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ORIGINAL ARTICLE

Do parents of adolescent patients undergoing fixed appliance treatment recall more information using written material or an animated video? A randomized controlled trial

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KEYWORD

Animation;
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Abstract *Objectives:* This "2-arm parallel" trial investigated the recall of information pertinent to obtaining informed consent of parents of orthodontic patients using; either written material and verbal support or an animation.

Materials and methods: Parents of patients, aged 12–18 years, about to undergo fixed applaince treatment, were randomized to either receive information by leaflet or by watching an animation. The parents were asked a series of open-ended questions immediately and one year later. The outcome measure was the total median questionnaire score immediately (T_0) and one year later (T_1). A Mann Whitney *U* test was performed to test for differences between T_0 and T_1.

Results: 31 parents were randomized into the leaflet group and 33 in to the animation group. The median leaflet group score was 81 (IQR = 27) at the time of consent (T_0) and 87 (IQR = 29) a year later (T_1), compared to a median score of 76 (IQR = 23) for the animation group at T_0 and 87

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(IQR = 32) at T_1. Statistically, there was no difference in the questionnaire score at (T_0) ($p = 0.567$) and at (T_1) ($p = 0.522$). The average time spent with the clinician in the leaflet group was an additional 9 min in the animation group.

Conclusion: The use of a leaflet and verbal information or an animation are equivalent in providing information to the parents of orthodontic patients. The use of an animation reduces the clinical time needed to deliver the information.

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1. Introduction

Most orthodontic treatment is undertaken during adolescence to utilise growth and compliance. Adolescents are unable to consent to their treatment and rely on their parents, or an individual taking parental responsibility, to provide consent. The consent process is generally undertaken in a clinical setting where information is given to both the patient and parent. The nature of their child's condition and the possible solutions needs to be processed and understood before informed consent can be given (King, 2001). The parent is committing their child to a potentially long treatment plan, multiple visits, pain, restricted diet, and a substantial increase in oral hygiene demand. The child patient needs to understand their role in treatment and will need parental support. Enhanced communication increases satisfaction, improves knowledge, and provides the motivation required to achieve compliance during treatment (Mehra et al., 1998). Previous studies have shown that patients generally remember little of the information discussed when using the traditional didactic face to face informed consent process (Hall et al., 2012; Lloyd et al., 2001). Having a signed consent form does not guarantee the parent has understood the proposed procedure and does not guarantee their child's compliance, and therefore does not constitute valid consent (Byrne et al., 1988). Studies have shown using written and verbal instructions for orthodontic consent, are relatively ineffective among adolescent patients (Carr et al., 2012; Thomson et al., 2001). Parents recall fewer reasons and risks associated with treatment than they had been told by the consenting clinician (Mortensen et al., 2003). During periodontal patient education, in terms of knowledge recall, three-dimensional animations have been shown to be more informative than real-time illustrations (Cleeren et al., 2014) and may be a useful tool for improving the parents' ability to provide orthodontic consent.

The study aimed to compare the retention of knowledge required for informed consent, amongst parents of adolescent patients undergoing fixed appliance treatment, based on either written material with verbal support (leaflet) or a video animation immediately (T_0) and one year later (T_1). A previous study has reported on the adolescent patient group (Shqaidef et al., 2021).

2. Materials and methods

2.1. Study design

The study was a 1:1 allocation ratio, randomized, parallel-group, controlled trial.

2.2. Participants and eligibility criteria

Consecutive parents of children who started fixed appliances treatment at the Orthodontic Department were recruited. The following selection criteria were applied:

- Parents of patients aged 12–18 years of age; the children required fixed appliance orthodontic treatment.
- No previous history of fixed appliance treatment by the parent, child or any other immediate family member.
- Parent's native language was Arabic.
- Parent's should be from middle eastern ethnicity.
- Parents should have a minimum of middle school literacy.
- Parents had no history of medical or psychological disorders that may affect their memory.
- Either the father or the mother participated in the study, not both.

2.3. Settings

Parents of children seeking fixed orthodontic treatment at Jordan University Hospital.

2.4. Clinical intervention

Information contained in the "Orthodontic Treatment – Patient Information Leaflet" (PIL) from the British Orthodontic Society was translated into Arabic by one of authors (AS). The translated BOS leaflet and the information contained in the University hospital consent form were merged to create the leaflet material. The same content was given to the professional company to produce an animation, Fig. 1. The BOS leaflet was written in a "question and answer style"; the same style was used to produce in Arabic written leaflet and the animation. This was achieved by following an animated character through an orthodontic consultation with the orthodontist answering the questions.

Sixty-four parents were recruited; 31 parents were recruited into the leaflet group and 33 into the animation group, Fig. 2. Following enrolment of parents into the study, their demographic data, including age, family monthly household income, gender, and level of educational were recorded. Parents allocated into the leaflet group were given 10 min to read the leaflet in a quiet setting. This was followed-up by a verbal explanation given by a qualified dentist. The time required to explain the contents of the leaflet, excluding the parents' questions, was noted. Parents allocated to the animation group were instructed to watch the animation on a Tablet (Galaxy

Fig. 1 Screenshot of the animation video.

Tab 10.1, Samsung T533 and Beats EP On-Ear Headphones) in a quiet room. Parents were encouraged to ask questions for clarification.

Immediately following the intervention (T_0), a blinded orthodontist (AS) asked the parents 13 open-ended questions (Appendix). The final questionnaire score was calculated by totaling the number of correctly answered questions; the maximum score was 25. A year later (T_1), the same orthodontist (AS) asked the parents the same 13 open-ended questions and marked their responses.

2.5. Outcome measures

The primary outcome measure was the questionnaire score, out of 25. This was taken as a measure of the knowledge each parent could recall at T_0 and T_1.

The secondary outcome measures were the time required to deliver the information to the parent, excluding any time taken to answer the parents' questions. In addition, the effect of parental income and educational level on information recall.

2.6. Sample size

Using G*Power (Erdfelder et al., 2009) a sample size calculation based on a power of 0.80, a statistical significance of 0.05 and a moderate to large effect size (0.6) (Cohen, 1988) showed that a minimum of 30 individuals, in each group would be required.

2.7. Randomization

Using block randomization parents were assigned into the leaflet group (group A) and the animation group (group B). Each block sequence was printed on paper, folded and stored in a jar. The treating clinician withdrew the folded paper from the jar to determine the sequence used to enroll the parents into the two groups.

2.8. Blinding

The orthodontist (AS) was blinded when marking the answers to the questionnaire at T_0 and T_1.

2.9. Statistical analysis

The difference in the questionnaire scores between the two interventions, at T_0 and T_1, were not normally distributed. To determine statistical differences in the median total questionnaire score, between group A and group B, at T_0 and T_1 a Mann-Whitney *U* test was undertaken. Whilst a Wilcoxon signed-rank test was used to determine statistical differences in the intra-group total questionnaire score between T_0 and T_1. To study the effect of knowledge recall overtime and the effect of parental income and educational level a repeated measures ANOVA and General Linear Model (GLM) were used.

3. Results

3.1. Participant flow

A total of sixty-four parents were assigned to the leaflet group and animation group. At T_1, two patients in the animation group were lost to follow-up. Fig. 2.

3.2. Baseline data

The characteristics of the two groups at baseline were found to be similar in both groups, Table 1.

3.3. Outcome of analysis

The primary analysis, at T_0, was performed on 33 parents in the animation group and 31 parents in the leaflet group. However, the analysis at (T_1) was performed on 31 parents in each group, as two parents were lost at follow-up, Table 2.

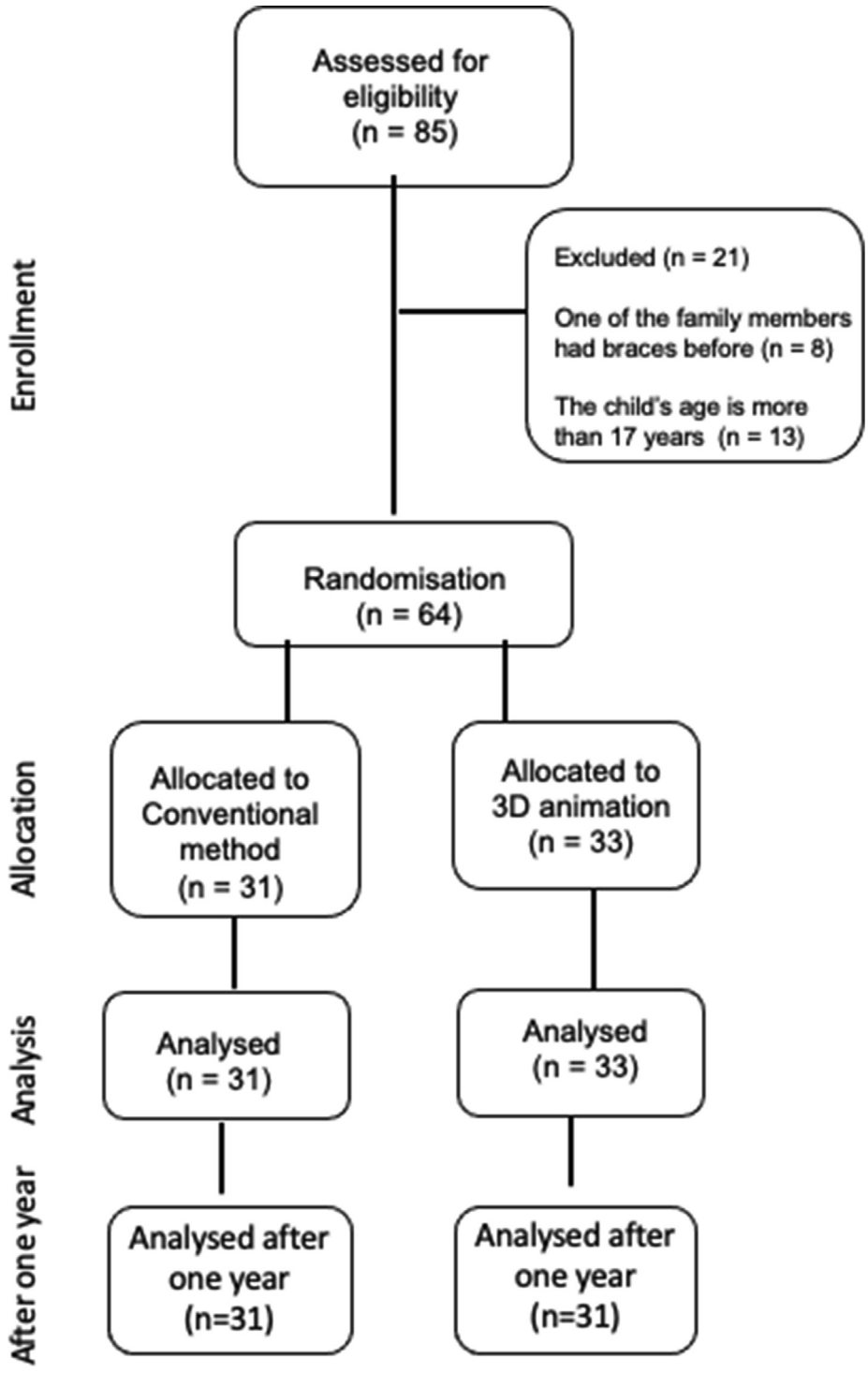

Fig. 2 CONSORT diagram for the study.

The answers to the questions, provided by the parents, were normalized out of 100. There was no difference in the questionnaire score ($p = 0.151$) between T_0 and T_1 for the leaflet group (median score 5, IQR = 26) and the animation group (median score −0.5, IQR = 18). There was no difference in the questionnaire score ($p = 0.567$) between the leaflet group (median score 81, IQR = 27) and the animation group (median score 76, IQR = 23) at the time of consent (T_0). Statistically at T_1, there was no significant difference between the leaflet group (median = 87, IQR = 29) and the animation group (median = 87, IQR = 32, $p = 0.522$).

On average the additional time spent with the leaflet group was 9 min; for the animation group no additional time was spent explaining the information provided. There was no significant interaction with parental income ($p = 0.676$) and parental education ($p = 0.508$).

Table 1 Description of the sample.

	Animation		Leaflet	
Number	33		31	
Gender	F = 15		F = 19	
	M = 18		M = 12	
Mean age of parents (SD)	46.5 (6.1) years		44.6 (6.8) years	
Mean age of patients (SD)	14.0 (2.1) years		14.6 (1.9) years	
Mean monthly income (JOD)	1017 (525) JOD		751 (987) JOD	
Educational level	Less than High school	4	Less than High school	4
	High school	2	High school	7
	BSc	21	BSc	19
	MSc	5	MSc	1
	PhD	1	PhD	0

SD: Standard deviation.
JOD: Jordanian Dinar.

Table 2 Median scores for difference in questionnaire score between the leaflet group and animation group at T_0 and T_1.

Time point	Group	Median	IQR	Mean rank	Minimum – Maximum score	p-value*
Immediate (T_0)	Animation	76	23	31.8	Min: 40 Max: 100	0.61
	Leaflet	81	27	33.7	Min: 56 Max: 96	
One year (T_1)	Animation	87	32	27.7	Min: 52 Max: 92	0.097
	Leaflet	87	29	35.2	Min: 48 Max: 96	

* Results of Mann Whitney *U* test.

At T_0, less than 50 % of the parents in the leaflet group answered two of the questions correctly; the benefits of orthodontic treatment improving dental health, and root resorption as a treatment risk. In the animation group, only one question was answered correctly by less 50 % of the participants at T_0; regarding the frequency of orthodontic appointments. At T_1, four questions were answered correctly by fewer than 50 % of the parents in both groups. Three of them were the same in both groups; improving the health of gum and teeth as a benefit of orthodontic treatment, root resorption as a risk of treatment, and how often should the patient brush their teeth. The detrimental dietary effects during orthodontic treatment were answered correctly by less than 50 % of participants in the leaflet group while the length of orthodontic treatment was answered correctly by less than 50 % of the parents in the animation group, Fig. 3.

4. Discussion

Many of the patients undergoing orthodontic treatment in the United Kingdom (UK) are between the ages of 11–13 years (Patel et al., 2008), and are unable to consent to treatment. The responsibility of providing consent then relies on the legal guardian. In this study, we aimed to find a more effective way of delivering the knowledge that is required by parents to consent to their child's orthodontic treatment. The child at this age, 11–13 years, may not be receptive to orthodontic treatment and may be driven by the parents, in the child's best interests. Parents need to reinforce the messages given by the clinician at the time of consent. Any "mixed messages" may undermine the tri-partite relationship and result in confusion. It is therefore essential that the parent can recall the correct information.

The results of the current study showed there was no difference in the parents' median questionnaire scores between the animation and leaflet groups, immediately and one year later. These results were similar to those obtained in adolescent patients aged between 12 and 18 years (Shqaidef et al., 2021). In the immediate term, questions regarding improving the health of gum and teeth as a benefit of orthodontic treatment and root damage as a risk of treatment were answered correctly by less than 50 % of the parents in the leaflet group. Whilst in the animation group, only one question was answered correctly by less than 50 % of the parents; this concerned how often the parent should bring their child to visit the orthodontist. With respect to root damage, the animation yielded a higher percentage of correct answers compared to the leaflet. This would suggest that the concept of root resorption is difficult for laypeople to understand, and that the animation helped explain this particular risk.

After one year, there was no statistically significant difference between the two groups. This finding agreed with previous studies that considered long-term retention as six weeks (Thickett and Newton, 2006) and eight weeks (Patel et al., 2008). Poor recall of root resorption as a risk of orthodontic treatment has previously been reported in the literature, with only 21 % of the parents and patients recalling root resorption as a risk after six months (Ernst et al., 2007) and less than

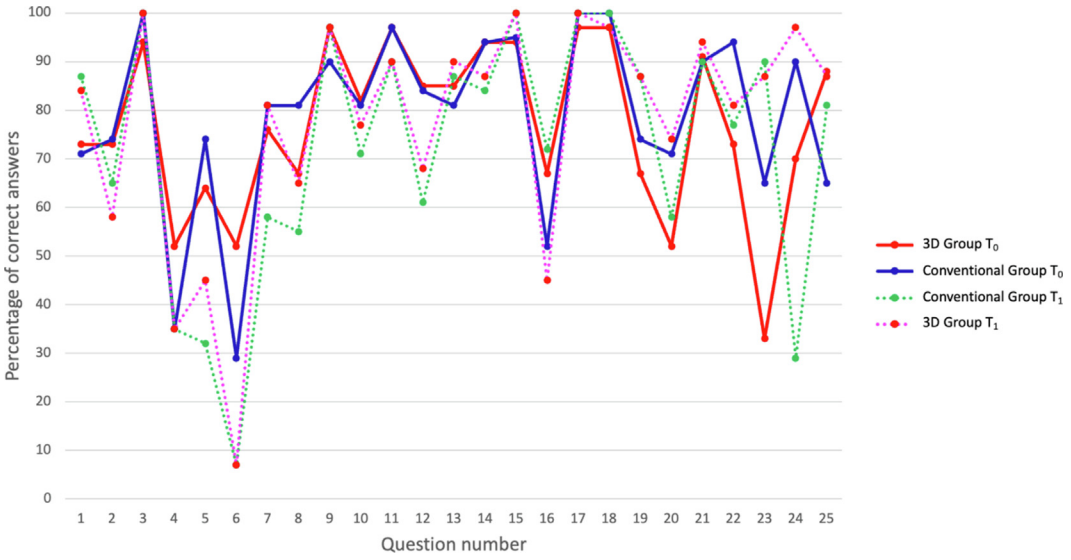

Fig. 3 Percentage of correct answers at time of consent (T_0). one year later (T_1).

10 % of the patients after one year (Shqaidef et al., 2021). Children and their parents failed to retain the risk of root resorption irrespective of the whether the information was given in a leaflet format or as an animation. This finding is significant as research has shown there is more than 90 % occurrence of root resorption because of orthodontic treatment (Harry and Sims, 1982), 14.5 % of this is severe root resorption (Marques et al., 2010) and may have longer term clinical implications. Parents also failed to remember how many times their children should brush their teeth a day during treatment. Again, this is significant, as any reduction in tooth brushing will result in decalcification. Decalcification is a common risk of orthodontic treatment with 50 % of orthodontic patients having at least one white spot lesion at the end of their treatment (Gorelick et al., 1982).

Consent is an ongoing process and can be withdrawn as any point. Patients sitting in the dental chair and allowing treatment is implied consent for treatment. However, the risks and benefits of treatment are rarely re-visited during treatment, unless there is an issue. The fact that parents have failed to recall two key risks suggests periodic reinforcement of the information would be beneficial at every contact with the patient and parent. It is important to appreciate that consent is not a singular event but a continual process.

In the present study parental monthly income had no effect on knowledge retention. This disagreed with a previous study (Mortensen et al., 2003), which raised concerns around the effectiveness of current consent techniques and recommended further research on methods to improve the informed consent process in a low-income population. However, the previous study lacked a control group and was conducted in a public clinic where all the participants had a low-income. Interestingly, in the present study the educational level of the parents did not affect their knowledge recall. However, this should be interpreted with caution as most of the parents had a bachelor's level degree.

The time spent by the clinician with the parents explaining the benefits and risks of treatment prior to taking consent was on average 9 min using the leaflet written material and verbal support. In the present study information necessary for informed consent was undertaken in a quiet room to minimize any distractions. However, in routine clinical practice this would normally be carried out rapidly in a distractive clinic environmental. By using the animation 9 min was saved which the clinician could use more effectively to target the key risks which this study has shown are not recalled i.e., the risk of root resorption, the need for excellent oral hygiene and regular appointments.

5. Conclusions

- An animation or leaflet written information and verbal support are both similar in providing information to parents of adolescents undergoing fixed appliance treatment prior to taking consent.
- When using written information, the orthodontist will spend, on average, an additional nine minutes with the parents compared to using the animation.
- Most parents of patients undergoing fixed appliance treatment do not remember the risk of root damage during treatment in the short-term using a leaflet.
- In the long term, parents in both groups failed to recall root damage as a risk of treatment and how many times their children should brush their teeth.

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Ethical approval

Ethical approval for this study was obtained from the Institutional review board (IRB) in the University Hospital.

Informed Consent

Written consent was obtained from the parents before their recruitment.

CRediT authorship contribution statement

Abedalrahman J. Shqaidef: Data curation, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Writing – original draft, Writing – review & editing. **Mohammad Y.N. Saleh:** Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Jumana Kussad:** Data curation, Investigation, Methodology, Writing – original draft. **Balvinder S. Khambay:** Formal analysis, Methodology, Project administration, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1. . The questionnaire used in the study (Shqaidef et al., 2021).

Question number	Questions asked to patients	Answer number
1	**In your opinion what is orthodontic treatment?**	
	• Wearing braces	1
	• Wire moving the teeth	2
2	**What are the benefits of orthodontic treatment?**	
	• Straight teeth / achieve more pleasing smile	3
	• Improve the health of the teeth / gums	4
	• Improve the bite / make it easier to eat	5
3	**What are the risks of orthodontic treatment?**	
	• Root damage / shortening	6
	• White marks on teeth / tooth decay	7
	• Damage to the gums	8
4	**What are the consequences of not brushing your teeth properly?**	
	• White marks on teeth / tooth decay	9
	• Damage to gums	10
5	**How often should you brush your teeth per day?**	
	• At least 3 times	11
6	**Which food you should avoid during orthodontic treatment?**	
	• Sweets / avoid sweets between meals	12
	• Fizzy drinks	13
	• Hard and sticky food	14
7	**What can you do to decrease the possible risks?**	
	• Brush teeth properly	15
	• Follow diet as instructed	16
8	**Should you tell your doctor about any previous injuries to your teeth?**	
	• Yes	17
9	**a. Do you expect any pain during teeth movement?**	
	• Yes	18
	b. When?	
	• 3-5 days after braces first fitted	19
	• Each time it is adjusted	20
	c. What should you do?	
	• If the pain is severe enough, take painkillers	21
10	**What will happen if you do not wear your retainer?**	
	• Teeth return to original position	22
11	**How often should you visit your orthodontist during the treatment?**	
	• Every 4-6 weeks	23
12	**How long on average does orthodontic treatment take?**	
	• 18 - 24 months	24
13	**What will happen as a result of bracket breakage?**	
	• Delay in the treatment progress.	25

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