodontic techniques and treatment philosophies during the study period (2007–2021) could have influenced interpretation of the findings. While all cases in this study used conventional fixed appliances without TADs, broader changes in orthodontic practice patterns, such as shifts in extraction decisions and case selection criteria, may have influenced treatment approaches. However, the university clinic setting maintained consistent treatment protocols throughout the study period, potentially minimizing the impact of these changes. Additionally, the random sampling of cases likely provided similar distribution of case complexities between generations, though authors of future studies may benefit from more detailed classification of case severity.

CONCLUSIONS

• Generation Z teenagers demonstrated better orthodontic treatment cooperation than Generation Y after age adjustment.

- Age independently influenced cooperation, with older teenagers showing better compliance regardless of generation.
- Treatment planning should consider both generational differences and individual patient factors.
- Individual assessment remains essential despite generational trends in compliance.
- Digital monitoring and communication strategies may be particularly effective for Generation Z patients.
- Age-appropriate motivation strategies should be incorporated into treatment planning.
- Regular compliance assessment using objective measures is recommended for all patients.

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