ORIGINAL RESEARCH

How is adult patient adherence recorded in orthodontists' clinical notes? A mixed-method case-note study

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Background: Patient adherence in orthodontic treatment is extremely important as it is linked with better treatment outcomes. Despite its importance, however, there is no shared definition of the concept. This makes the recording of adherence-related behaviors in patient notes difficult. The current study explored how, and to what extent adherence is recorded in adult patients' medical records by orthodontists working in a large National Health Service (NHS) London hospital.

Materials and methods: A mixed-methods approach was used. A total of 17 clinicians with a mean age of 31 years (SD =4.87) provided N=20 case notes spanning N=324 appointments with patients they judged to be non-adherent. The notes were inspected for evidence of recording of patient adherence using adherence indicators identified in the literature.

Results: The term "adherence" did not feature in any notes. The quantitative analysis showed that the three most frequent adherence-related behaviors recorded in notes were "oral hygiene," "appointment attendance" and "breakages of appliances." Qualitative analysis not only confirmed these factors but also showed that 1) the clinical aspects of treatment, 2) clinician–patient interaction factors and 3) patient attitudes also featured. This part of the analysis also highlighted inconsistencies across case notes in terms of the amount of information being recorded.

Conclusion: Adherence as a term does not feature in the clinical case notes of clinician-identified non-adherent adult patients, while predictors of adherence are recorded with varying degrees of consistency.

Keywords: adherence, adults, orthodontic treatment

Introduction

For any programme of orthodontic treatment to succeed, patients are expected to cooperate with the clinician and modify their behavior outside the dental surgery.[1–4] This patient behavior is known in clinic as "patient compliance," although in research the concept has been replaced by the more current term known as "adherence" to indicate the patient's involvement in this exercise. Patient non-adherence and its relationship with successful treatment outcomes are well known.[5] Patients who have been judged as "adherent" tend to present with better clinical orthodontic outcomes than "non-adherent" ones.[6]

Adherence to orthodontic treatment starts with the patients' willingness to attend their first appointment with the orthodontist.[3] Similarly, non-adherence presents itself as a reluctance to attend. Nonattendance may result in early termination of treatment, wastage of workforce time and financial resources,[7] unnecessary treatment plan changes, longer treatment time and frustration for the patient and the orthodontist.[8] The literature, however, sees non-adherence more broadly than attendance; for example, failure to

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follow the orthodontists' recommendations, ranging from caring for appliances and maintaining good oral hygiene (OH) to cooperating with the use of elastics or headgear appliances, is also considered as behavior typically seen in non-adherent patients.[9] Although these factors are within the patient's control and can directly influence the course of treatment, there may be additional, psychological factors, such as a patients' ability to cope with the experience of pain and discomfort during treatment, which can also affect adherence.[3]

Attempts to measure patient adherence have looked at direct (eg, timing devices[10,11]) and indirect (eg, self-report) measures[9,12] which, while useful, also have limitations. These limitations rest on the fact that adherence is not an all-or-nothing unidimensional construct. For example, patients might attend appointments promptly, but not wear appliances.[3] Then, adherence can be situational.[13] Patients may be more likely to adhere if they can see positive results and, as such, they may be adherent at some times during treatment but non-adherent at other times. It is thus essential that fluctuations in type and frequency of non-adherence are recorded routinely, so that clinicians might become alerted about instances of non-adherence as and when these present themselves.

Previous work has reported that "certain" patient behaviors, such as appointment attendance and OH levels, are rated by orthodontists as particularly good measures of patient adherence.[14] At the same time, psychological evidence reliably reports that, often, there is a gap between people's beliefs (attitudes) and behaviors. This phenomenon is known as the "attitude–behavior" gap.[15] There are currently no data to show whether orthodontists' attitudes regarding indicators of adherence reflect their everyday, actual behavior of recording adherence in patient case notes or whether there is an attitude–behavior gap in adult orthodontics. Thus, this study used a mixed-measures approach to measure how and to what extent the factors described in the literature as predictors of adherence appear within non-adherent patients' clinical case notes.

The study research question was "How is adherence reported in the clinical notes of non-adherent patients?" The study research hypothesis was that factors reported in the literature as reliable measures of adherence would match those recorded in patients' clinical case notes.

Materials and methods

All orthodontists at a large London teaching dental hospital were invited to participate in the study, and those who agreed were asked to provide patient records for analysis. In total, a convenience sample of 17 clinicians (eight males)

with a mean age of 31 (SD =4.87) years provided 20 sets of patient records (11 females, with a collective total number of appointments of N=324) of adult patients they judged as non-adherent. A sample of 20 was considered appropriate in line with previous work in the area.[16] The majority of clinicians had completed their education in the UK, and the data collection took place between May and July 2015.

The patients whose notes were examined were undergoing orthodontic treatment, with class I, II and III malocclusions treated with removable and/or fixed appliances. The mean age of patients at the start of their orthodontic treatment was 31 years, and the majority had a class II malocclusion (n=13). Five patients had a class III, one patient had a class I and for another patient this information was missing. Orthognathic patients, patients with cleft lip and/or palate and patients with craniofacial syndromes, were excluded. All relevant research approvals were granted before the study started by King's College London Dental Institute (KCLDI) Audit Committee (project reference 5352). Patient consent to observe clinical notes was neither necessary nor sought as the project fell under the remit of a clinical audit, and only anonymized clinician notes that did not include any patient personal information were examined.

Quantitative analysis

To address the study hypothesis, patients' adherence was evaluated quantitatively, in a top-down fashion using a tool based on adherence predictors from Slakter et al's[17] scale, Mehra et al's[18] study, Bos et al's[1,2] study, an extensive literature search and findings from previous work published by our group.[14] Figure 1 shows the tool used to find evidence of these predictors in the study case notes.

Using this tool, the frequency of each predictor of adherence that orthodontists use in case notes was noted.

Inter-rater reliability

Five case notes (N=107 appointments, appointments/mean per patient case =21, SD =16.07) were assessed by two researchers, with training in orthodontics, for inter-rater reliability. Each patient record was examined independently for evidence of a range of adherence predictors, and the percentage of agreement was calculated for instances where both researchers had recorded a predictor as present in the notes. Agreement was high between the two raters and ranged between 79% and 93% for each adherence predictor of those appearing in Figure 1. Inter-rater reliability was further assessed with Cohen's kappa. There was a substantial agreement between the two researchers, κ=0.71, $p<0.001$.

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Identification of patient (codebook)	
ID number	
Date of birth	
Gender	
Appointment	
Date of first appointment	
Number of scheduled appointments	
Number of "kept" appointments	
Number of "cancelled" appointments	
Number of "DNA" appointments	

Factor	√: mentioned in the notes					×: unmentioned in the notes							
Factor	**Visits**												**Total**
	1	2	3	4	5	6	7	8	9	10	11	12	
Predictors informed by the literature													
The patient keeps appointments													
The patient cooperates with the use of removable dental appliances (such as retainers) and/or elastics													
The patient demonstrates an appropriate oral hygiene													
The patient is observed to be engaged in treatment													
The patient has distorted or damaged wires and/or loose bands													
The patient arrives promptly at clinic													
The patient's behaviour is sullen, hostile, belligerent, or rude													
The patient complains about having to wear braces													
The patient has a negative view or perception of their malocclusion													
The patient is observed to be enthusiastic about treatment													
The patient complains about treatment procedures (ie, procedures performed by the orthodontist)													
The patient thinks that facial aesthetics are important													
The patient speaks of personal problems or demonstrates such problems													
The patient is pleasant to the clinic staff													
Clinician-derived predictor from Al Shammary et al, 2015[25]													
Treatment knowledge and awareness													
Cost of treatment													
Importance in their life (ie, treatment and retention)													
Previous experiences													
Work schedule and environment													
Other factors (ie, age, case improvement, and presence of dental disease)													

Figure 1 Tool for inspection of dental records. Reprinted from Al Shammary NH, Newton T, McDonald F, Scambler S, Asimakopoulou K. Adherence in orthodontic settings: understanding practitioner views in a UK sample. *Angle Orthod*. 2015;85(5):826–832.[14] With permission ©2015 The E. H. Angle Education and Research Foundation.

Qualitative analysis

To address the qualitative research question, a bottom-up content analysis was undertaken. The case notes were reviewed in detail, and every word recorded in the notes was entered into a spreadsheet. Single words were excluded from the analysis if illegible to three members of the research team. During the second phase of analysis, the words and phrases recorded were systematically coded and grouped into overarching themes. The final phase involved the refinement of themes and rechecking against the case notes to ensure that the context of the data had not been lost in the coding process. This process was performed independently by two

Results

Quantitative analysis

The frequency of adherence predictors appearing in the patient notes was recorded. The data are shown in Figure 2.

Evidence for two predictors was prominent; "the patient keeps appointments" was found in 61 visits (19%), and "the patient demonstrates an appropriate OH" was found in 34 visits (11%). The next most prevalent predictors mentioned were as follows: "the patient has distorted or damaged wires and/or loose bands" and "the patient has a negative view or perception of their malocclusion." Evidence for the following predictors was limited: "the patient arrives promptly," "the patient complains about having to wear braces," "the patient complains about treatment procedures" and "the patient speaks of personal problems or demonstrates such problems," as these factors were only occasionally reported. The weakest evidence was found for the following items: "the patient thinks that facial esthetics are important," "previous experiences," "work schedule" and "the patient is observed to be enthusiastic about treatment."

Chi-squares examined whether the 14 predictors included in the tool were equally recorded across all visits and across all case notes. The results showed that recording for the 14 predictors was not equally distributed χ^2 (10, N=145) =259.27, $p<0.01$. The most frequently recorded predictors were as follows: "the

patient keeps appointments," "the patient demonstrates an appropriate OH" and "the patient has distorted or damaged wires and/or loose bands."

The notes were examined in detail for the presence of the word "adherence" or the associated terms "compliance" or "concordance." These terms failed to appear in any one of the 320 recorded visits that were examined.

Qualitative analysis

The qualitative analysis resulted in three themes with 10 associated subthemes. Theme 1 – clinical aspects of treatment – included the subtheme history, diagnosis and treatment. The second theme – clinicians' and patients' interaction – included subthemes on information/advice, OH, attendance and patients' cooperation with treatment procedures. The last theme incorporated explicit mention of "patients' experiences and attitudes" and included the following subthemes: experiences of pain and/or discomfort, perception of their malocclusion and attitude toward treatment/motivation. Each theme is presented in the following sections and illustrated using excerpts from the notes. Each excerpt is linked to the patient notes it originated from via the number in parentheses included after the excerpt.

Theme 1: clinical aspects of treatment
History

All but one of the case notes incorporated general medical and dental history at the start: "history of high blood pressure – no medication" (13). Patients' dental history was also recorded,
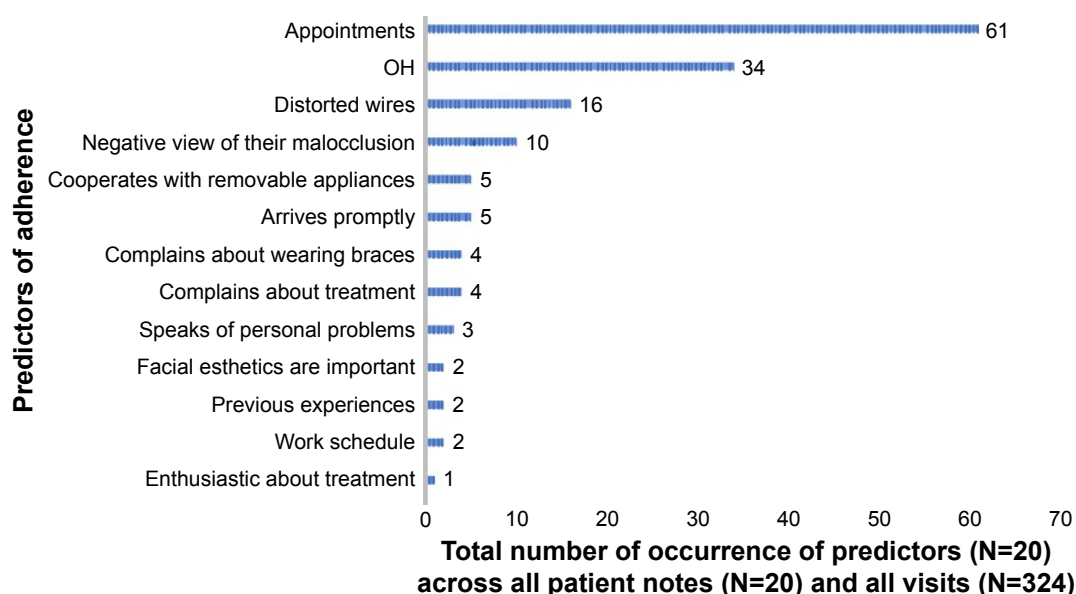
Figure 2 Total number of occurrence of predictors of adherence across all patient notes and all visits.
Abbreviation: OH, oral hygiene.

and similarly related to existing dental problems: "ULS proclined, ULS mild crowding" (5) and "molar retention – not applicable as both molars 6/6 are absent" (14). In addition, orthodontic history was also recorded: DH: 4/4 extracted when she was 14; no orthodontic treatment" (8). Also, there were four case notes in which regular attendance was noted, although this was not explicitly linked to adherence.

Diagnosis
In all but one case, a diagnosis was recorded in relation to malocclusion: "class II div 1 malocclusion with traumatic OB" (13). In three cases, comments on the lips were also included: "lips incompetent" (3, 18). However, this was not reported consistently. It appeared that patients' dental structure was examined for the presence of teeth and caries, restorations and cross bite: "crossbite" (7, 17, 19) and "heavily restored dentition" (13, 16, 18). In addition, facial photos were taken in 14 cases: "photos taken" (1, 3, 4, 5, 7, 11, 12, 13, 14, 15, 16, 17, 18, 20). Although ample information was recorded as part of the patients' diagnosis, the quality and quantity of the information recorded varied significantly. This information made no reference to the patient being non-adherent.

Treatment procedures
In addition to the history and diagnosis, treatment progress and procedures were frequently reported. Words such as "rebond" (1, 2, 3, 5, 10) and "debond" (6, 10, 14) were commonly recorded with no clarification over the reasons for re-bonding. Other treatment procedures were also reported: "reposition brackets" (11); "URA fit and bond up" (18). Occasionally, treatment outcomes were noted, but no further explanation was given. For example, in the following quote, it is unclear whether the reported treatment outcome was due to patients' lack of engagement with the appliances, the treatment procedure or the material used: "lost bracket" (1, 4).

Theme 2: clinicians and patients' interaction
Information/advice
It appeared that patients received instructions or information, and this was frequently reported in the case notes: "instructions given" (2, 3, 14, 18), "leaflets" (5, 7, 14) or "advice given" (4). However, the content of instructions or information was not recorded. It remains unknown how instructions or information was given and whether they were understood and/or accepted. In some cases, the reason for the advice was recorded, however: "advised to see GDP for

oral hygiene" (10); "smoking cessation advice given" (12). There was no record to show whether the advice given had been adhered with. There was, however, a single set of notes where specific advice was given, and this was checked and recorded in three consecutive visits. In the notes for the first visit: "advised patient to wear URA full time" (1), and at visits 2 and 3, respectively: "patient only wears URA 6 hours a day" (1) and "patient has not been wearing URA" (1). This observation demonstrates both continuity of care and patient adherence but was only found in a single set of notes of 320 appointments inspected.

Attendance
The majority of patients' notes mentioned attendance/nonattendance, "patient missed her previous joint clinic" (3), and punctuality, "patient came in 30 min late" (5). There was no explicit link to adherence, however.

OH
Similarly, OH was commonly reported using qualitative descriptors although it was never linked directly to non-adherence: "poor OH" (1, 4, 10, 14, 20) and "OH satisfactory" (17). But the "details" of why OH was judged as such were only provided in a single set of case notes: "OH bad, calculus, chronic periodontitis due to smoking and OH" (13).

Patients' cooperation with treatment procedures
Patients' cooperation with the treatment procedures and the degree of engagement was often reported: "he has stopped wearing a bite guard…" (15), but the reasons as to "why" patients were not following the clinicians' advice were not recorded. Again, there was no direct link or descriptor to suggest that there was a relationship between the observed patient noncooperation and non-adherence.

Theme 3: patients' experiences and attitudes
Pain and/or discomfort
General experiences of pain were recorded in the notes: "pain from jaw" (13). Some notes were also specific to pain experienced as a result of treatment: "pain from expansion appliance" (10). In most of the cases, however, there was no follow-up of pain reports and no notes on how it had been dealt with. Only once was the patient's experience of pain rechecked and the process recorded: "pain improving but still in discomfort" (10). There was no commentary on how the recorded pain might influence a patient's subsequent adherence with appliance wearing.

Patients' attitudes and feelings

In a small number of case notes, the patients' attitude toward treatment was reported: "patient very keen to start" (16), or their feelings: "patient very anxious" (12), or perceptions of their malocclusion: "hates teeth" (20). In none of these cases, the reasons for these patient attitudes, perceptions and feelings were recorded nor the case was made that despite these positive attitudes to treatment the patient was considered as non-adherent.

Discussion

This study used a mixed-method approach to explore aspects of adherence as reported in case notes of non-adherent adult orthodontic patients. A common finding in both the quantitative and qualitative analyses was that the word adherence was never recorded in the case notes. Findings from both analyses also showed that predictors were not consistently reported across visits, clinicians and case notes. This was more evident with the qualitative analysis, where insufficient information was recorded to judge the extent of non-adherence.

The quantitative analysis showed that some predictors typically related to adherence in the literature[1,2,16,17] were being recorded in the case notes. In a top-down analysis, it was found that two adherence predictors were frequently recorded in the case notes. These were related to "OH and attendance." "Damage to wires and negative views of the malocclusion" were mentioned in approximately half (16/20 and 10/20, respectively) of the case notes examined. All the other predictors in the tool were mentioned only a few times except those related to "levels of engagement with treatment," "negative attitudes" and "politeness" which did not appear in the notes at all. However, when the presence of predictors of adherence was considered in terms of total visits examined, it was interesting to find that the "top" predictors (OH and keeping appointments) were only reported in a very small percentage (19% and 11%, respectively) of case notes. These findings are consistent with previous studies,[19,20] which suggested that OH and keeping appointments were commonly used by orthodontists to assess adherence. What is surprising, however, is that although these are, according to the literature,[19,20] the most commonly used predictors of adherence, they did "not" feature in real patients' case notes around 80% of the time. It would appear that although these adherence predictors are believed to be important by orthodontists, they are not routinely recorded in clinical notes pertaining to patients these clinicians have judged as non-adherent.

The qualitative analysis examined the case notes for content that might be related to adherence. This bottom-up analysis yielded some themes that confirmed predictors included in the tool on the basis of previous research[19,20] such as OH, keeping appointments, cooperating with fixed appliances and a negative view of malocclusion. However, none of these predictors of adherence were "explicitly" linked to patient non-adherence in the notes. This could be because orthodontists did not feel it necessary to do this as there might be some common understanding among clinicians that these issues are "signs" of non-adherence. Or it could be that "non-adherence" is perceived as a derogatory term, and as such, clinicians were reluctant to discuss this in notes. Or it could be that time limitations stopped the clinicians from fully noting their thoughts on these factors of adherence. Further qualitative work with clinicians would help answer this question. What is known is that where clinical notes do not explicitly record instances of non-adherence, it follows that communication between different members of the team might be undermined as one clinician's understanding of non-adherence might be different to that of another clinician's view.

Furthermore, although some themes that emerged from this bottom-up qualitative analysis (eg, information/advice) are central to seminal work on adherence (such as Ley's model of adherence[22,23]), they do not appear in the orthodontic adherence literature as important predictors. More work is required to understand how proxies of adherence such as information[21] might be beneficial to our understanding of adherence in the orthodontic clinic.

Finally, it would appear that predictors that the adherence literature tends to consider as "objective" (such as attendance, OH and breakages of appliances/distorted wires) were the most frequently recorded behaviors although recording was indeed sparse. In contrast, "subjective" behaviors (eg, patient is complaining about treatment) were less frequently reported. The latter involves a degree of interpretation of patients' behaviors that might require additional skills and time,[3] and this is one possible reason why they were rarely reported.

Overall, the current findings have shown evidence of sparse reporting, at best, of predictors of adherence in the clinical notes of patients judged to be non-adherent. Our data would suggest, therefore, that the recording of adherence in adult orthodontic settings may be subject to an attitude–behavior gap. We have found no evidence that the term non-adherence or its synonyms (compliance/concordance) are recorded in clinical notes. As such, the current findings have shed light on adherence reporting, but they have also raised questions about how clinicians link

the adherence predictors that they sometimes record in their notes to the likelihood of non-adherence. For example, it is unclear how many missed appointments a patient would need to be considered as non-adherent and thus what criteria clinicians use to classify non-adherence in their notes and in their face-to-face interactions. Similarly, while all of the notes we observed were from patients judged as non-adherent, this judgment was never reflected using this term in their notes. It would appear that just like in other works in dentistry,[24] a reliable tool to record adherence might be necessary that will help orthodontists with standardizing their efforts to record and be alerted about patient non-adherence.

This study reported on a substantial number of appointments recorded in patient case notes, but these came from a single large NHS London teaching dental hospital, so the results might not generalize to other contexts. In addition, all of the adult patients were seen within an NHS setting, so these results would need to be replicated in a different setting before they could reliably be generalized to, eg, private dentistry patients.

Conclusion

"OH," patients' "attendance" and "breakage of appliances" and/or "distorted wires" were the most common factors related to adult patients' adherence as reported by orthodontists working in a London hospital, but these were only reported in 20% of clinical notes examined. In addition, and most significantly, the term non-adherent is not used by clinicians in the notes of patients they have judged as such. This is the first study using mixed methods to complement existing literature on clinicians' attitudes to adherence by showing which factors related to adherence are and are not actually recorded in practice.

Disclosure

The authors report no conflicts of interest in this work.

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