Parenting and Child Behaviour as Predictors of Toothbrushing Difficulties in Young Children

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Abstract

Background: Oral disease is one of the most prevalent chronic health conditions affecting children. Twice-daily toothbrushing is recommended to promote good oral health; however, a large proportion of Australian families are not meeting this recommendation. **Aim**: This study aimed to identify important barriers to regular toothbrushing for young children. **Design:** In this study, 239 parents of 0- to 4-year-old children completed an online survey that investigated child, family and parent factors associated with child toothbrushing. Hierarchical linear regression was used to identify predictors of toothbrushing frequency in children, and perceived difficulty of the task by parents. **Results:** We found that parent factors, specifically oral health knowledge, were the most significant predictors of toothbrushing frequency. Conversely, parent factors did not contribute significantly to the prediction of perceived difficulty of toothbrushing once family and child factors were taken into account. Oral health knowledge and use of routines were identified as the most important predictors of toothbrushing frequency, whereas resistant child behaviour and household organisation were found to be the most important predictors of perceived difficulty of regular toothbrushing. **Conclusions:** The findings of the study have implications for behavioural interventions to support parents, as well as directions for future research.

For Australian children, dental caries is the most common form of oral disease[1]. Between 48% and 69% of Australian children experience caries in their infant or permanent teeth, with children aged 5 and 6 years experiencing the highest rate of untreated decay [2]. One of the main identified risk factors is inadequate toothbrushing [1]. The Australian Dental Association (ADA) recommends that, from the appearance of an infant's first tooth, teeth should be brushed twice daily and with adult assistance until the child reaches 8 years of age. There is

empirical support for the protective role of regular toothbrushing against dental caries [3], and earlier onset of toothbrushing is related to fewer caries in childhood [4]. Despite this, 27% of Australian school-aged children, 39% of preschool-aged children and 58% of infants and toddlers have their teeth brushed less than twice daily [5]. This is despite most (81%) parents reporting confidence in caring for their child's oral health [5].

Fisher-Owens et al.'s [6] conceptual model argues for a multilevel approach to child oral health that considers the complex relationships between child, family and community level influences, mediated by developmental factors. Oral health behaviours are highly routinised behaviours, most often instilled in children by their parents [7]; however, socioenvironmental factors related to the family, including family functioning, household routine [8,9] and other caregivers [4,10], impact the likelihood that a parent will regularly brush their child's teeth. For example, children from families with average levels of functioning tend to start brushing at an earlier age than children with poorer family functioning; likewise, high family organisation is linked to more frequent (twice daily) toothbrushing [8]. The mechanisms underlying the relationship between family functioning and toothbrushing behaviour are poorly understood; however, it is anticipated that routinised behaviours play a role. It is therefore important to consider what parent, child, and family factors might make it difficult for families to initially develop a toothbrushing routine.

Parental attitudes, knowledge and health beliefs have implications for the development of health behaviours in children [11]. Li et al. [4] identified a relationship between lower levels of parental knowledge and greater child dental decay, although this has not been shown in other studies [12]. The links between parental oral health knowledge, child oral health [4] and toothbrushing behaviour appear to be mediated by factors potentially related to control, self-efficacy and the strategies that are implemented to successfully carry out the health behaviour. For example, more internal parental locus of control (LOC) has been associated with better child oral health behaviour [13,14]. Parental perceptions of control are likely to play a role in parents' confidence in their ability to implement certain behaviours, especially when a child is resistant or uncooperative.

Although factors such as routine and household functioning appear to impact the implementation and maintenance of regular toothbrushing, child resistance (e.g., non-compliance with instructions) is one of the most commonly cited challenges in qualitative research [14-16]. Parental reactions to resistance are important predictors of toothbrushing frequency [10,14]. Several studies support the notion that parenting style [17] as well as specific parenting strategies [18] influence toothbrushing behaviour and oral health in children, and for

many parents these skills stem largely from their confidence to implement parenting strategies with their child [18]. Parental self-efficacy is associated with child toothbrushing frequency [12,18,19]; however, many parents report lack of confidence with managing resistant behaviour, and lack adaptive coping mechanisms to manage their own emotional reactions [16].

This study aimed to identify child, parent, and family predictors of toothbrushing frequency and perceived toothbrushing difficulty with parents of 0- to 4-year-old children. It was hypothesised that parental factors, specifically parenting skill and self-efficacy, would be the strongest predictors of children's toothbrushing frequency and parents' perceived difficulty of toothbrushing behaviour, followed by difficult child behaviour and familial factors.

Method

Participants

Participants were 239 parents of 0- to 4-year-old children residing in Australia, mostly mothers (94.5%; 4.6% fathers; 0.8% other carers). There were approximately equal numbers of male (53.6%) and female (46.4%) children. Most parents were born in Australia (73.2%), reported university/postgraduate qualifications (73.7%), and were married or in a de facto relationship (92.9%). Most children were residing in their original family (92.1%; 5.9% sole parent family; 0.4% step-family; 1.7% other). Most parents (92.1%) denied that their child experienced a socioemotional or behavioural problem. The study was approved by the [Blinded for Review].

Measures

Child, parent and family factors associated with toothbrushing behaviour were assessed using an online questionnaire combining existing measures and questions created specifically for this study. Parents with multiple children aged 0-4 years were asked to respond in relation to the child whose oral health behaviours they were most concerned about, or, if there were no specific concerns, their youngest child.

Toothbrushing frequency was assessed by parent report of how often their child brushes their teeth in a typical day ranging from zero (0) to three times (3). Parents reported how easy or difficult they find it to brush their child's teeth on a 5-point Likert scale, ranging from extremely difficult (1) to extremely easy (5). Scores were recoded so that high scores indicated greater difficulty.

The **Family Background Questionnaire** [22] was used to collect demographic information including marital status, household structure, education, and employment.

The **Confusion, Hubbub, and Order Scale** (CHAOS) [23] is a 15-item true/false measure

of environmental confusion, including environmental noise, clutter, hubbub, frenetic activities and disorganisation. Higher scores indicate more chaotic and disorganised characteristics within the household. The CHAOS possesses sound psychometric properties [23] and had strong internal reliability in this sample, α = .77.

The **Child Adjustment and Parent Efficacy Scale** (CAPES) is a 30-item measure of child adjustment and parental efficacy [24]. Only the Intensity scale was used, which has 30 items rated on a 4-point Likert scale ranging from not true of my child at all (0) to true of my child very much (3). Higher scores indicate greater adjustment issues (range from 0-90). The Intensity scale had strong internal consistency, α = .86.

The **K*nowledge of Children's Oral H*ygiene** (KCOH), and parental **Oral Health Self-Efficacy** (OHSE) scales were taken from Finalyson et al. [25]. Parental oral health knowledge was measured by six questions using a 5-point Likert scale ranging from strongly agree (1) to strongly disagree (5). The questions ask about misconceptions related to children's oral health (e.g., "Cavities in baby teeth don't matter, since they fall out anyway") with higher scores indicating higher levels of knowledge. Parental oral health self-efficacy was measured by nine questions using a 4-point Likert scale ranging from not at all confident (1) to very confident (4). Respondents rate their level of confidence in ensuring their child's teeth are brushed under several different circumstances (e.g., "When you are bothered by your child crying"), with higher scores indicating higher levels of OHSE. The KCOH and OHSE scales had good internal consistency, α = .85 and .95 respectively. Furthermore, parents' confidence to implement regular toothbrushing was measured on a 4-point Likert scale ranging from not at all confident (1) to very confident (4).

A 13-item measure of **parental oral health locus of control** (LOC) was used [26,13]. Participants respond on a 5-point Likert scale ranging from strongly agree (5) to strongly disagree (1), with higher scores indicating more external LOC. The scale demonstrated good internal consistency, α = .80.

The 7-item stress subscale of the **Depression Anxiety Stress Scales** (DASS-21) [27] was used to measure parental stress and demonstrated strong internal reliability in the current study, α = .90. Respondents provide an indication of how much each statement applied to them over the past week, from never (1) to almost always (4), with higher scores indicating higher levels of stress.

The **Parenting Scale** [28] is a 30-item measure of use of dysfunctional disciplinary techniques. The scale measures Laxness, Over-reactivity and Verbosity, and provides a total parenting score. Parents respond to a scenario by indicating which disciplinary technique they

would most often implement in the situation, using a 7-point scale anchored at one end with an effective discipline technique and at the other end with its ineffective counterpart. We used the total parenting score in analyses, with higher scores indicating greater levels of dysfunctional discipline. The scale has sound psychometric properties, including moderate test-retest reliability and validity, and demonstrated strong internal consistency, α = .81.Additional questions measured specific areas of research interest that were not captured in an existing scale. These included questions presented alongside Likert response scales that assessed: age of toothbrushing onset for child (How old was your child when you first started brushing their teeth?); presence or absence of toothbrushing routines in the morning and evening (Tooth brushing is a regular part of my child's morning/evening routine) with response format ranging from 1 (strongly disagree) to 5 (strongly agree); and level of anxiety, resistance and sensory distress experienced by the child in relation to toothbrushing (My child is anxious about brushing his/her teeth; My child is resistant to brushing his/her teeth; My child appears distressed by the sensory experience of tooth brushing (i.e. complains of the toothbrush in his/her mouth, complains about the sensation of tooth paste) rated on a scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Procedure

The study used a cross-sectional design and was conducted between March and July 2018. Parents were recruited via a number of methods. Firstly, study information was disseminated via Facebook and online web forums for parents. We also approached childcare services via email, asking them to share information about the study with the parents accessing their service. Finally, paediatric dentists were approached via email and encouraged to share information about the project with their networks. Participants completed the 20-30 minute survey online, and were then given the opportunity to provide contact details to go into a draw to win a $50 gift card.

Statistical Analyses

Two hierarchical multiple regressions were conducted to investigate the predictors of child toothbrushing frequency (henceforth referred to as “frequency”; including tooth or gum wiping for infants) and parental perceived difficulty with implementing twice-daily toothbrushing with their child (henceforth referred to as “difficulty”). The regression models each involved 16 predictor variables entered in steps. Step 1 included demographic variables (parent age, child age and child gender) and Step 2 involved family variables (CHAOS Total Score, morning and evening routine). Step 3 included child variables (resistance, anxiety, sensory distress and CAPES Intensity) and Step 4 comprised parent variables (Parenting

Scale Total Score, parental oral health self-efficacy, parental oral health LOC, parental confidence, parental oral health knowledge, and DASS Stress). Data were analysed using SPSS version 25. Statistical significance was set at $p < .05$.

Results

Of 277 respondents, 29 were excluded due to greater than 50% of the survey being incomplete, and a further nine respondents were excluded due to ineligibility, leaving a final sample of 239. The proportion of missing values ranged from 0% to 34.2% and was accounted for using pairwise deletion. Most parents reported once-daily (47.3%) or twice-daily (45.6%) toothbrushing for their child, while 7.1% reported that their child does not brush every day. Most (53%) parents reported regular toothbrushing with their child to be either somewhat or extremely difficult. Spearman's rank order correlation coefficient (ρ) was used to identify significant relationships between the variables (see Table 1).

Predictors of toothbrushing frequency. Hierarchical multiple regression assessed the predictors of child toothbrushing frequency (see Table 2). Demographic variables added at Step 1 significantly contributed to the prediction of frequency, $F(3,126)=3.42$, $p=.02$, accounting for 8% of the variance. Addition of family variables at Step 2 significantly contributed to prediction, $F_{change}(3,123)=40.24$, $p<.001$, with the model explaining 53% of the total variance, $F(6,123)=23.43$, $p<.001$. Addition of child variables at Step 3 did not make a significant contribution to prediction of frequency, $F_{change}(4,119)=1.73$, $p=.15$, with the model explaining 56% of the total variance $F(10,119)=15.09$, $p<.001$. Addition of parent variables in the final block at Step 4 significantly contributed to prediction of frequency, $F_{change}(6,113)=4.51$, $p<.001$. The total variance explained by the final model was 64%, $F(16,113)=12.79$, $p<.001$.

Child age made a statistically significant unique contribution to the model at Step 1, however this effect was no longer present following the addition of family variables in Step 2. Morning routine made the largest unique contribution to the model, followed by knowledge and evening routine respectively.

Predictors of toothbrushing difficulty. Hierarchical multiple regression assessed the predictors of child toothbrushing difficulty (see Table 3). Demographic variables added at Step 1 significantly contributed to prediction of difficulty, $F(3,126)=3.57$, $p=.02$, accounting for 8% of the total variance. Addition of family variables at Step 2 contributed an additional 9% of variance, $F_{change}(3,123)=4.20$, $p=.01$, and 17% in total, $F(6,123)=4.03$, $p<.001$. Child variables added at Step 3 significantly contributed to the prediction of difficulty, explaining

an additional 44% of variance, $F_{change}(4,119)=33.66$, $p<.001$, and 61% in total, $F(10,119)=18.45$, $p<.001$. Addition of parent variables at Step 4 did not make a significant contribution to the prediction of difficulty, $F_{change}(6,113)=.90$, $p=.50$. The total variance explained by the final model was 63%, $F(16,113)=11.81$, $p<.001$. Child age made a statistically significant unique contribution to the model at Steps 1 and 2, however this effect was no longer present following the addition of child variables at Step 3. The CHAOS variable made a unique contribution to the model at Steps 2, 3 and 4. Resistance made the strongest unique contribution to the model at Steps 3 and 4.

Post-hoc analyses. Post-hoc analyses were conducted to further explore the results (see Table 4). Given the contribution of parents' knowledge scores to the models, individual items on the oral health knowledge scale were considered. The items that were most strongly correlated with toothbrushing frequency were those relating to when toothbrushing should be first initiated with young children: *"Children don't need to brush every* day until they get *their permanent teeth"*, $\rho=.49$, n=210, $p<.001$, and *"Children don't really need their own* toothbrush until all their teeth *come in"*, $\rho=.41$, n=210, $p<.001$.

Discussion

This is one of the first studies to examine predictors of frequency and perceived difficulty of toothbrushing with parents of young children. Most parents reported that their children do not brush their teeth twice daily, and over half reported that they find regular toothbrushing difficult to implement. These findings are consistent with Rhodes [5], and highlight the need to support families to facilitate regular implementation of this important health behaviour.

As predicted, parent factors were most important for the frequency of brushing for young children. Inconsistent with expectations, however, parenting skill and self-efficacy did not make unique contributions, whereas oral health knowledge and routine made the most significant contributions to the model. The link between routine and frequency of oral health behaviour is well acknowledged [7,9]; while routine is also important to household functioning, which is itself important for the development of health behaviours for children [8]. Importantly, parents appear to be most challenged by developing a morning toothbrushing routine. This is consistent with previous research by Huebner and Riedy [16], which identified that parents reported lack of time in the morning as an external constraint to regular toothbrushing.

Given our sample was highly educated we expected that oral health knowledge would play a minor role [12]. One possible explanation for our results involves a lack of knowledge about the appropriate age of toothbrushing onset. The two items on the knowledge scale that

correlated most strongly with frequency focused on the appropriate time for children's toothbrushing to commence. Moreover, greater levels of parental oral health knowledge were associated with earlier onset of toothbrushing, and a younger age of onset was associated with greater frequency. This suggests that parents' knowledge regarding when toothbrushing should be initiated impacts on age at commencement, which appears to then be important to frequency [18,10]. We also found that more effective parenting was associated with use of routine and better oral health knowledge. These findings suggest that parenting strategies may play an important role for toothbrushing through their relationship with knowledge and the development of routine.

When considering factors that had a direct effect on parents' perceived difficulty with implementing regular toothbrushing, parenting factors did not show a significant direct effect. Rather, child factors – specifically, resistant child behaviour - made the most important contribution to the model, explaining more unique variance than all of the other variables combined. This is consistent with Duijster et al. [15], but in contrast to findings by Huebner and Riedy [16] , who found that parents' reactions to, and ability to manage resistant child behaviour were more important for toothbrushing challenges than the child's behaviour itself. Importantly, our findings suggest that difficult child behaviour specific to toothbrushing itself, rather than generalised behavioural difficulties, were most important to perceived difficulty. The current findings indicate that parents' perceptions of how difficult or challenging a task is, is highly contingent on observable child reactions to the task, and further research is required to better explain the factors that precipitate and perpetuate resistant child behaviour.

Household functioning also made a unique, although smaller, contribution to the model predicting difficulty. Parents appear to find toothbrushing more difficult if they perceive greater dysfunction in the household. Inconsistent with our hypotheses, parenting behaviours were not identified as significant predictors of toothbrushing frequency, nor level of difficulty experienced by parents. This pattern of results might be explained by the fact that the Parenting Scale assesses the use of parenting strategies to manage generalised disruptive behaviour in children [28], however, our results suggest that the main problem is resistant behaviours specifically around toothbrushing. Although broader parenting practices have implications for routine and household organisation, general measures such as the Parenting Scale may be less sensitive to assessing parenting in the context of oral health care, and a context-specific measure may be more useful.

Self-efficacy was also not a significant contributor to the prediction of frequency or

difficulty. This might be attributed to an incongruence between a parent's confidence in their ability to carry out the health behaviour and their actual intention to do it. For example, Rhodes [5] found that, despite most parents feeling confident in their ability to implement regular toothbrushing, a large proportion of the sample did not report twice-daily brushing. This suggests that another process is at play, and further research is warranted.

The findings of this study have implications for public health and parenting intervention priorities. Given the number of children currently not meeting twice-daily toothbrushing recommendations, an intervention designed to support parents to increase toothbrushing frequency and reduce behaviour difficulties is warranted. Results support a holistic, sociobiological approach to toothbrushing [6], and further support the multidimensional role that child, parent and family factors play in toothbrushing behaviour for young children. A behavioural intervention with parents should combine education and skill-building to equip parents with strategies that facilitate the development of functional household organisation and routine, and increase knowledge about the importance of early onset of toothbrushing. The development of morning routines appears to be a priority. It also appears that resistant child behaviour can be toothbrushing-specific, and not necessarily representative of a generalised pattern of disruptive behaviour. As such, the intervention could be targeted towards most families with young children.

Findings should be considered in the context of several limitations. Firstly, the highly educated sample of predominantly mothers was not representative of the general population. The study design also does not allow for consideration of causality. Future research should explore the precipitants and perpetuating factors of resistant child behaviour to inform development of early-intervention strategies targeting toothbrushing. We did not explore variables beyond the family (e.g., neighbourhood context, availability of oral health education) nor family sociodemographic variables (due to limited variability) which may also affect child toothbrushing. We asked parents about toothbrushing frequency, however we did not assess toothbrushing effectiveness. Thus, we do not know how carefully or effectively parents brushed their child's teeth, which has implications for understanding oral health outcomes. Lastly, existing literature focuses on several different outcome variables, with few studies investigating toothbrushing frequency specifically. Oral health is contingent on toothbrushing, as well as factors such as sugar consumption and access to dental care. Therefore, although an important health behaviour worthy of discussion, toothbrushing is only one behaviour of many that are likely to impact children's oral health.

This study contributes to the existing body of literature focusing on oral health

behaviours with young children and provides quantitative support for the importance of child and parent factors for regular toothbrushing. The findings suggest a combination of parent-focused education and skill-building may be needed to facilitate earlier onset of toothbrushing, greater use of routine, and better household functioning, and reduce the impact of child resistance. An intervention that focuses on parent health behaviour education and skills might support parents to facilitate adaptive health behaviours in their young children.

Why this paper is important to paediatric dentists

- Parent's oral health knowledge and use of household routines were the most significant predictors of child toothbrushing frequency.
- Resistant child behaviour and household organisation were the most important predictors of perceived difficulty of regular toothbrushing.
- Strategies to improve the frequency of toothbrushing in young children should focus on helping parents understand the importance of starting early, and providing effective ways to develop household routines and ways to manage resistant child behaviour.
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Table 1. Relationship between outcome variables toothbrushing frequency and perceived difficulty of toothbrushing behaviour, and predictor variables as demonstrated by Spearman's rank order correlation coefficients (ρ)

Outcome variable		Parent age (years)	Child age (months)	Child gender[1]	Morning routine[2]	Evening routine[3]	CHAOS[4]	Knowledge[5]	LOC[6]
	Mean	35.41	34.75		3.36	4.36	3.22	27.68	23.17
	SD	5.35	12.59		1.61	1.15	2.85	2.81	5.67
	Min-Max	23-56	2-59		1-5	1-5	0-12	13-30	13-39
Toothbrushing frequency	Correlation Coefficient (ρ)	.07	.28**	.03	.71**	.37**	-.04	.40**	-.33**
	p	.30	<.001	.62	<.001	<.001	.56	<.001	<.001
	N	197	233	239	226	226	223	210	209
Difficulty	Correlation Coefficient (ρ)	.01	-.28**	-.04	-.25**	-.17*	.19*	-.21**	.27**
	p	.91	<.001	.53	<.001	.01	.01	.002	<.001
	N	186	221	226	226	226	223	210	209

Outcome variable		Confidence[7]	Self-efficacy[8]	Stress[9]	Parenting[10]	Resistance[11]	Anxiety[12]	Sensory distress[13]	CAPES intensity[14]
	Mean	3.38	27.07	13.53	85.69	2.75	1.76	1.96	22.84
	SD	.82	7.3	4.36	16.74	1.4	1.05	1.28	9.2
	Min-Max	1-4	9-36	7-28	39-129	1-5	1-5	1-5	5-52
Toothbrushing frequency	Correlation Coefficient (ρ)	.48**	.52**	-.13	-.17*	-.30**	-.20*	-.17*	-.20*
	p	<.001	<.001	.07	.02	<.001	.01	.02	.01
	N	209	208	209	194	207	205	203	158
Difficulty	Correlation Coefficient (ρ)	-.38**	-.41**	.14*	.02	.75**	.43**	.38**	.38**
	p	<.001	<.001	.04	.75	<.001	<.001	<.001	<.001

N	209	208	209	194	207	205	203	158

Note. **Value significant at p<.01, *Value significant at p<.05, [1]Child gender, 1=male, 2=female, [2, 3] 5-point Likert scale, higher scores indicate greater presence of routine, [4]CHAOS=Confusion, Hubbub And Order Scale, higher scores indicate greater chaotic and disorganised characteristics within the household. [5]Knowledge of Children's Oral Hygiene, 5-point Likert scale, higher scores indicate higher levels of knowledge, [6]Parental oral health locus of control, 5-point Likert scale, higher scores indicate greater external LOC, [7] 4-point Likert scale, higher scores indicate greater confidence, [8]Oral Health Self-Efficacy, higher scores indicate greater levels of self-efficacy, [9]Stress subscale of DASS21, higher scores indicate higher levels of stress, [10]The Parenting Scale, 7-point scale, higher scores indicate greater levels of dysfunctional discipline. [11] 5-point Likert scale, higher scores indicate greater resistance, [12] 5-point Likert scale, higher scores indicate greater levels of anxiety, [13] 5-point Likert scale, higher scores indicate greater levels of sensory distress, [14]CAPES = Child Adjustment and Parent Efficacy Scale, 4-point Likert scale, higher scores indicate greater adjustment issues.

Table 2. Summary of values for hierarchical regression analysis predicting toothbrushing frequency

				95% confidence interval for β				
	R	R^2	β	Lower bound	Upper bound	t	r	sr^2
Step 1	.28	.08						
Parent age			.04	-.13	.21	.46	.10	<.01
Child age			.27	.09	.44	3.01**	.27	.07
Child gender			-.02	-.19	.15	-.19	.02	<.01
Step 2	.73	.53						
Parent age			.05	-.08	.17	.73	.10	<.01
Child age			.09	-.04	.22	1.30	.27	.01
Child gender			-.02	-.14	.11	-.25	.02	<.01
CHAOS			-.02	-.15	.11	-.30	-.07	<.01
Morning routine			.61	.48	.74	9.42**	.67	.34
Evening routine			.28	.16	.40	4.45**	.35	.08
Step 3	.75	.56						
Parent age			.07	-.06	.19	1.01	.10	<.01
Child age			.06	-.07	.19	.88	.27	<.01
Child gender			-.04	-.16	.09	-.57	.02	<.01
CHAOS			.04	-.10	.18	.53	-.07	<.01
Morning routine			.59	.46	.71	9.04**	.67	<.01
Evening routine			.27	.15	.40	4.26**	.35	<.01
Resistance			-.10	-.25	.05	-1.25	-.31	<.01
Anxiety			.04	-.11	.19	.56	-.17	<.01
Sensory distress			-.07	-.22	.08	-.96	-.16	.14
CAPES intensity			-.10	-.24	.04	-1.38	-.19	.13
Step 4	.80	.64						
Parent age			.04	-.08	.16	.72	.10	<.01
Child age			.04	-.08	.16	.63	.27	<.01
Child gender			-.02	-.14	.09	-.36	.02	<.01
CHAOS			.10	-.04	.23	1.36	-.07	.01
Morning routine			.48	.35	.60	7.29**	.67	.17
Evening routine			.17	.05	.29	2.73**	.35	.02
Resistance			-.06	-.20	.08	-.85	-.31	<.01
Anxiety			.07	-.08	.21	.89	-.17	<.01
Sensory distress			-.04	-.18	.10	-.58	-.16	<.01
CAPES intensity			-.06	-.20	.08	-.81	-.19	.01
Parenting Scale			-.05	-.18	.08	-.71	-.21	<.01
Self-efficacy			.15	-.03	.33	1.64	.57	.02
LOC			.08	-.00	.22	1.12	-.31	.01
Confidence			.12	-.05	.30	1.40	.56	.02
Knowledge			.21	.07	.35	2.92**	.45	.07
Stress			.03	-.10	.16	.44	-.11	<.01

Note. **Value significant at p<.01, *Value significant at p<.05, CHAOS = Confusion, Hubbub and Order Scale, LOC = Locus of Control, CAPES = Child Adjustment and Parent Efficacy Scale.

Table 3. Summary of values from hierarchical regression analysis predicting difficulty of toothbrushing behaviour

				95% confidence interval for β				
	R	R^2	β	Lower bound	Upper bound	t	r	sr^2
Step 1	.28	.08						
Parent age			.11	-.07	.28	1.20	.04	.01
Child age			-.28	-.45	-.11	-3.17**	-.26	.07
Child gender			-.03	-.20	.14	-.32	-.05	<.01
Step 2	.41	.16						
Parent age			.06	-.11	.23	.70	.04	<.01
Child age			-.24	-.42	-.07	-2.76**	-.26	.05
Child gender			-.00	-.17	.16	-.04	-.05	<.01
CHAOS			.21	.04	.38	2.38*	.21	.04
Morning routine			-.17	-.34	.00	-1.92	-.25	.03
Evening routine			-.09	-.25	.08	-1.03	-.14	.01
Step 3	.78	.61						
Parent age			-.03	-.15	.09	-.52	.04	<.01
Child age			-.12	-.25	.00	-1.94	-.26	.01
Child gender			.06	-.06	.18	1.03	-.05	<.01
CHAOS			.14	.00	.27	1.99*	.21	.01
Morning routine			-.06	-.18	.06	-.95	-.25	<.01
Evening routine			.01	-.10	.13	.24	-.14	<.01
Resistance			.63	.49	.77	8.71**	.74	.25
Anxiety			.07	-.07	.21	.94	.42	<.01
Sensory distress			.03	-.11	.17	.46	.38	<.01
CAPES intensity			.09	-.04	.23	1.40	.37	.01
Step 4	.79	.63						
Parent age			-.04	-.16	.08	-.62	.04	<.01
Child age			-.10	-.23	.03	-1.52	-.26	.01
Child gender			.05	-.07	.16	.74	-.05	<.01
CHAOS			.16	.02	.30	2.21*	.21	.02
Morning routine			-.03	-.16	.10	-.47	-.25	<.01
Evening routine			.02	-.10	.15	.35	-.14	<.01
Resistance			.60	.45	.75	8.06**	.74	.22
Anxiety			.07	-.07	.22	.97	.42	<.01
Sensory distress			.02	-.12	.16	.24	.38	<.01
CAPES intensity			.13	-.02	.27	1.66	.37	.01
Parenting scale			-.08	-.21	.06	-1.14	.06	<.01
Self-efficacy			-.14	-.33	.04	-1.50	-.41	.01
LOC			.07	-.08	.21	.93	.29	<.01
Confidence			.04	-.14	.21	.39	-.39	<.01
Knowledge			.04	-.11	.19	.53	-.20	<.01
Stress			-.10	-.23	.04	-1.40	.14	.01

Note. **Value significant at p<.01, *Value significant at p<.05, CHAOS = Confusion, Hubbub and Order Scale, LOC = Locus of Control, CAPES = Child Adjustment and Parent Efficacy Scale.

Table 4. Summary of post-hoc analyses

Post-hoc variable		Toothbrushing frequency	Knowledge[1]	Resistance[2]	CHAOS[3]	Morning routine[4]	Evening routine[5]
Age of brushing onset (months)	Correlation Coefficient (ρ)	-.18*	-.23**	-.05	.08	-.07	-.20**
	p	.01	<.001	.46	.26	.34	.003
	N	220	204	201	217	220	220
Parenting[6]	Correlation Coefficient (ρ)	-.17*	-.15*	-.01	.29**	-.14*	-.15*
	p	.02	.04	.86	<.001	.050	.04
	N	194	194	194	193	194	194
Resistance[2]	Correlation Coefficient (ρ)	-.30**	-.15*		.10	-.21**	-.17*
	p	<.001	.03		.17	.003	.02
	N	207	207		206	207	201

Note. **Value significant at p<.01, *Value significant at p<.05, [1]Knowledge of Children's Oral Hygiene, 5-point Likert scale, higher scores indicate higher levels of knowledge, [2] 5-point Likert scale, higher scores indicate greater resistance, [3]CHAOS=Confusion, Hubbub And Order Scale, higher scores indicate greater chaotic and disorganised characteristics within the household, [4,5] 5-point Likert scale, higher scores indicate greater presence of routine, [6]The Parenting Scale, 7-point scale, higher scores indicate greater levels of dysfunctional discipline.