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Mokopuna Māori me oranga niho (Māori infants and oral health) an early childhood caries randomised control trial among New Zealand Māori children.

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Abstract

Background and objectives: New Zealand Māori do not enjoy the same oral health status as non-Māori people across all age groups. The aim of this study was to determine whether the implementation of a culturally-appropriate Early Childhood Caries intervention reduced dental disease burden and oral health inequalities among Māori children.

Methods: This was a randomised intervention using a delayed intervention comparison design. The interventions comprised dental treatment for the mothers, topical fluoride application to the child, and motivational interviewing together with anticipatory guidance. Dental examinations of the children were conducted at age 24 months and 36 months.

Results: A total of 259 pregnant Māori women were recruited into the study with 133 women randomly assigned to the intervention group and 126 assigned to the delayed intervention group. There were 137 children examined at both 2 and 3 years of age. The mean number of decayed teeth at age 2 years was 0.1 for both groups; the mean at age 3 years was 0.2 for the intervention group and 0.7 (sd) for the delayed intervention group. There were no statistically significant differences between the two groups. What was significant was that not one child in either group had a tooth extracted.

Conclusion: Overall, the oral health outcome of this intervention study suggests that the timing of such oral health interventions does not matter. What was important was the cultural connectedness of the research participants to Māori health services.

Introduction

Māori are the Indigenous people of Aotearoa/New Zealand who arrived in great *waka* or canoe from the far distant Hawaiki over a 500-year migration period, from the early moa hunters of circa 800AD to circa 1300AD. Māori established their way of life and social system based on *whānau* (family), *hapū* (subtribe) and *iwi* (tribe) which traced their *whakapapa* (descent lines) back to the original *waka*. (Buck 1949).

In 1769 Captain Cook claimed the new found country for Britain. Cook was followed by other explorers from Europe who noted that “the New Zealanders have ... an ordinary sized mouth and strong white teeth.” (Salmond 1991). In 1840 the relationship between Māori and the colonists was formalised in the Treaty of Waitangi which

was an agreement signed between Rangatira Māori (Māori chiefs) on behalf of their *hapū* and *iwi* and Queen Victoria of England. An account from this time (Maning 1930) noted the introduction of sugar to Māori:

The next thing we heard was that the Governor was travelling all over the country with a large piece of paper, asking all the chiefs to write their names or else make marks on it. We heard, also, that the Ngapuhi Chiefs, who had made marks or written on that paper, had been given tobacco, and flour, and sugar, and many other things for having done so.

Maning (1863) observed the decline in the oral health of the New Zealand population, both Māori and European:

When we first became acquainted with the New Zealanders they had no such thing as decayed teeth or toothache. The oldest people retained their teeth to the last, worn down to the very gums. But when they became accustomed to sugar and consumed it in large quantities and drank hot tea, they soon had decayed teeth and toothache equally with their European neighbours. The teeth of colonial children are invariably bad from excess of sweets.

Gluckman (1976) noted that “the dental health of Māori rapidly declined after European contact.” He stated that by 1880 dental decay was so widespread that it “was almost universal in the Māori.”

If we come forward some 140 years, what has changed in all that time? The unfortunate reality is that today, Māori do not enjoy the same oral health level across all age groups as the majority New Zealand European population. Although Māori were guaranteed the rights and duties of citizenship as the people of England under Article 3 of the Te Tiriti O Waitangi as espoused in the Māori version, history has shown that this was not always the case. The health of Māori has suffered due to in part, the impact of colonisation. This study is a concerted attempt to contribute to the improvement of the oral health of Māori.

A number of studies over recent decades have highlighted the oral health disparities between Māori and non-Māori children. Thomson (1993) reported that 5-year-old Māori children in the Manawatū-Wanganui Area Health Board were three times more likely than non-Māori children to have high experience of dental caries. In December 2000, National Radio broadcast an “Insight Documentary” entitled ‘An epidemic of dental decay in



Northland'. The mean dmft for non-Māori children was reported as 1.99, but for Māori it was 4.22. The dental surgeon at Whangarei Hospital stated: 'I have seen children as young as 10 months that have needed to have all their teeth out.' (National Radio (2000). Koopu (2005) concluded that 'for a cohort of New Zealanders followed over their life course, the oral health features of caries prevalence, caries severity and periodontal disease prevalence are higher among Māori than non-Māori.' The unfortunate reality is that such Māori child oral health disparities still persist. The Cure Kids report, *State of Child Health in Aotearoa New Zealand* (2020) highlighted the inequalities in oral health for children in Aotearoa. In 2018 Māori children had double the average number of decayed, missing and filled teeth (mean dmft or DMFT) than non-Māori and non-Pasifika children: 41% of Māori 5-year-old children were caries free compared to 69% of other children, 56% of Māori Year-8-children were caries free compared to 71% of other children; the dmft for Māori 5-year-old children was 2.9 but 1.3 for other children; and the DMFT for Māori Year-8-children was 1.1 but 0.6 for other children.

The aim of this study was to determine whether the implementation of a culturally-appropriate early childhood caries (ECC) intervention reduced dental disease burden and oral health inequalities among Māori children living within the tribal area of Waikato-Tainui. Such an intervention involved upholding certain cultural aspects of *Te Ao Māori*, (the Māori world) which included *te reo* Māori (Māori language), and *tikanga Māori* (Māori custom) such as *manaakitanga* (hospitality), *whakawhanauangatanga* (Māori relationships and interaction), and *utu* (reciprocity). A tailored approach was utilised including anticipatory guidance and motivational interviewing. Anticipatory guidance (Nowak 1995) is a pro-active, developmentally-based counselling technique that focuses on the needs of a child at a particular stage of life; in this study at 3-years of age. Motivational interviewing (Harrison et.al. 2007), on the other hand, focuses on strategies to move carers from inaction to action, with many possible paths to a solution provided. The range of contexts included oral health knowledge, oral self-care, dental service utilisation, oral health-related self-efficacy and oral health literacy.

The hypothesis was that exposure to a culturally-appropriate ECC intervention will reduce dental disease burden and improve the oral health status of Māori children living within the tribal area of Waikato-Tainui. The mothers and their babies recruited into this study were randomly assigned into two groups for comparison, an intervention group and a delayed intervention group. This paper reports on the oral health outcome of the infants at age 36 months.

Methods

The study was a randomised control trial of Māori mothers and their infant children, with the primary outcome being dental caries experience (including both cavitated and pre-cavitated lesions) in the children at 24 and 36 months of age. Two hundred pregnant Māori women who lived within the tribal area of Waikato-Tainui

in the central North Island were recruited through the 10 primary health care clinics operated by Raukura Hauora O Tainui. Once the mother had agreed to participate in the study they were randomly allocated to either the intervention group or the delayed intervention group by choosing an envelope which contained the name of the group. The full study design was outlined by Broughton et.al. (2013). In this study the four interventions were: dental care provided to mother during her pregnancy; topical fluoride application to the child which was undertaken by a dental therapist who worked for the local Community Oral Health Service; and anticipatory guidance and motivational interviewing. Both the intervention group and delayed intervention group received all four interventions. The four interventions have been shown to be effective independently (Nowak and Casamissimo, 1995; Li et al, 2005; Weintraub et al., 2006; Harrison et al. 2007).

The Māori researcher who conducted the anticipatory guidance and motivational interviewing received training through the Waikato Tainui College for Research and Development by a motivational expert who came from the United States to specifically undertake this training. The three motivational interviewing and anticipatory guidance themes were developed by health promotion and oral health experts and were: firstly, oral health knowledge, which encompasses teeth eruption and teething, reasons for childhood dental diseases, ways childhood dental disease can be prevented, foods and beverages harmful for oral tissues, behaviours harmful for the oral tissues, and the oral health and general health relationship; secondly, oral self-care, which encompasses ways to look after children's teeth, use of toothbrush, toothpaste and disclosing solution, and use of oral health services; and thirdly, oral health protection and community water fluoridation. The infants in the delayed intervention group received these interventions after 24 months of age. This study was conducted by Māori, with Māori and as such a *kaupapa Māori* (Māori philosophical approach) was utilised (Broughton et.al. 2016).

Data were collected through maternal self-report questionnaires at baseline, (Broughton et.al. 2014) and at the 24-month and 36-month follow-ups through both (a) clinical examination of the child and (b) maternal self-report. The questionnaires were administered by one of two Māori project officers who had each been trained in the appropriate *tikanga* (procedure) for introducing and administering the questionnaire such as the use of *te reo Māori* (Māori language), *whakawhanaungatanga* (acknowledging that other *whānau* members may be present), the presentation of a *koha* (gift) of appreciation, and *awhi* (offering assistance for any other health related concerns the *whānau* may have). The maternal self-report questionnaires were undertaken to gain a deeper insight into the oral health literacy, oral health behaviours and oral health expectations for not just the infant but also for the whole *whānau*. This served to inform the final development of the motivational interviewing and anticipatory guidance sessions to enhance the importance of *oranga niho* (oral health). Standardised examinations were conducted at child age

24 months and again at age 36 months. Examinations were conducted by calibrated dental therapists and followed a standardised protocol to record dental disease experience. The therapist did not know which intervention group the child had been allocated to. Procedures appropriate for young children were used (such as children being examined in the 'knee-to-knee' position on their mother's lap), and a fibre-optic head light used. Before the examination, teeth were dried with cotton pads. Standard cross-infection control procedures were followed. Carious lesions were diagnosed as cavitated if a loss of continuity of the enamel was detected. In addition, tooth loss and dmft/s indices were computed from the tooth- and surface-level recorded observations. Diagnosis was based on visual criteria only as these examinations were carried out in the whānau home. Dental caries data were collected at surface level on both pre-cavitated (that is, an area of demineralisation without loss of surface continuity) and cavitated (a visible break in the enamel surface caused by dental caries) lesions.

Data were also collected (Broughton et al. 2014) on socio-demographic characteristics (maternal age, education, income and means-tested Community Services Card status), health status and dental behaviours (usual reason for visiting a dentist, maternal tooth brushing behaviour, self-rated oral health and self-rated general health) and psychosocial factors (perceived stress, sense of control, social support, subjective social standing, fatalism and self-efficacy).

Statistical analyses

Dental caries increment between ages 24 months and 36 months was determined by comparing the caries status of each surface at baseline and follow-up (using the "do repeat" procedure in SPSS, version 24), counting

the number of surfaces which changed status and then adjusting for any reversals, so that the net caries increment was determined. Incident cases of caries were identified as those with one or more surfaces which were sound at 24 months but carious at 36 months (that is, those with an increment of one or more). Following the computation of descriptive statistics, differences between the intervention and delayed-intervention groups were tested for statistical significance using Chi-square tests for proportions and analysis of variance or Mann-Whitney U-tests (as appropriate) for continuous variables. Effect sizes were computed in order to determine the magnitude and statistical significance of the observed differences.

Ethics approval

Ethics approval was obtained from the Northern Y Regional Ethics Committee in September 2010, reference NTY/10/06/051).

Results

Study participation data are presented in Table 1. Most of the 259 recruited to the study and allocated to either the intervention group or the delayed intervention group then completed the baseline questionnaire. The intervention group received all four interventions before the infant was 24 months of age while the delayed intervention group undertook these sessions after the infant was 24 months old.

At the follow-up when the child was 24 months old, under half of the mothers in the intervention group were assessed and over half of these two-year-old children were dentally examined. When the child was 36 months old, participation rates were higher, but only about one third of the original cohort had complete data for all three assessment stages. Comparison of the baseline

Table 1. Numbers assessed at each stage, by group (brackets contain row percentages unless otherwise indicated)

Stage of study	Intervention group		Both combined ^a
	Delayed	Not delayed	
Baseline			
Recruited	126 (48.6)	133 (51.4)	259 (100.0)
Completed questionnaire	121 (48.4)	129 (51.6)	250 (96.5)
Follow-up at age 24 months			
Completed questionnaire	63 (51.6)	59 (48.4)	122 (47.1)
Child dentally examined	71 (49.0)	74 (51.0)	145 (56.0)
Exam and questionnaire	56 (51.9)	52 (48.1)	108 (41.7)
Follow-up at age 36 months			
Completed questionnaire	66 (46.8)	75 (53.2)	141 (54.4)
Child dentally examined	81 (47.9)	88 (52.1)	169 (65.3)
Exam and questionnaire	65 (48.5)	69 (51.5)	134 (51.7)
At all 3 stages			
Completed 3 questionnaires	46 (50.5)	45 (49.5)	91 (35.1)
Child dentally examined twice	66 (48.2)	71 (51.8)	137 (52.9)
Complete data	44 (51.2)	42 (48.8)	86 (33.2)

^a Column percent



Table 2. Comparison of baseline characteristics of those included and not included in the longitudinal analyses (brackets contain column percentages unless otherwise indicated)

	Complete longitudinal data?			
	No		Yes	
Number	173	(66.8)	86	(33.2)
In the delayed group	82	(47.4)	44	(51.2)
Mean maternal age (sd) ^a	26.2	(6.2)	28.1	(7.2) ^e
Expecting first child ^b	97	(60.2)	59	(68.6)
Mean number of weeks pregnant (sd)	25.5	(9.1)	25.6	(9.1)
Excellent/very good self-rated oral health	18	(10.9)	13	(15.3)
Excellent/very good self-rated general health	56	(33.9)	41	(48.2) ^e
Edentulous	4	(2.4)	3	(3.5)
Usually visit for check-ups ^c	61	(37.7)	31	(38.3)
Has a Community Services Card ^d	110	(68.8)	54	(62.8)
Education level ^d				
High school or below	76	(47.2)	26	(30.6) ^e
Trade/vocational	54	(33.5)	35	(41.2)
University	31	(19.3)	24	(28.2)
Mean psychological and social scale scores (sd)				
Perceived stress	27.7	(6.6)	26.3	(6.1)
Control	46.2	(7.2)	46.7	(7.7)
Social support	13.6	(2.6)	13.8	(2.2)
Self-efficacy	7.9	(7.0)	6.4	(7.0)
Oral-health-related fatalism	3.6	(2.9)	3.9	(2.8)

^a 1 missing response ^b 4 missing responses ^c 8 missing responses ^d 13 missing responses ^e P<0.05

Table 3. Mothers' baseline characteristics, by group (brackets contain row percentages unless otherwise indicated)

	Intervention group			
	Delayed		Not delayed	
Number	121		129	
Mean age (sd) ^a	27.1	(6.1)	26.6	(7.0)
Expecting first child ^b	39	(32.8)	52	(40.6)
Mean number of weeks pregnant (sd)	24.9	(8.6)	26.2	(9.6)
Excellent/very good self-rated oral health	19	(15.7)	12	(9.4)
Excellent/very good self-rated general health	41	(33.9)	56	(43.8)
Edentulous	2	(1.7)	5	(3.9)
Usually visit for check-ups ^c	46	(39.0)	46	(37.1)
Has a Community Services Card ^d	83	(69.2)	81	(64.3)
Education level ^d				
High school or below	49	(41.2)	53	(41.7)
Trade/vocational	42	(35.3)	47	(37.0)
University	28	(23.5)	27	(21.3)
Mean psychological and social scale scores (sd)				
Perceived stress	27.8	(7.0)	26.6	(6.0)
Control	46.1	(7.8)	46.5	(7.0)
Social support	13.6	(2.5)	13.7	(2.4)
Self-efficacy	7.4	(7.1)	7.3	(6.9)
Oral-health-related fatalism	3.8	(2.8)	3.7	(2.9)

^a 1 missing response ^b 4 missing responses ^c 8 missing responses ^d 13 missing responses

characteristics of those with complete data and the others (Table 2) showed that there were few systematic differences between the two groups. The former were older (on average), and had better self-rated general health, and were better educated; otherwise, there were no differences.

Comparison of the baseline characteristics of the mothers (Table 3) showed no important differences by intervention group. About one third were expecting their first child, and the baseline assessment was conducted (on average) at about 25 weeks of gestation. Only a minority in each group reported excellent or very good self-rated oral health, but that proportion was higher for general health. Almost all were dentate, but fewer than half usually visited for dental check-ups. About one-quarter had been educated to tertiary level, and the two groups did not differ in this respect. There was an expectation that tertiary education of the mothers,

(regardless of which group they were assigned to) may have had an impact on the outcome but there was no significant difference between the two groups in this respect. Mean psychological and social scale scores were very similar in the two groups.

Summary data on dental caries experience among the children at 24 and 36 months of age are presented in Table 4. At 24 months of age, only a small minority of the children had visible signs of dental caries experience: the mean dt for both the Intervention Group and the Delayed Intervention Group was 0.1. Almost all of that disease experience was apparent as decayed or demineralised surfaces rather than filled ones, although two children in the delayed intervention group each had a single filled surface. By 36 months of age, the proportion with caries experience had increased to about one-third of each group, with greater restorative experience apparent, particularly in the Intervention group. There were two

Table 4. Summary data on child dental caries experience among those examined at both 24 and 36 months of age, by group (brackets contain standard deviation unless otherwise indicated)

	Intervention group		Effect size ^a (and 95% CI)
	Delayed	Not delayed	
At 24 months of age			
Number	66	71	
% with 1+ dmfs	9.1	5.6	1.61 (0.46, 5.72)
% with 1+ ds	7.6	5.6	1.34 (0.36, 5.01)
% with 1+ white spot lesions	1.5	1.5	1.08 (0.07, 17.20)
Mean dt (sd)	0.1 (0.4)	0.1 (0.3)	0.96 (0.50, 1.85)
Mean dmfs (sd)	0.3 (0.9)	0.3 (1.3)	0.97 (0.51, 1.83)
At 36 months of age			
Number	66	71	
% with 1+ dmfs	31.8	36.6	0.87 (0.49, 1.54)
% with 1+ ds	31.8	36.6	0.87 (0.49, 1.54)
% with 1+ ms	0.0	0.0	—
% with 1+ fs	1.5	4.2	0.36 (0.04, 3.44)
% with 1+ white spot lesions	13.6	9.9	1.38 (0.52, 3.71)
Mean no of white spot lesions (sd)	0.6 (1.7)	0.2 (0.5)	3.72 (1.90, 7.27)
% with 1+ arrested lesions	4.5	4.2	1.08 (0.22, 5.33)
Mean no of arrested lesions (sd)	0.1 (0.7)	0.1 (0.5)	1.61 (0.57, 4.53)
Mean dt (sd)	0.7 (1.7)	0.2 (0.6)	3.64 (1.96, 6.76)
Mean fs (sd)	0.2 (0.9)	0.4 (2.7)	0.31 (0.10, 0.93)
Mean dmfs (sd)	1.7 (3.1)	2.3 (5.2)	0.73 (0.58, 0.93)
Longitudinal changes from 24 to 36 months of age			
Cavitated lesions only			
% with 1+ dmfs increment	24.2	31.0	0.78 (0.41, 1.49)
Net dmfs increment	0.7 (1.5)	1.6 (4.1)	0.42 (0.30, 0.60)
Non-cavitated lesions included			
% with 1+ dmfs increment	30.3	35.2	0.65 (0.49, 0.88)
Net dmfs increment	1.1 (2.1)	1.7 (4.0)	0.86 (0.49, 1.55)

^a Relative risk for binary variables, computed in Stata using glm with a modified Poisson approach; incidence risk ratio for continuous variables, computed in Stata using Poisson regression; reference category in all cases is the *Not delayed* group



notable differences between the two groups: the mean number of white spot lesions was higher in the delayed group, and the mean number of decayed teeth was also higher in that group (the effect sizes and confidence intervals showed those differences to be statistically significant). No child in either group had yet had a tooth extracted. The longitudinal caries data show that about one-quarter of the delayed group and one-third of the not delayed group were incident cases of caries over the one-year observation period. Including non-cavitated lesions as well increased the proportion of incident cases to over 30% in each group (as well as slightly increasing the net caries increment), and the caries increment was higher in the Intervention group.

Discussion

This interventional study compared the dental caries outcomes of Māori infants up to 3-years of age whose mothers had or had not had the motivational interviewing sessions. At 36 months of age, not one child in this study in either the intervention group or the delayed intervention group had yet had a tooth extracted nor had been admitted to hospital for any dental care or treatment. This is quite remarkable as data obtained from the Waikato District Health Board on Preventable Hospital Admissions for 2007 indicated that 12.8 percent of admissions for children aged 0–4 years were for a dental reason (which was the second highest cause), while 30.8 percent of admissions for children aged 5–14 years were for dental problems (the highest cause for this age group)¹.

A weakness of the study was the retention of participants in all aspects of the study over its 3 years. Of the 259 mothers recruited to the study, half were assessed and half of the two-year-old children in both the intervention group and the delayed intervention groups were dentally examined at 24 months. When the child was 36 months old, participation rates were higher, but only about one third of the original cohort had complete data for all three assessment stages. The Māori project officers who engaged with the mothers and their *whānau* went to great lengths to maintain contact with them. However, many of the participants moved from their residential homes out of the area including a number who emigrated to Australia. Other participants chose to exit the study because of a change in their economic circumstances such that participating in the study was then a low priority for them. The project officers reported that not one of the children who exited from the study had done so because of poor or deteriorating oral health. The study data show that, while there were minor differences between the two groups at baseline which are unlikely to have been important (Table 3), there

were some important differences between those who completed the study and those who did not (Table 4), with the latter being younger and less well-educated and having poorer general health. Nevertheless, the mothers and their infants who completed the study comprised a sufficient number to enable satisfactory analyses, albeit with some adverse effects on the power to detect meaningful differences at follow-up.

There are a number of possible explanations for the lack of a more marked difference in caries outcomes between the intervention group and the delayed intervention group. The first might be that motivational interviewing does not work as a means to improve oral health; the second might be that motivational interviewing is indeed effective but the actual timing of the intervention is of no consequence; and the third is the Hawthorne effect, which refers to the tendency of some people to work harder and perform better when they are being observed as research participants. The clinical interventions of dental care for the mother at the outset of their participation in the study and the application of topical fluoride to the teeth of the infant children would have contributed to the outcome of this study. However, from a Māori perspective, the important factor is the Māori concept of *whakawhanaungatanga* or relationships between the participants in the study. These relationships include both biological relationships and social relationships. This interaction between members of the two groups may be the most likely explanation for the study outcome. There was an expectation that the participants in the intervention group may have fared better than the participants in the delayed intervention group in respect of the oral health outcomes for their child, and this was indeed apparent by age 36 months, although the differences were relatively minor and not consistent.

The study was conducted within the *rohe* (tribal area) of Waikato-Tainui. As such many of the mothers participating in the study were known to have been related as sisters or cousins, *whāngai* (adopted *whānau* member) or related through intermarriage. In contemporary Māori society being part of an extended *whānau* is the norm. The research interviewers reported that within this environment, there were conversations among the participants about their involvement in the study, regardless of which group they were assigned to. In Māori terms this is referred colloquially as the “*kūmara vine*” which is concerned with the distribution of information and experiences on a particular subject throughout a community of families. This scenario would have had a major effect. One participant in the study commented on the closeness of the extended *whānau* that surrounded the infant that are all part of the “*kūmara vine*”:

Whānau are everywhere. There is lots of whānau. Our baby, she's lucky to have all her brothers, sisters, cousins, aunties and uncles around her.

1 Waikato District Health Board, Preventable Hospital Admissions for 2007. Personal communication, Mr. Wayne McLean Board member of the Waikato District Health Board.

An important aspect of this study was the Māori researchers who interacted with the *whānau* of the participants in this study. They were well known and highly respected within the communities in which they served and acted as a link between the *whānau* and the local Māori health services. The *whānau* members did not hesitate in their interactions with the researchers if they felt they required information, advice and guidance on any other health concerns they may have had.

The study highlighted the importance of oral health to all participants and their *whānau* and the *kōrero* (conversation) that would have ensued along the *kūmara* vine would have been concerned with the actual interventions that they had experienced. These included the dental care provided to the mother during her pregnancy; topical fluoride application to the child; anticipatory guidance; and motivational interviewing which covered 3 aspects of maintaining *oranga niho* (oral health): oral health behaviours, diet and oral health, and access to oral health services.

In addition, many of the mothers participating in the study interact socially through *kōhanga reo* (Māori language pre-schools), *marae* (Māori community facilities), *hui* (Māori community gatherings or meetings), *hahi* (the church) as well as Māori sports and Māori cultural clubs. As such the mothers and their immediate family are linked into and participate in a whole range of Māori community activities. Once again, the *kūmara* vine would have had a major effect. An example of the *kūmara* vine coming into play was when one mother commented on a particular community activity where the emphasis was on the health and well-being of their children:

*They have courses every Wednesday,
parenting courses...*

where they show us activities so we can help our kids.

*We can do things, even make snacks and
what are good snacks for baby.*

Within the *rohe* (tribal area) of Waikato-Tainui, most of the mothers participating in the study were recruited through the Māori health provider, Raukura Hauora O Tainui. If they were not an enrolled member of this service, they subsequently became clients of Raukura Hauora O Tainui. As clients of this Māori health provider, the mothers had access to a number of child health services which include outreach immunisation, rheumatic fever services, school-based services, Tamariki Ora (Well-Child Services), GP clinical services and community health workers. These services provide yet another avenue in which the *kūmara* vine comes very much into play.

A key factor in accounting for the outcome of this study was the cultural connection that the participants have in their daily lives. The cultural connection comes through three particular avenues: firstly, their association

as clients of the Māori health provider, Raukura Hauora O Tainui, and the subsequent services that entails; secondly, being part of a wide extended *whānau* and the interactions that occur; and thirdly, through the social interactions and participation in a whole range of Māori community-based organisations and associations. This cultural connectiveness is what forms the basis of being Māori and expressing cultural identity.

Conclusion

This study provided a focus for oral health for not just the infant and their mother but also for the whole *whānau* in which the participants live. This focus resulted in a reasonably good oral health outcome for the infants. Although a small minority of the children in both groups had visible signs of dental caries experience not one child had a tooth extracted within the study period. The two key factors that contributed to this research outcome were firstly, the oral health interventions; and secondly, and what is probably more significant was the Māori cultural connectiveness that the mother, their infant child and their *whānau* engage in with Te Ao Māori, the Māori world. This cultural connectiveness comes through the engagement with the Māori health provider, Raukura Hauora O Tainui as well as with a whole range of cultural, sporting and social activities. Having such an important cultural connection in their every day lives is a major factor in maintaining not only good oral health but overall health and well being for the whole *whānau* and especially the younger generation. As one participant stated:

*I encourage all my tamariki to have good teeth
because I have a lot of teeth problems
and I encourage them all to look after their teeth
so when they smile it's a beautiful smile.*

The Māori cultural principle of *whakawhanaungata* may account for why there was no difference between the two groups. The cultural connectedness of *whānau* within Te Ao Māori (the Māori world) is a protective factor in the overall health and well-being including oral health of Māori.

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