

Using Written Material to Support Recall of Orthodontic Information: A Comparison of Three Methods

Eleanor Thickett^a; J. Tim Newton^b

ABSTRACT

The objective was to determine the effect of three different methods of presenting information on the recall of information in orthodontic patients in the short and long term. Thirty orthodontic patients at the commencement of their treatment were allocated randomly to groups receiving supporting written information in one of the three formats: mind map, acronym, and information leaflet. Short-term retention was assessed by administration of a nine-item questionnaire 10 to 15 minutes after receiving the information, and long-term retention was assessed after six weeks by repeating the same questionnaire without repetition of the information. Correct answers to the questions were compared across the three groups at short-term recall and long-term recall. A total knowledge score was determined by summing the number of correct answers across all nine items, and an analysis of covariance (ANCOVA) was conducted to determine the effect of the method of information on long-term retention of the information. There were significant differences in recall between the three methods of presentation at both time 1 and time 2 ($F_{\text{short-term}} = 5.97, P < .01; F_{\text{long-term}} = 3.19, P < .05$). Participants who were given a written information leaflet recalled less information on both occasions of testing. ANCOVA revealed that the three methods did not differ in the rate of forgetting of the material ($F = 1.96$, nonsignificant). Mind maps and acronyms convey a small but significant advantage in patient recall of information over written information leaflets. (*Angle Orthod* 2006;76:243–250.)

KEY WORDS: Behavioral science; Communication; Compliance

INTRODUCTION

The provision of appropriate and accurate information to patients is generally considered beneficial for many reasons. Information empowers patients to take charge of their lives and to assert their needs.¹ Bishop et al² suggested that patients who have a good knowledge of their disease or procedure have a better outcome than those who do not. Ley³ stated that providing the patient with greater information generally leads to increased compliance with treatment recommen-

dations. Good communication is associated with improved clinical outcome, especially if the patient is involved in decision making.⁴ Finally, most complaints are related to problems with communication rather than clinical competence.⁵

In order for a communication to be effective, it must be both remembered and understood.⁶ Patients often do not understand or misinterpret the information given to them. Frequently, this is because the form in which information is given is inappropriate. The sentences used and material written by clinicians may be too technical or difficult for the patients to understand, or ambiguous.³ The use of medical terminology has been shown to be a particular problem for patients.⁷ Patients may be reserved when asked about their diagnosis and treatment.⁸

Patients forget much of what they are told almost immediately after being presented with information. Patients attending outpatient clinics for consultant appointments in general medicine on average recall just more than 60% of what they are told.^{8,9} In a general medical practice setting, a sample of 20 patients recalled on an average only half of seven statements

^a Specialist Registrar in Orthodontics, GKT Dental Institute, Orthodontics and Pediatric Dentistry, King's College London, King's College Hospital, London, UK.

^b Professor, GKT Dental Institute, Oral Health Services Research, King's College London, King's College Hospital, London, UK.

Corresponding author: Dr. Tim Newton, GKT Dental Institute, Oral Health Services Research, King's College London, King's College Hospital, London SE5 9RW, UK (e-mail: tim.newton@kcl.ac.uk)

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made by their doctor.¹⁰ Similar findings have been noted among orthodontic patients. Witt and Bartsch¹¹ studied the understanding and recall of information by patients during an initial consultation at an orthodontic clinic. The average result was just more than 30% of information reproduced correctly after 10 days.

The amount of time between presentation of information and recall appears not to be important. It would be expected that with time, recall would diminish; however, there is only weak evidence to show that this is the case with medical investigations. Ley and Spelman^{6,9} and Joyce et al¹² found no significant differences between recall and the amount of time elapsed. Ley³ suggests that the lack of a relationship between recall and time may be connected to how frequently the patient had rehearsed the information to family and friends. The suggestion is that each time the information is repeated it becomes easier to recall.

The amount that a patient will forget is not related to age or intelligence but is related to the type of information presented, the anxiety level, and the order of presentation of information. Ley and Spelman⁶ showed that patients with low or high anxiety, recall less than those with moderate anxiety levels. Patients tend to forget instructions and advice more than other sorts of medical information.⁹ Ley¹³ has shown that patients remember what they are told first and what they consider important.

The provision of information to both patients and parents is important throughout orthodontic treatment. Pratelli et al¹⁴ showed how "experienced" parents (those whose children had previously received orthodontic treatment or were receiving treatment or who had been patients themselves) had little knowledge of the implications of orthodontic treatment. Only 41% knew that decay could occur beneath a fixed appliance and less than a third knew that relapse could occur after treatment. It is unlikely that patients had not been informed of these risks, but rather they had not recalled the information.

However, despite assertions of the importance of communication in orthodontics,^{15,16} there has only been one published study of communication and retention of information in orthodontics. Thomson et al¹⁷ explored the retention of information at an initial orthodontic consultation. In this study, a comparison of the effectiveness of written, verbal, and visual methods was assessed using a questionnaire. A questionnaire was carried out 15 minutes after the information was provided and then mailed six weeks later. The study reported little difference between the methods of information provision in recall and concluded that verbal instruction should be supplemented by written instruction.

This study will compare the recall of patients for in-

formation regarding their orthodontic treatment given verbally and supported by written material of one of three types: written information leaflet, mind map, or acronym.

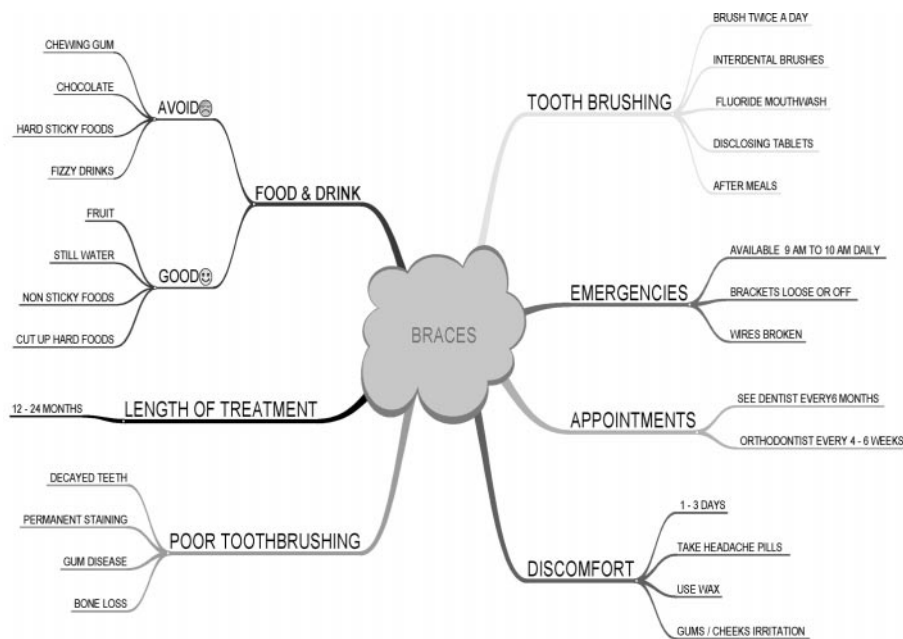
Study techniques such as mind maps that incorporate imagery, color, or the visual spatial arrangement have been reported to significantly improve recall when compared with rote learning or simple note taking. Farrand et al¹⁸ compared two sets of medical students in their ability to retain a 600-word passage. One group used "self-selected study technique," whereas the other used "mind map". The mind map group was shown to retain 10% more factual knowledge after a one-week interval.

There have been no studies assessing whether mind maps improve the retention of information given to patients regarding the treatment they are receiving. Similarly, a Medline search revealed no published studies exploring the use of acronyms to support information giving in medical or dental settings.

Written information sheets are a commonly used source of information for patients; however, some limitations of leaflets have been discussed. Beaver and Luker¹⁹ concluded that if written information is used as a substitute for verbal information, it cannot be assumed that all patients will understand it. Ley and Florio²⁰ confirm this point. In a study to examine the use of reading formula in health setting, they concluded that material written at a reading age of 15 is likely to be understood by only 54% of the population. They noted that tabloid newspapers are written at a reading age of 12. This has been concluded to be an appropriate reading age for written information in the medical setting. The format of the written information will also affect the manner in which it is perceived. Headings that stand out should be used to enable the reader to scroll through the information.²¹ Sentences should be short, and instructions should be given in the active rather than in the passive voice.^{22,23} The use of technical jargon should be avoided.²⁴ In addition to the above, the use of specific statements,²⁵ repetition,²⁶ and explicit categorization²⁷ would be incorporated into the text to improve chance of recall.

MATERIALS AND METHODS

A controlled trial of the use of three different written materials to support information giving to new orthodontic patients was conducted. Patients were assigned randomly to receive one of the three forms of written information. Short-term and long-term recall of the information given was assessed using a nine-item questionnaire. Ethical approval was obtained from the Local Research Ethics committee of King's College Hospital.



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FIGURE 1. The mind map.

Participants

Participants were recruited from patients attending their first treatment appointment after a period on the waiting list after initial assessment. All patients were aged between 12 and 14 years. Their parents or legal guardians were approached and asked to give permission for the child to participate. The criteria for inclusion were that participants should speak English as their first language and they should have no previous experience of wearing an orthodontic appliance.

The candidates were assigned randomly to one of three groups using the last two digits of their hospital number: numbers 01, 05, 09 = group 1 (received mind map), numbers 04, 06, 08 = group 2 (received acronym), and numbers 02, 03, 07 = group 3 (written information leaflet). Each patient was given a unique study code to identify them.

The sample size was based on an estimate of the number of participants required to detect a difference of two points on a nine-item recall questionnaire (maximum score = 20) where the standard deviation is 2.5, given the usual assumptions of power and significance level. This effect size was based on data from Thomson et al.¹⁷

Intervention

Each child was presented with the relevant information regarding the care of their orthodontic appliance, supported by written material according to their experimental group membership. Participants were

encouraged to read the information for as long as they wished before their recall being tested. The information was removed before asking the subjects to complete the recall questionnaire. The subject was not allowed to ask any questions from the parent or the investigator nor was the information taken home.

The information to be included in the methods was deemed to be useful for patients during orthodontic appliance wear by peer review of orthodontists.

Mind map

The mind map was devised using the computer program Mindmapper 3.4 (Sim Tech Systems) using the information that was determined by peer review (see Figure 1).

Acronym

The word BRACES was used to impart the information from the peer review (see Figure 2).

Written information leaflet

The leaflet used in this study was that published by the British Orthodontic Society. This leaflet is readily available in most orthodontic practices and hospital departments in UK. The leaflet was subjected to a Gunning Fog Test. This provides a simple numerical index to test readability. If the test gives a reading score of higher than 12 then it is suggested that the leaflet is rewritten to make the text easier to under-

- B** Brush twice a day and after meals, use floss and a fluoride mouthwash
- R Reduce fizzy drinks to zero
- A Aching of teeth and irritation of cheeks and gums.
Use the wax and headache tablets if necessary.
- C Cut out all sticky foods eg chewing gum, toffee, sweets etc
- E Emergencies for breakages attend clinic between 9 – 10 am
- S See your own dentist for routine checks 6 monthly
See orthodontist every 4 – 6 weeks.

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FIGURE 2. The acronym.

stand. Two different sections of 100 words were chosen and tested. The readability score were 9.6 and 8.0, which suggested that the leaflet was relatively easy to read and comprehend.

Assessment of recall of information

A questionnaire was used to assess participants' short- and long-term recall of the information presented (see Appendix 1). The questionnaire comprised nine questions with a closed response format. The closed questions allowed subjects to choose from a fixed number of alternatives, allowing for greater uniformity of responses. The maximum score on the questionnaire was 20. The subjects were instructed to answer as many of the questions as they could and to leave blank any that they were unable to complete. The questionnaire was administered by an independent researcher masked to the group membership of the participant. Participants were accompanied at all times to ensure that no external help was provided. A second questionnaire was completed in person six weeks later under the same circumstances.

Statistical analysis

Statistical analysis was conducted using SPSS version 10 (SPSS Inc, Chicago, Ill). Analysis was carried out independently by a statistician masked to the group membership of the participants. Analysis was conducted in two phases. First, the number of correct answers for each question given by members of the three groups was compared at time 1 and time 2 using bivariate, nonparametric tests. Second, knowledge scores were obtained by totaling the number of correct answers given by participants (from a possible total of nine) at time 1 and time 2. To determine whether the method of presentation of the written information produced differences in long-term recall of information, an analysis of covariance (ANCOVA) was conducted with knowledge scores at time 2 as the dependent variable, group membership as the independent variable, and knowledge scores at time 1 as the covariate. For a

TABLE 1. Demographic Characteristics of Participants^a

	Group 1 Mind Map	Group 2 Acronym	Group 3 Leaflet	Pearson Chi-square
Gender				
Male	10 (35%)	8 (28%)	12 (40%)	1.01, NS
Female	19 (65%)	21 (72%)	18 (60%)	
Age at last birthday				
12	10	8	6	3.67, NS
13	11	14	11	
14	8	7	13	
Mean (y)	12.93	12.97	13.23	

^a NS indicates not significant.

repeated measures design with an experimental group between subjects variable, such as in this study, an ANCOVA is the appropriate method of analysis.²⁸

RESULTS

Demographic characteristics of participants

The distribution of male and female patients within the three groups is shown in Table 1. There was no significant difference in the proportion of female patients within the three groups (chi-square = 1.01, non-significant [NS]). All three groups had a higher proportion of female patients than male patients.

The age distribution of the participants in the three experimental groups is shown in Table 1. There was no significant difference between the three groups in terms of age (chi square = 3.67, NS).

Analysis of findings by item

Table 2 shows the number of participants who gave particular responses to each specific question at time 1. Significant differences between the three groups were found for four items.

Time 2 responses to specific questionnaire items are shown in Table 3. Significant differences between the three groups were found for four items.

Analysis of findings by overall score on the nine-item scale

The mean scale scores for the nine-item questionnaire were calculated at time 1 and time 2. The means and standard deviations of these scores are shown in Table 4.

To compare the knowledge scores of the three groups at time 1 and time 2, two separate one-way analysis of variances were conducted. Post hoc Tukey B tests were carried out to analyze where significant differences lay between groups. There were significant differences between the three groups for recall at time 1, $F = 5.97$ and $P < .01$. The Tukey B test suggested that the mean for group 3 was significantly different

TABLE 2. Participants' Responses to Recall Questionnaire at Time 1 (Short-term Recall)^a

	Group 1 Mind Map	Group 2 Acronym	Group 3 Leaflet	Pearson Chi-square
Question 1				
No. of correct answers				
4	0	0	1	
5	5	4	7	6.85, NS
6	5	8	6	
7	9	9	12	
8	10	8	4	
Question 2				
Incorrect	8	4	5	1.975, NS
Correct	21	25	25	
Question 3				
Incorrect	4	4	6	0.569, NS
Correct	25	25	24	
Question 4				
Incorrect	0	0	0	0 as constant, NS
Correct	29	29	29	
Question 5				
Incorrect	1	0	0	2.058, NS
Correct	28	29	30	
Question 6				
Incorrect	6	0	0	13.100, <i>P</i> < .001
Correct	23	29	30	
Question 7				
No. of correct answers				
0	0	0	4	
1	7	9	13	22.695, <i>P</i> < .001
2	14	8	13	
3	8	12	0	
Question 8				
Incorrect	3	6	7	1.855, NS
Correct	26	23	23	
Question 9				
No. of correct answers				
0	3	1	1	
1	9	8	16	6.748, NS
2	11	14	8	
3	6	6	5	

^a NS indicates not significant.

from the means of groups 1 and 2. Group 3 recalls significantly less information at time 1. Similarly, there were significant differences between the three groups in long-term recall, *F* = 3.19 and *P* < .05. Group 3 recalls significantly less information at time 2 than group 1.

To investigate whether the three groups differed in the rate of forgetting over time, an ANCOVA was conducted.²⁸ The scores of the participants at time 2 were analyzed by group with time 1 scores as a covariate. There was no significant difference in the mean scores of the three groups at time 2 once time 1 scores had been covaried out (*F* = 1.96, NS). The effect of the covariate was significant (*F* = 49.32, *P* < .001), sug-

gesting that initial recall is a good predictor of recall at time 2; however, the three groups do not differ in their rate of forgetting the information.

DISCUSSION

Three methods of presenting information on the care of orthodontic appliances were compared for immediate and long-term retention. The use of both an acronym and a mind map proved superior for recall in comparison with written information leaflet. However, rates of forgetting over six weeks were similar for all three methods of information presentation. Initial knowledge is a good predictor of knowledge at time 2,

TABLE 3. Participants' Responses to Recall Questionnaire at Time 2 (Long-term Recall)^a

	Group 1 Mind Map	Group 2 Acronym	Group 3 Leaflet	Pearson Chi-square
Question 1				
No. of correct answers				
4	1	2	0	
5	10	11	2	3.913, NS
6	11	9	15	
7	6	6	10	
8	1	1	3	
Question 2				
Incorrect	7	8	8	0.096, NS
Correct	22	21	22	
Question 3				
Incorrect	2	5	5	1.673, NS
Correct	27	24	25	
Question 4				
Incorrect	8	10	6	1.561, NS
Correct	21	19	24	
Question 5				
Incorrect	0	2	0	4.164, NS
Correct	29	27	30	
Question 6				
Incorrect	5	4	4	0.212, NS
Correct	24	25	26	
Question 7				
No. of correct answers				
0	0	0	0	
1	8	10	2	24.960, $P < .001$
2	20	12	19	
3	1	7	9	
Question 8				
Incorrect	0	10	6	11.691, $P < .01$
Correct	29	19	24	
Question 9				
No. of correct answers				
0	3	0	1	
1	8	12	16	7.720, NS
2	16	16	11	
3	2	1	2	

^a NS indicates not significant.

TABLE 4. Means and Standard Deviations of Participants' Scores on Recall Questionnaire for the Three Experimental Groups^a

	Group 1 Mind Map	Group 2 Acronym	Group 3 Leaflet
Time 1 Mean (SD)	15.79 (1.50) a	16.21 (1.99) a	14.63 (1.92) b
Time 2 Mean (SD)	14.45 (1.30) c	13.93 (2.46) cd	13.20 (1.79) d

^a Groups with different letters have different means (post hoc Tukey B test).

as postulated by Ley and Spelman.^{6,9} For some questions, the number of correct responses increased for the second questionnaire. This may be because of the candidate making a better guess than before or that

they may have rehearsed the information with family and friends outside the clinic.

The findings are unlikely to be the result of experimental bias. The results cannot be attributed to differences between the three groups in the age and sex of participants. The age and sex distribution within the three groups were similar. All the questionnaires were completed within the department; therefore, the response rate was 100% for both time 1 and time 2. All the questionnaires were completed independent, and all questions were answered. Therefore, it can be assumed that the responses were to the best of the individual's ability, truthful, and questions were fully understood. The experimenters and the data analyst

were masked to group membership to minimize any bias that might arise from knowledge of participants' group membership.

The provision of information to patients is part of clinical governance, and in this increasingly litigious culture, full knowledge of treatment procedures and possible outcomes is highly important. Therefore, the most effective method of imparting information, which enables a patient to appreciate all the facts, must be obtained. This study suggests that methods such as the use of acronyms or mind maps convey a small, but significant, advantage over a traditional written information leaflet. The small magnitude of the effect may be partly because of a "ceiling effect" because all groups showed high levels of recall. This is surprising, given estimates from previous studies of recall in clinical settings.⁶ Two possible interpretations of this finding could be given. First, all participants were given supporting materials to aid recall, and there was no condition where the clinician gave only a verbal description. Second, it is possible that for some questions the correct answers were either readily apparent (eg, Q7) or built on preexisting knowledge (Q2). Future research investigating the effect of different methods of information presentation should ensure that sufficient information is presented to place a considerable demand on recall, thus avoiding ceiling effects.

Rates of forgetting were similar across the three groups presented with the three methods of providing information. This is supported by previous research, which suggests a fairly constant rate of forgetting.⁶ Clinically, patients should be reminded of key information at follow-up appointments, rather than the clinician assuming that patients will recall information given at the initial appointment.

CONCLUSIONS

- Overall, there appears to be little difference in recall between the three methods of providing information. The majority of answers were largely correct.
- The questionnaire results at time 1 showed that the acronym resulted in greater recall than the other two methods, but at time 2, it was the mind map.
- Recall at time 1 is a good indicator of patient retention of information in the long term.

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APPENDIX 1

Questionnaire to test recall of information provided.

1. Which food and drinks should you avoid?
- | | Yes | No |
|-------------------|--------------------------|--------------------------|
| FRUIT | <input type="checkbox"/> | <input type="checkbox"/> |
| CHEWING GUM | <input type="checkbox"/> | <input type="checkbox"/> |
| CRUSTY BREAD | <input type="checkbox"/> | <input type="checkbox"/> |
| STILL WATER | <input type="checkbox"/> | <input type="checkbox"/> |
| SWEETS | <input type="checkbox"/> | <input type="checkbox"/> |
| HARD FOODS | <input type="checkbox"/> | <input type="checkbox"/> |
| FIZZY DRINKS | <input type="checkbox"/> | <input type="checkbox"/> |
| DIET FIZZY DRINKS | <input type="checkbox"/> | <input type="checkbox"/> |
2. How often should you visit your High Street dentist while wearing braces?
- Never
- Every 3-4 months
- Every 6 months
- Every year
3. Should you use a fluoride mouthwash?
- Yes No
4. How often should you brush?
- Once a day
- Twice a day

- Three times
5. It is important to brush after a meal?
- Yes No
6. How long will treatment take?
- 6 months to 1 year
- 1-2 years
- Over 3 years
7. If the brace makes your teeth or cheeks ache what should you do?
- | | Yes | No |
|---------------------|--------------------------|--------------------------|
| Just put up with it | <input type="checkbox"/> | <input type="checkbox"/> |
| Use some wax | <input type="checkbox"/> | <input type="checkbox"/> |
| Do take painkillers | <input type="checkbox"/> | <input type="checkbox"/> |
8. What do you do if you damage your brace?
- | | Yes | No |
|--|--------------------------|--------------------------|
| Do nothing & wait until you next appointment | <input type="checkbox"/> | <input type="checkbox"/> |
| Phone your own dentist for an appointment | <input type="checkbox"/> | <input type="checkbox"/> |
| Come into the hospital as an emergency | <input type="checkbox"/> | <input type="checkbox"/> |
9. Can poor brushing lead to the following?
- | | Yes | No |
|---------------|--------------------------|--------------------------|
| Healthy gums | <input type="checkbox"/> | <input type="checkbox"/> |
| Decayed teeth | <input type="checkbox"/> | <input type="checkbox"/> |
| No staining | <input type="checkbox"/> | <input type="checkbox"/> |