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Dental treatment needs of children in a rural subcounty of Uganda

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Summary. *Objectives.* To describe normative dental treatment needs of 5–7 and 12-year-olds in a rural sub county of Uganda and devise a strategy to improve oral health.
Design. Clinical survey.
Setting. Primary schools in the subcounty.
Sample and methods. School-based random cluster sample of 236 5–7-year-olds and 202 12-year-olds. Dental status and treatment need data were collected according to WHO Oral Health Surveys Basic Methods. Additional data for 12-year-olds included dental fluorosis using the Thylstrup and Fejerskov index (TFI), oral hygiene procedures and experience of oral pain in the previous month.
Results. In the 5–7-year-olds, mean dmft was 1·47 (50·8% dmft = 0). A total of 52·5% needed fillings and almost one third needed a tooth extracted. Among the 12-year-olds, mean DMFT was 0·64 (65·8% DMFT = 0), 28·5% had dental fluorosis and 6·7% had TFI > 2. Toothache in the previous four weeks was reported by 36·5%, 30·2% needed a filling and 6·4% needed one or more teeth extracted.
Conclusions. Dental disease is a significant public health problem in this population. An efficient way to meet the needs of the children would be to increase the availability of fluoride toothpaste and to develop a service to provide treatment using Atraumatic Restorative Technique.

Introduction

This study aimed to assess the dental treatment needs of 5–7 and 12-year-old children in a rural subcounty of Uganda and propose appropriate options for dental care. The UK Medical Research Council/Uganda Virus Research Institute Unit (MRC/UVRI) have been conducting population-based research, primarily into HIV/AIDS, in this subcounty since 1989 [1,2]. The people of the subcounty have identified child oral health as a priority and have liaised with MRC/UVRI to consider the provision of dental services for the area.

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The subcounty is a small hilly and fertile rural area in Masaka District approximately 75 miles WSW of Entebbe. Water is drawn from wells and bore holes. The populace are largely subsistence farmers with a little coffee, bananas and other produce grown as cash crops. There are no data on local family income. Life expectancy at birth is 43 years. Fifty per cent of the population are under 15 years of age. There are no data for school attendance rates but approximately 85% of children attend in rural areas (Personal Communication, Mr George Katongole).

Dental services are provided by a Public Health Dental Assistant (PHDA) who visits a health centre 12 km away on two days each week. He is trained to undertake most types of clinical dentistry but a lack of instruments and materials restricts his services to extractions, oral hygiene instruction, scaling

and polishing and occasional temporary fillings. The cost of permanent fillings would be excessive for the local people.

Few oral health data are available for Uganda. Furthermore, national data should be viewed with caution as the prevalence of caries varies across urban and rural locations and with exposure to naturally occurring fluoride in some areas [3,4]. Estimates have placed the 12-year-old decayed, missing or filled teeth (DMFT) value at 0·5 in 1987, 0·45 in 1988 and 0·4 in 1993 [5,6]. Cultural practices may affect oral health in rural areas. Extraction of 'Ebinnyo', the practice of removing incipient canines in infants as a treatment for fevers and diarrhoea is found in several parts of the eastern region [7]. Lalloo placed the mean dmft of 5–7-year-old Ugandan children at 2·2 when missing canine teeth were excluded from the analysis [4].

The purpose of this paper is to describe the dental treatment needs of 5–7 and 12-year-old children in the rural subcounty and to provide a case study of how such data can be used to propose appropriate options for dental care.

Method

The target population for the study was all 5–7 and 12-year-olds in the subcounty, of whom the accessible population included those attending primary schools in the study area of the MRC/UVRI. An intended sample of 200 in each age group was chosen to yield a 95% confidence interval of ±7% based on Lalloo's estimate of 47% of 5–7-year-olds caries free [4]. Such a sample would comprise more than one third of the target population and this level of precision was deemed adequate for planning purposes. Of 14 primary schools in the study area, five were sampled randomly with the expectation that they would contain approximately 200 children of each age group.

Data on dental status and treatment need were collected by a single examiner using the criteria of the WHO Oral Health Surveys Basic Methods [8]. The teeth of the 12-year-old children were examined for fluorosis. The highest score on the upper incisors was recorded for each child using the index of Thylstrup and Fejerskov (TFI) [9]. A guided self-completed questionnaire was used to ascertain the oral hygiene procedures used by the 12-year-old children and their experience of oral pain in the previous month.

Twenty-nine children with 796 teeth were examined twice for reliability regarding the presence of caries on each tooth. The Kappa statistic was 0·89 and reliability was deemed acceptable.

The study was undertaken with the support of the local Subcounty Council, the head teachers of the primary schools and the Ministry of Health of Uganda. The Uganda Virus Research Institute Science and Ethics Committee approved the protocol. Parents were sent an information sheet about the study one week before data collection. Negative consent was used in that it was assumed that the parents or the children gave consent to participate unless they expressed a wish not to do so. All children in imminent need of a dental extraction were referred for dental treatment at the expense of the MRC/UVRI unit.

Descriptive analyses were used to present the proportions of children in each age group with decayed, missing or filled teeth, sound teeth and the mean number of decayed, missing or filled teeth. The proportions of children in the categories for treatment need were also described.

Results

Two hundred and forty-eight 5–7-year-olds who regularly attended the five schools were present on the day of the examinations. Two declined to take part in the study and 10 in one school were not examined because of a shortage of instruments. Clinical data were therefore available for 236 children aged 5–7 years.

Two hundred and eleven 12-year-olds were present and invited to take part in the clinical and questionnaire studies. Eight declined to take part in either part of the study. Twenty-two were not sufficiently literate to attempt the questionnaire. Questionnaires were therefore attempted by 181 12-year-olds. One child who completed the questionnaire declined a clinical examination. Clinical data were therefore available for 202 12-year-olds.

The mean dmft of 5–7-year-old children was 1·47 (SD = 2·17). Mean d, m and f were 1·37, 0·10 and 0·00, respectively (SD 1·99, 0·49 and 0·00, respectively).

Among the 49·2% of 5–7-year-olds who had experienced tooth decay or treatment, mean dmft was 3·00 (SD 2·24). Mean d, m and f were 2·79, 0·21 and 0·00, respectively (SD 2·03, 0·69 and 0·00, respectively). One hundred and fourteen (48·3%) of this age group had untreated decay on a total of 314 teeth. Twenty-one (8·9%) had previously had a total of 24 primary teeth extracted. There was no evidence of Ebinnyo in any of the children.

Most (81%) of the 5–7-year-olds had all four first permanent molars present. Three children of this age already needed a total of five permanent first molars extracting and 17 (7·2%) already needed a total of 26 permanent molars filled.

The mean DMFT of the 12-year-old children was 0·64 (SD = 1·08). Mean D, M and F were 1·00, 0·34 and 0·00, respectively (SD 0·30, 0·00 and 1·08, respectively). Two-thirds (65·8%) of the 12-year-old children were caries free.

DMFT among 12-year-olds with dental caries or treatment experience (DMFT > 1) was 1·88 (SD = 1·02). Mean D, M and F among this group was 1·67, 0·22 and 0·00, respectively (SD 1·04, 0·57 and 0·00, respectively). Sixty-five children (35·9%) had a total of 114 adult teeth with untreated decay. Eleven had already had a total of 14 adult teeth extracted due to tooth decay.

Approximately one-quarter (28·5%) of the children showed signs of dental fluorosis [Table 1]. More than two-thirds of these (i.e. 21·8% of the total) had a score of 1 or 2 using the TFI. Diagnosis of mild fluorosis is prone to error, but differences between schools were still evident when the comparison was limited only to children with socially noticeable fluorosis (i.e. a score of three or more).

Dental treatment need was considered to be 'the ability to benefit from treatment'. As no services were available, complex treatments such as endodontic care were not considered. Any tooth thought to warrant endodontic treatment was considered to be in need of extraction. More than half (52·5%) of the 5–7-year-old children needed fillings or a dental extraction, of whom (36·4%) needed one or more fillings [Table 2]. Dental extractions were needed by almost one-third of this age group. One child aged 5–7 required urgent care for a dental emergency.

Among the 12-year-olds, 13 children (6·4%) required a total of 18 teeth extracted. Two children were in need of emergency dental care for dental abscesses. Sixty-one 12-year-olds (30·2%) needed a filling, of whom 53 (26·2%) needed a single surface filling and 12 (5·9%) needed a two-surface filling. The total number of fillings needed by the 12-year-olds was 100, of which 87 were needed in one surface of the tooth. Ninety fillings were needed on the molar teeth.

One hundred and eighty-one 12-year-olds provided questionnaire data, 58·6% of whom were girls. Sixty-six 12-year-olds (36·5%) could remember having toothache in the previous 4 weeks. The affected children had previously had toothache for a mean of 3·7 days (SD 2·6 days) during that period.

Fifteen children did not provide usable responses to the question about frequency of cleaning their teeth. Most children (59%) cleaned their teeth every day, 2·4% most days, 13·2% a few times each week and 25·3% did so less regularly. The most common cleaning aids were sticks (61·9%), toothbrush (45·3%) and finger (31·5%) (categories are not mutually exclusive). One-third (35·6%) of the 12-year-olds used toothpaste.

Table 1. Dental fluorosis in central incisors of 12-year-olds attending five primary schools.

School	*n*	Any fluorosis (TFI > 0) (%)	Noticeable fluorosis (TFI > 2) (%)
K	29	17·2	0·0
N	31	9·7	3·2
YA	49	18·4	10·2
KB	21	19·0	0·0
B	72	54·2	13·9
Total	202	28·5	6·7

Discussion

Allowing for sampling differences and for diagnostic variability the dental health of these children was compatible with earlier Ugandan data where dmft was 2·2 for 5–7-year-olds and DMFT varied between 0·4 and 0·5 for 12-year-olds [3–6].

Table 2. Dental treatment needs among 236 children aged 5–7 years.

	All teeth		Primary teeth		Permanent teeth	
	Children in need *n* (%)	Teeth in need *n*	Children in need *n* (%)	Teeth in need *n*	Children in need *n* (%)	Teeth in need *n*
Dental extraction	77 (32·6)	141	64 (27·1)	119	18 (7·6)	22
1 surface filling	73 (30·9)	133	63 (26·7)	112	14 (5·9)	21
2 surface filling	31 (13·1)	43	29 (12·3)	38	3 (1·3)	5

Whilst there are few published comparator data, the health of these children seems to be similar to those in neighbouring countries. Lalloo and colleagues found the dmft among rural 5–7-year-olds in Tanzania to be 1·5 [4]. The WHO oral health database places DMFT for 12-year-olds in Congo, Kenya, Rwanda, Sudan and Tanzania at 0·4–1·1, 0·9–1·8, 0·3, 1·4 and 0·3, respectively [6]. These data should be viewed with caution as some were collected up to 20 years ago and may suffer from sampling error. More recently, DMFT of a sample of 9–14-year-olds in Tanzania was 0·4 [10].

More than one-third of 12-year-olds had experienced toothache in the previous 4 weeks and a similar proportion had adult teeth with untreated decay. Almost half of the younger children had untreated decay. These data reflect the concerns expressed by the people of the subcounty and confirm that dental health is a public health problem.

The most mutable factor associated with dental health is the availability of fluoride. Water fluoridation is not possible in the absence of a reticulated supply but with 59% of children cleaning their teeth everyday and most using a toothbrush or stick, fluoride toothpaste could be incorporated into this daily regimen. Both imported and locally made toothpastes contain fluoride and could be made freely or cheaply available to the entire population or just to children. The effectiveness of fluoride toothpaste is related to the baseline level of caries, type and concentration used and the frequency of tooth cleaning. However, a randomised controlled trial in a deprived area of the UK in which toothpaste (1450 p.p.m. fluoride) was mailed to children between the ages of 1 and 5 years yielded a 16% decrease in dental caries [11].

The only tangible risk of greater availability of fluoride toothpaste is that of dental fluorosis. Only 7·9% of the 12-year-olds had marked fluorosis compared to 34·2% with tooth decay [Table 1]. The majority of the marked fluorosis was in one school, which suggests a local source of fluoride in the area of that school.

Aesthetically significant dental fluorosis is related to fluoride exposure during the third year of life as the permanent upper central incisor teeth are mineralized. Not using fluoride pastes until later in childhood denies the children the benefits of the protective effect in the primary dentition. Half of all 5–7-year-olds examined in this study already had decay or treatment experience. Lower concentration toothpastes offer a compromise between protective effect and fluorosis risk, but the protection is in proportion to the concentration of fluoride therein [12].

Individuals and communities need both knowledge and skills to make and act upon healthy decisions. However, recent systematic reviews of the effectiveness of dental health education and oral health promotion were limited by the availability of good evidence [13–15]. A school-based oral health education programme with supervised toothbrushing did not affect dental health in Tanzania [10]. There is no compelling evidence of the value of individual or school-based dietary or tooth cleaning advice in the prevention of tooth decay.

The dental service offered by the PHDA will continue to be needed for the relief of pain and the treatment of sepsis in adults, for treatment of primary teeth in young children and for permanent teeth in older children. Dental services could be expanded to provide both primary and secondary preventive care.

For the most cost-effective use of limited resources, developments in dental treatment could be limited to the permanent teeth in children. Restricting treatment in this way will be an investment for the future and may be the only option with the limited resources available. The vast majority of dental treatment need in the permanent teeth of the children was limited to the occlusal surfaces of the posterior teeth. The atraumatic restorative technique (ART) is well suited to this situation. There are two components to an ART programme, the use of glass-ionomer cement (GIC) as fissure sealants or as fillings in teeth prepared without use of rotary instruments.

GIC fissure sealants placed as part of an ART programme prevent caries [16]. The relative risk of developing caries was 4 in unsealed teeth when compared to sealed teeth although more modern materials may improve this level of success. At the low caries prevalence seen in 12-year-olds it may not be cost-efficient to apply fissure sealants to all children. Those with caries experience in the primary dentition will be at high risk for caries in permanent teeth and the application of fissure sealants could be limited to this group.

Evaluation of fillings provided within ART has centred on uncontrolled feasibility studies, most of which suffer from poor follow up. These data and those from one controlled study suggest that survival of ART is comparable to amalgam fillings and up to 89% over three years [17,18]. One controlled study has considered the effectiveness of ART in the prevention of loss of teeth [19]. Untreated controls lost,

on average, one additional tooth after 3 years. The technique can be used in dental clinics but has also been adapted to providing treatment in a non-clinical setting, with the mouth being illuminated with natural light or a hand-held torch [20].

Thirty per cent of the 12-year-olds examined needed a filling. If these data are extrapolated to the entire population of 12-year-olds in the subcounty then 271 12-year-olds will need a total of 444 fillings. Assuming that 10 fillings can be placed by one operator in a day (based on 17–22 min per filling but allowing for operator fatigue) it will take 45 person days to provide the fillings for all the 12-year-olds. These data can be extrapolated, with a little caution, to the other year groups between 6 and 15 years of age. The younger children will require fewer fillings and older children will require more. If we use the 12-year-old data as an average, 45 person days will be required to provide the fillings per year group that the service is offered to. Alternatively, based on providing a service for 40 weeks a year, one operator could meet the ART treatment needs of four year groups per year or two operators could meet the needs of all the children aged between 7 and 15.

Options for staff to provide the ART include a PHDA and other health personnel. A PHDA would offer the advantages of being ready trained and experienced in dental care but would have a range of expertise extending far beyond ART and may be dissatisfied with offering such a limited repertoire of treatments. With this level of training a PHDA may also command a greater salary.

Other health personnel in the subcounty could be trained to diagnose caries and provide fissure sealants and ART. Existing personnel include traditional birth attendants, trainers, community resource persons and a range of service providers from midwives and fully-trained nurses to aid nurses and trainees. The training needs of these personnel would be greater but they may not be as expensive to employ. In addition they are likely to be known and trusted by the local community and less likely to move from the community. Yee and colleagues trained non-dental primary healthcare workers in Nepal in two weeks to provide ART with results comparable to those in other studies [20]. The workers had received 18–24 months of paramedical training but had variable experience in oral health care. One option may be for the PHDA to diagnose and examine the children for dental disease and for other personnel to provide the treatment.

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Résumé. *Objectifs.* Décrire les besoins normatifs en traitements dentaires chez les 5–7 ans et 12 ans dans une zone rurale d'Ouganda et définir une stratégie pour améliorer la santé buccale
Protocole. Suivi clinique
Mise en place. Ecoles primaires de la zone
Echantillon et methods. Echantillon de 236 enfants de 5–7 ans et 202 de 12 ans, pris au hasard dans une population scolaire. Les données sur l'état dentaire et les besoins en soins ont été collectés selon les méthodes de l'OMS d'analyse de base de la santé buccale. Des données supplémentaires pour les 12 ans ont concerné la fluorose dentaire en utilisant l'indice de Thylstrupp et Fejerskov (TFI), les techniques d'hygiène buccale et le passé de douleur buccale dans le mois précédent.
Résultats. Chez les 5–7 ans, le caod moyen était de 1,47 (50.8% caod = 0). 52,5% nécessitaient des restaurations et seulement un tiers avaient besoin d'une extraction dentaire. Parmi les 12 ans, le CAOD moyen était de 0,64 (65.8% CAOD = 0). 28,5% présentaient une fluorose dentaire et 6,7% avaient un TFI > 2. 36,5% ont déclaré avoir eu mal aux dents dans les semaines précédentes. 30,2% nécessitaient une obturation et 6,4% avaient besoin d'au moins une extraction dentaire.
Conclusions. Les maladies dentaires sont un réel problème de santé publique dans cette population. Un moyen efficace de répondre aux besoins de ces enfants serait d'augmenter la disponibilité du dentifrice fluoré et de développer un service de soins par techniques atraumatiques de restauration.

Zusammenfassung. *Ziele.* Beschreibung des Behandlungsbedarfs bei 5–7 jährigen und 12 jährigen Kindern einer ländlichen Gegend Ugandas und Strategien zur Verbesserung der Mundgesundheit. Design. Klinische Übersichtsarbeit. Untersuchung-

sumgebung. Grundschulen in einem ländlichen gebiet.
Stichprobe und Methoden. Schulbezogene Zufallsstichprobe von 236 5–7 jährige Schulkinder und 202 12 jährige. Zahnstatus und Behandlungsbedarf wurden gesammelt gemäß WHO-Kriterien. Zusätzlich wurde für die 12 jährigen die Dentalfluorose mit dem Index Thylstrupp und Fejerskov ermittelt, weiterhin Mundhygienegewohnheiten und das Auftreten von Zahnschmerzen im vorangegangenen Monat.
Ergebnisse. Bei den 5–7 jährigen lag der dmft im Mittel bei 1.47 (50.8% dmft = 0). 52.5% benötigten Füllungen und fast ein Drittel benötigte eine Zahnextraktion. Bei den 12 jährigen war der DMFT im Mittel 0.64 (65% DMFT = 0). 28.5% hatten Dentalfluorose und 6.7% einen TFI > 2. 36.5% gaben Zahnschmerzen innerhalb des vorangegangenen Monats an. 30.2% benötigten eine Füllung und 6.4% eine oder mehrere Extraktionen.
Schlussfolgerungen. Zahnerkrankungen stellen ein signifikantes Gesundheitsproblem in der untersuchten Gegend dar. Eine Möglichkeit die Bedürfnisse zu erfüllen wäre die Erhöhung der Verfügbarkeit fluoridhaltiger Zahnpasta und die Etablierung einer Versorgung mit Atraumatic Restorative Technique.

Resumen. *Objetivos*. Describir las necesidades de tratamiento odontológico en niños de 5–7 años y de 12 años en un sub-condado rural de Uganda y crear una estrategia para mejorar la salud bucal.
Diseño. Exploración clínica
Lugar. Escuelas primarias en el sub-condado
Muestra y métodos. Una muestra cluster aleatoria basada en la escuela de 236 niños de 5 a 7 años y 202 niños de 12 años. El estado dental y las necesidades de tratamiento se recogieron según los Métodos Básicos de Exploración de Salud Bucal de la OMS. Se incluyeron datos adicionales para los niños de 12 años tales como, la fluorosis dental usando el índice de Thylstrupp and Fejerskov (ITF), procedimientos de higiene bucal y experiencia de dolor bucal en el mes previo.
Resultados. La media caod en los niños de 5 a 7 años fue de 1,47 (50,8% caod = 0). El 52,5% necesitaba obturaciones y casi un tercio necesitaba la extracción de un diente. La media CAOD en los de 12 años fue de 0,64 (65,8% CAOD = 0). El 28,5% tenía fluorosis dental y el 6,7% tenía un ITF > 2. El 36,5% señaló haber tenido dolor dentario en las cuatro semanas previas. El 30,2% necesitaba una obturación y el 6,4% necesitaba la extracción de uno o más dientes.
Conclusiones. La enfermedad dental es un problema de salud pública significativo en esta población. Una manera eficiente de enfrentarse a las necesidades de los niños sería aumentar la disponibilidad de pasta fluorada y desarrollar un servicio para proveer un tratamiento mediante el uso de Técnicas de Restauración Atraumáticas.

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