

## A study of the dental treatment needs of children with disabilities in Melbourne, Australia

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### Abstract

A selected population of children with disabilities in Melbourne, Australia, was studied with reference to their oral disease and treatment needs. A total of 300 children (aged 9-13 years), 150 attending special developmental schools (SDS) and 150 attending special schools (SS), received an oral examination and the parent/guardian completed a questionnaire. Six levels of function were defined, based on the child's independence for five self-care activities (brushing teeth, feeding self, dressing self, walking and performing toilet). The caries experience of children in the SS was lower than in SDS (d+D: 1.3±1.6 versus 1.5±2.4; dmft+DMFT: 2.0±2.3 versus 2.5±3.1); those attending SDS had higher unmet preventive and restorative needs. Significant associations were seen between the number of decayed teeth, the dmft+DMFT index, and the level of function ( $p<0.005$ ). Periodontal disease was prevalent; significant associations were seen between periodontal status, the need for periodontal therapy, and the level of function ( $p<0.005$ ). Assessment of the level of function by staff could assist in triaging individuals for urgent dental examination. Despite 41 per cent of children requiring simple treatment, the preventive and treatment needs of many remained unmet. Following examination, diagnosis and treatment planning by a dentist, much of the preventive, simple treatment and oral health promotion could be performed by trained dental auxiliaries. An epidemiological survey followed by the implementation and evaluation of a long-range public dental health care plan for children and adolescents with disabilities is needed urgently.

**Key Words:** Children, dental disease, disability, oral hygiene, treatment needs.

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### Introduction

Children and adolescents with disabilities

appear to have poorer oral health than their non-disabled counterparts. Variable access to dental care, inadequate oral hygiene and disability-related factors may account for the differences.<sup>1</sup> The type of dental care received may be determined more by the disability than the oral condition, compounding the chronicity of dental disease.<sup>2</sup> Multiple factors including disability type and institutionalization can contribute to oral health, affecting disease prevalence.<sup>2</sup> Caries prevalence appears lower in institutionalized individuals with intellectual disability than in the non-institutionalized and the general population,<sup>2-4</sup> attributed to segregation of the more severely disabled and stricter dietary control in institutions.<sup>3</sup>

The most recent reports in Australia of oral disease in children and adolescents with disabilities were made over 15 years ago.<sup>5-8</sup> Surveying parents of affected children in South Australia, Gurling *et al.* identified two priorities: for parents/guardians to become aware of the treatment facilities available; and the need for further education of dentists in care of disabled individuals.<sup>5</sup> Watson reported on 33 years (1946-1978) of dental care at the Spastic Centre of New South Wales, where treatment was provided by honorary dentists emphasizing oral hygiene and prevention.<sup>6</sup> A significant improvement in dental status was seen, with 70 per cent of children seen in 1978 requiring no treatment. Orthodontic treatment was provided following careful case selection for those able to tolerate appliances. Most restorative treatment was carried out under general anaesthesia, because a higher quality of treatment was possible.<sup>6</sup>

Surveying administrators of 299 institutions for individuals with disabilities in Melbourne and conducting dental examinations of institutionalized children, Crack *et al.* in 1980 reported major treatment needs for individuals in 44 per cent of the institutions.<sup>7</sup> Among those aged 3-65 years in 42 institutions, few had access to dental care and caries and periodontal disease were present universally in the dentate. Those living in training centres had the lowest caries experience, perhaps reflecting the strict

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**Table 1. Distribution of children by level of function based on dependency for self-care**

Level of function*	Distribution of affirmative responses (%)		
	Children at special developmental schools n=150	Children at special schools n=150	Total children n=300
(A) Fully independent	6(4)	60(40)	66(22)
(B) Dependent for one to four self-care activities other than brushing teeth	8(5)	17(11)	25(8)
(C) Dependent for brushing teeth only	12(8)	34(23)	46(15)
(D) Dependent for brushing teeth plus one other self-care activity	12(8)	21(14)	33(11)
(E) Dependent for brushing teeth plus two or three other self-care activities	43(29)	10(7)	53(18)
(F) Fully dependent	69(46)	8(5)	77(26)

\*Level of function based on dependency for five self-care activities: brushing teeth, feeding self, dressing self, walking and performing toilet.

diet and preventive measures.<sup>7</sup> Orthodontic treatment was deemed unnecessary. The lack of treatment indicated an urgent need for the establishment of delivery systems, including the introduction of dental hygienists and further education for dentists.<sup>7</sup> In 1980 in Queensland, Brown noted that the costly cycle of treatment backlog and emergency care could be broken by the implementation of effective preventive programmes.<sup>3</sup> By 1983, the availability of care for individuals attending the Spastic Centre in Brisbane had improved; most received regular examinations and only 10 per cent of parents reported difficulty in accessing care, although most requested a government dental service at the centre.<sup>8</sup>

Omitted from the 1987-1988 National Oral Health Survey in Australia, a survey of oral health of people with disabilities is needed.<sup>9</sup> The 1986 Ministerial Review of Dental Services in Victoria identified groups at risk, estimating that approximately 13.2 per cent of Australians had a disability.<sup>10</sup> Dental care for such children and adolescents in the state is provided mainly by the public dental health service. In order to provide effective dental care for individuals with disabilities, it is essential to ascertain unmet needs, so that decisions can be made on improving care. Measurement of oral disease will enable focusing of services.

The objectives of the present study in Melbourne of a selected group of 9-13 year old children with disabilities were to:

1. Record the frequency and severity of their oral disease.
2. Survey their treatment needs with reference to dental caries, periodontal disease and malocclusion.
3. Investigate associations between their dental health status, treatment needs, and levels of function.
4. Make recommendations for public dental health care for individuals with disabilities.

## Material and methods

### *Ethics approval and consent*

Study approval was obtained from the Ethics Committee of the Department of Health and Community Services, Victoria; the Directorate of

School Education, Victoria; and the regional general manager and principal of each school. Participation of each child was voluntary and informed consent was obtained from each parent/guardian.

### *Study design*

The study was conducted between April and November 1996, in 13 special developmental schools (SDS) and three special schools (SS) in different socio-economic areas attended by Dental Health Services Victoria (DHSV) in Melbourne, in accord with the roster of DHSV for dental visits to these schools. Children attending SDS are multi-disabled, with congenital or acquired conditions and more severe physical and/or intellectual disabilities than those attending SS. Frequently medically compromised, most have moderate to severe intellectual disabilities. Children attending SS are slow learners (IQ: 50-70), may be deficient in social/cognitive skills and have physical disabilities.

All children aged 9-13 years were identified from the school register; the number per school for SDS ranged from six to 37, and for SS from 47 to 84. All children were in the mixed dentition stage. An informational article was placed in school newsletters. A letter, consent form and questionnaire were sent to parents/guardians and a reminder letter was sent to non-respondents two weeks later. Returned consents and questionnaires were reviewed and incomplete forms were returned for completion. An eligible child was excluded if consent was refused, the consent form or questionnaire was incomplete, or the child was absent for the examination.

### *Distribution of schools and subjects*

Of 189 eligible children attending SDS, 150 (79 per cent) provided consents and usable questionnaires and were examined. Participation rates for individual SDS ranged from 56-100 per cent. Of 181 eligible children attending SS, 150 (83 per cent) provided consents and usable questionnaires and were examined. Participation rates for each SS were 76-88 per cent. The sample contained 300 children, 150 from SDS (94 males, 63 per cent of group; 56

**Table 2. Distribution of children by dental status and need for preventive and/or restorative treatment**

Dental status	Children at special developmental schools n=150		Children at special schools n=150		Total children n=300	
	Range	Mean score (±SD)	Range	Mean score (±SD)	Range	Mean score (±SD)
No. decayed teeth (d+D)	0-16	1.5(2.4)	0-8	1.3(1.6)	0-16	1.4(2.0)
No. missing teeth (m+M)	0-2	0.1(0.3)	0-2	0.1(0.3)	0-2	0.1(0.3)
No. filled teeth (f+F)	0-8	0.9(1.7)	0-8	0.7(1.4)	0-8	0.8(1.6)
Total No. teeth present (t+T)	17-29	24.0(2.0)	14-31	24.6(2.3)	14-31	24.3(2.2)
dmft + DMFT index*	0-18	2.5(3.1)	1-10	2.0(2.3)	0-18	2.2(2.8)
No. teeth with enamel defects	0-18	1.2(2.8)	0-26	2.2(4.1)	0-26	1.7(3.5)
No. teeth with attrition	0-22	3.1(5.1)	0-16	2.1(4.1)	0-22	2.6(4.6)
Need for preventive and/or restorative treatment	No. of children (%)		No. of children (%)		Total children (%)	
None	18(12)		8(5)		26(9)	
Simple	66(44)		57(38)		123(41)	
Moderate	38(25)		53(35)		91(30)	
Complex	28(19)		32(21)		60(20)	

\*dmft+DMFT index = sum of No. of decayed teeth (d+D), plus No. of missing teeth (m+M), plus No. of filled teeth (f+F).

females, 37 per cent) and 150 from SS (92 males, 61 per cent; 58 females, 39 per cent). The mean ages in months (calculated from birth date to examination date) of children at SDS was 128±15, and 135±14 for children at SS.

### Questionnaire

The questionnaire obtained biographic data and the child's history (disabilities, motor coordination, developmental delay, epilepsy, cerebral palsy, visual impairment, hearing impairment, speech, neurological, allergies, hospitalizations, asthma, cardiac, diabetes, renal, Rubella and other), medications, habits, behaviour and dental problems (a copy of the questionnaire is available from the corresponding author). The child's dependence on a carer for five self-care activities was requested: brushing teeth, feeding self, dressing self, walking and performing toilet.

### Clinical environment and examination

All examinations were performed at the schools in a mobile dental clinic by one examiner (MD), using a mouth mirror, sickle probe, World Health Organization (WHO) periodontal probe, air/water spray, vacuum suction, high intensity lighting and universal infection control procedures. A dental nurse assisted with patient management and data entry. Each examination took approximately 15 minutes. All children were examined using positive reinforcement, 'tell, show and do', and music to calm the child. Some examinations required restraint to stabilize the child and to open the mouth using a mouth prop. The examinations did not involve any invasive procedures or radiographs.

Standardization of the examiner and nurse was based on the WHO survey recommendations and

the WHO Oral Health Criteria and Assessment Form was modified to record caries, periodontal disease, malocclusion, oral health status and treatment needs.<sup>11</sup> Behaviour was assessed subjectively (Frankl Behavioural Scale);<sup>12</sup> indices were used to measure caries experience (number of decayed, missing and filled primary and permanent teeth: dmft+DMFT), dental treatment needs,<sup>11</sup> periodontal disease (Community Periodontal Index of Treatment Needs: CPITN),<sup>13</sup> and malocclusion (Index of Orthodontic Treatment Need: IOTN).<sup>11,14</sup> A pilot study of the questionnaire and clinical form was conducted using 20 parents/guardians and their children (not part of the study) and the forms were then modified to aid clarity and accuracy.

### Dental needs and recommendations

The dental treatment needs of each child were judged, based on the following categories. None: no restorative treatment required. Simple: preventive treatment required, such as scaling and prophylaxis (S and P), oral hygiene instruction (OHI), application of topical fluoride, fissure sealants. Moderate: one or more teeth required a one and/or two surface restoration. Complex: one or more teeth required a three or four surface restoration/stainless steel crown, endodontic therapy/crown, and/or extraction.

The recommendations were based on the dental treatment needs plus the behaviour rating, classified as follows. No treatment required: child required no dental or periodontal treatment, but required assistance with oral hygiene. Simple treatment need/cooperative behaviour: child required simple preventive or periodontal treatment and/or displayed positive/definitely positive behaviour; treatment could probably be performed using conventional behaviour management techniques and local

**Table 3. Distribution of children by periodontal status, need for periodontal therapy, malocclusion status and need for orthodontic therapy**

Status and need for therapy	Classification	Distribution of children (%)		
		Children at special developmental schools n=150	Children at special schools n=150	Total children n=300
Periodontal status*	Healthy	15(10)	16(11)	31(10)
	Bleeding gingivae	61(41)	57(38)	118(39)
	Calculus present	62(41)	74(49)	136(45)
	With pockets >4 mm	12(8)	3(2)	15(5)
Need for periodontal therapy	None	15(10)	16(11)	31(10)
	Oral hygiene instruction (OHI) only	61(41)	57(38)	118(40)
	OHI plus scale and prophylaxis (S and P)	65(43)	74(49)	139(46)
	Periodontal surgery plus OHI plus S and P	9(6)	3(2)	12(4)
Malocclusion status†	No malocclusion	10(7)	14(9)	24(8)
	Minor occlusal irregularities	28(19)	39(26)	67(22)
	Moderate to severe malocclusion	102(68)	91(61)	193(65)
	Severe dentofacial anomalies	10(7)	6(4)	16(5)
Need for orthodontic therapy	None	23(15)	46(31)	69(23)
	Removable appliance therapy	15(10)	7(5)	22(7)
	Fixed appliance therapy	102(68)	91(61)	193(65)
	Appliance therapy plus orthognathic surgery	10(7)	6(4)	16(5)

\*Periodontal status classified according to Community Periodontal Index of Treatment Needs (CPITN).<sup>13</sup>

†Malocclusion status classified according to the Index of Orthodontic Treatment Need (IOTN).<sup>14</sup>

anaesthesia. Moderate treatment need/variable behaviour: child required moderate dental and/or periodontal treatment with behaviour ranging from positive to negative; treatment could probably be performed using restraint and/or relative analgesia or sedation and behaviour management techniques. Complex treatment need/uncooperative behaviour: child required complex dental and/or periodontal treatment and/or displayed definitely negative behaviour; treatment probably required general anaesthesia.

### Level of function

The level of function was a qualitative summation of the child's dependence, which was defined as the inability of the child to perform the self-care activity unassisted. Responses for the five self-care activities were re-grouped into six levels of function: (A) child fully independent for all five activities; (B) child independent for toothbrushing but dependent for one to four activities; (C) child dependent for toothbrushing only and independent for all other activities; (D) child dependent for toothbrushing plus one other activity; (E) child dependent for toothbrushing plus two or three other activities; (F) child fully dependent for all five activities.

### Data management and statistical analyses

Thirty children attending one SS (10 per cent of sample) were re-examined to measure the examiner reliability and to ensure reproducibility of criteria. The Kappa coefficients of reliability were: DMFT index, 0.93; CPITN sextant score, 0.79. Data were verified, collated, entered into an Excel spreadsheet and analysed statistically using the Office

Professional Package for Windows 95 (Microsoft Corporation, Redmond WA, USA). Non-parametric statistics (chi-square) were performed using Minitab Version 11 for Windows Statistical Package (Microsoft Corporation, Redmond WA, USA). Seven dependent variables were examined: dental status, dental treatment needs, periodontal status, periodontal treatment needs, occlusion, malocclusion treatment needs, and overall treatment need recommendations. The single independent variable was the level of function.

## Results

### Distribution of children

All children recorded multiple impairments and/or disabilities; almost all (n=280, 93 per cent) had a learning disability or developmental delay and most had intellectual disability (75 per cent) and speech problems (61 per cent). Medical conditions (physical disability, motor incoordination, autism, seizure disorder/epilepsy, cerebral palsy, visual impairment and speech problems) were more frequent among children at SDS. Conditions more frequent among SS children were emotional and/or behavioural problems, Down syndrome, hearing impairment and asthma. Over half the children (57 per cent) reported at least one hospitalization; for 20 per cent this was for dental treatment under general anaesthesia. Almost half (44 per cent) of the children were currently on medications; many of these were multiple and daily. Of 53 medications recorded, anti-epileptics were the most common. Almost half the parents/guardians thought their child had a dental problem, many requesting a dental 'check up'. Overall, children at SDS were more dependent

than those at SS; 4 per cent were fully independent (Level A, Table 1), and 46 per cent were fully dependent (Level F). Of children at SS, 40 per cent were fully independent (Level A) and 5 per cent were fully dependent (Level F). Most children required assistance with brushing teeth (Levels C, D, E and F).

#### Dental status and need for preventive and/or restorative treatment

The caries experience of children in SS was lower than in SDS (d+D:  $1.3 \pm 1.6$  versus  $1.5 \pm 2.4$ ; dmft+DMFT:  $2.0 \pm 2.3$  versus  $2.5 \pm 3.1$ ), and the number of teeth present for those in SS was slightly higher (t+T:  $24.6 \pm 2.3$  versus  $24.0 \pm 2.0$ ; Table 2). The number of filled teeth was slightly lower for children in SS than in SDS (f+F:  $0.7 \pm 1.4$  versus  $0.9 \pm 1.7$ ), but the number of teeth missing due to caries was similar for both groups (m+M:  $0.1 \pm 0.3$ ). The mean dental care index [(f+F)/(d+D)] for both groups was similar (SDS: 0.6; SS: 0.5), indicating similar amounts of restorative treatment relative to untreated caries. The decay component of the mean dmft+DMFT index was the largest component of the index for both groups. Teeth with enamel developmental defects were more frequent in children at SS than at SDS ( $2.2 \pm 4.1$  versus  $1.2 \pm 2.8$ ), but attrition was more frequent among children at SDS ( $3.1 \pm 5.1$  versus  $2.1 \pm 4.1$ ). Overall, 50 per cent of children had either simple or no treatment needs. Children at SDS were more likely to need either simple treatment (44 per cent) or none (12 per cent) compared with those at SS who were more likely to

require moderate (35 per cent) or complex (21 per cent) treatment.

#### Periodontal status and occlusion

Periodontal disease was frequent and only 10 per cent of all children had healthy periodontal tissues; 85 per cent needed OHI only, or OHI plus S and P; 4 per cent required periodontal surgery in addition (Table 3). Malocclusion was present in 92 per cent, ranging from minor occlusal irregularities to severe dentofacial anomalies. Most children had moderate to severe malocclusion, with 65 per cent requiring fixed appliance therapy; 5 per cent had severe dentofacial anomalies, requiring orthognathic surgery in addition.

#### Behaviour rating and overall treatment need recommendations

Overall, 66 per cent of children displayed positive or definitely positive behaviour (Frankl III and IV). Those at SDS were more likely to display negative or uncooperative behaviour than those at SS (Frankl I and II: 58 per cent versus 10 per cent). More children attending SS than SDS displayed positive or definitely positive behaviour (90 per cent versus 41 per cent). Overall, 6 per cent of children required no treatment other than regular examinations. Although treatment needs were high, 56 per cent required simple preventive and/or periodontal treatment deliverable in the dental chair with or without local anaesthesia; 18 per cent required complex restorative and/or periodontal treatment performed best under general anaesthesia. More children at SDS than SS required

**Table 4. Distribution of children by caries experience and restorative treatment needs by level of function**

Caries experience and needs for restorative treatment			Distribution of children by level of function* (%)						
			(A) n=66	(B) n=25	(C) n=46	(D) n=33	(E) n=53	(F) n=77	Total n=300
Caries experience	No. decayed teeth (d+D)	0	32(48)	10(40)	23(50)	16(48)	36(68)	41(53)	158(53)
		1-2	25(38)	9(36)	12(26)	11(33)	10(19)	9(12)	76(25)
		>2	9(14)	6(24)	11(24)	6(18)	7(13)	27(35)	66(22)
	No. missing teeth (m+M)	0	66(100)	24(96)	40(87)	31(94)	49(92)	74(96)	284(95)
		1-2	0(0)	1(4)	6(13)	2(6)	4(8)	3(4)	16(5)
		No. filled teeth (f+F)	0	43(65)	16(64)	30(65)	19(58)	40(75)	55(71)
	Total No. teeth (t+T)	1-8	23(35)	9(36)	16(35)	14(42)	13(25)	22(29)	97(32)
		14-23	13(20)	6(24)	12(26)	11(33)	19(36)	22(29)	83(28)
	dmft + DMFT index†	24	21(32)	12(48)	21(46)	13(39)	21(40)	36(46)	124(41)
		25-31	32(48)	7(28)	13(28)	9(27)	13(24)	19(25)	93(31)
0		23(35)	8(32)	18(39)	12(36)	30(57)	34(44)	125(42)	
1-2		21(32)	9(36)	10(22)	7(21)	6(11)	8(10)	61(20)	
Restorative treatment needs	3-4	17(26)	2(8)	7(15)	7(21)	13(24)	15(19)	61(20)	
	5-18	5(7)	6(24)	11(24)	7(21)	4(8)	20(26)	53(18)	
	None	4(6)	2(8)	2(4)	2(6)	9(17)	7(9)	26(9)	
	Simple	23(35)	9(36)	21(46)	11(33)	27(51)	32(41)	123(41)	
Moderate	30(45)	7(28)	11(24)	10(30)	11(21)	22(29)	91(30)		
Complex	9(14)	7(28)	12(26)	10(30)	6(11)	16(21)	60(20)		

\*Classification of level of function of subjects: (A) = fully independent; (B) = required assistance for one to four activities, but not for toothbrushing; (C) = required assistance with toothbrushing; (D) = required assistance with toothbrushing plus one other activity; (E) required assistance with toothbrushing plus two or three activities; (F) = fully dependent.

†dmft+DMFT index = sum of No. of decayed teeth (d+D), plus No. of missing teeth (m+M), plus No. of filled teeth (f+F).

moderate or complex restorative and/or periodontal treatment, involving local anaesthesia or general anaesthesia (58 per cent versus 18 per cent).

#### ***Caries experience, need for restorative treatment and level of function***

The majority of children (53 per cent) were caries free (Table 4). There was a significant association between function level and the number of decayed teeth; a decrease in function was associated with an increase in caries ( $\chi^2=26.377$ ,  $df=10$ ,  $p=0.003$ ). Among those independent for toothbrushing (Levels A and B), the frequencies of caries-free teeth ( $d+D=0$ ) tended to be lower (48 per cent, 40 per cent) than for those who were dependent for toothbrushing (Levels C=50 per cent, D=48 per cent, E=68 per cent, F=53 per cent). There were no significant associations between function level and the number of missing teeth ( $\chi^2=10.087$ ,  $df=5$ ,  $p=0.073$ ), filled teeth ( $\chi^2=3.980$ ,  $df=5$ ,  $p=0.552$ ), and teeth present ( $\chi^2=14.454$ ,  $df=10$ ,  $p=0.153$ ). Decreasing function was associated significantly with increasing caries experience ( $\chi^2=33.380$ ,  $df=15$ ,  $p=0.004$ ). Among those individuals independent for toothbrushing, the frequencies of  $dmft+DMFT=0$  were lower (A=35 per cent, B=32 per cent) than for the toothbrushing dependent (C=38 per cent, D=36 per cent, E=57 per cent, F=44 per cent), and the frequencies of  $dmft+DMFT=1-2$  were higher (A=32 per cent, B=36 per cent) than for Levels C to F (22 per cent, 21 per cent, 11 per cent, 10 per cent, respectively). There was no significant association between level of function and need for preventive and/or restorative treatment ( $\chi^2=22.870$ ,  $df=15$ ,  $p=0.087$ ).

#### ***Periodontal status, need for periodontal therapy and level of function***

There was a significant association between function level and periodontal status ( $\chi^2=30.234$ ,  $df=15$ ,  $p=0.011$ , Table 5). Healthy periodontal tissues were slightly more frequent among those independent for toothbrushing (A=14 per cent, B=12 per cent versus C=11 per cent, D=18 per cent, E=11 per cent, F=3 per cent), and the frequencies of those with calculus were higher among those independent for toothbrushing (C=56 per cent, D=51 per cent, E=30 per cent, F=57 per cent versus A=36 per cent, B=36 per cent). Decreasing function was significantly associated with increasing need for periodontal treatment ( $\chi^2=30.436$ ,  $df=15$ ,  $p=0.010$ ). The frequency of those needing OHI plus S and P was greater in the toothbrushing dependent (C=56 per cent, D=51 per cent, E=32 per cent, F=58 per cent versus A=38 per cent, B=36 per cent). Level F group contained the most children with either calculus present, or

pocket depths over 4 mm (67 per cent), and the most children requiring either OHI plus S and P, or periodontal surgery.

#### ***Status of malocclusion, need for orthodontic therapy and level of function***

No associations were seen between the function level and malocclusion ( $\chi^2=16.424$ ,  $df=15$ ,  $p=0.354$ ), or need for orthodontic therapy ( $\chi^2=20.031$ ,  $df=15$ ,  $p=0.171$ ; Table 5). With increasing dependence, there was an increase in moderate to severe malocclusion and in severe dentofacial anomalies. Across all function levels, most children (64 per cent) had moderate to severe malocclusion. Children in Level A represented the largest proportion with either nil or minor occlusal irregularities. Those in Level F represented the largest proportion with severe dentofacial anomalies (10 per cent), requiring fixed appliance therapy alone, or orthognathic surgery.

#### ***Overall treatment need recommendations and level of function***

Decreasing function was significantly associated with more complicated treatment needs ( $\chi^2=57.031$ ,  $df=15$ ,  $p=0.000$ ; Table 6). The majority of children in Levels A and B (89 per cent, 68 per cent) required simple treatment, performed with or without local anaesthesia. The majority of children in Levels E and F (52 per cent, 57 per cent) had moderate to complex treatment needs requiring restraint plus local anaesthesia, or general anaesthesia. Overall, 91 children (30 per cent) could brush their own teeth (Levels A and B) and 209 children (70 per cent) could not (Levels C to F). There was a significant association between the toothbrushing ability and overall treatment need recommendations ( $\chi^2=30.428$ ,  $df=3$ ,  $p=0.000$ ), with significantly more children in Levels C to F requiring more complicated treatment and management. Overall, most children (62 per cent) had simple treatment and management needs, irrespective of their ability to brush their teeth.

#### **Discussion**

Caries prevalence in 12 year old Australian children without disabilities has decreased markedly with the mean DMFT falling from 4.8 in 1977 to 1.1 in 1993.<sup>15</sup> In Victoria, the mean DMFT for 9-11 year old children was 0.67 in 1997.<sup>16</sup> In the present study, the mean  $dmft+DMFT$  of 2.2 for 9-13 year old children with disabilities was higher than the national oral health target of 1.0 at age 12 years in 2000,<sup>17</sup> but was lower than the WHO global goal of 3.0 for 2000.<sup>18</sup> Using similar criteria, a study of children of similar age with physical disabilities in the UK reported similar caries experience ( $DMFT=2.0$ ) to the present findings, where most of the  $dmf+DMF$  index was in the

**Table 5. Distribution of children by dental status and needs for therapy, versus level of function**

Dental status and needs for therapy		Distribution of children by level of function (%) <sup>*</sup>						Total n=300
		(A) n=66	(B) n=25	(C) n=46	(D) n=33	(E) n=53	(F) n=77	
Periodontal status <sup>†</sup>	Healthy	9(14)	3(12)	5(11)	6(18)	6(11)	2(3)	31(10)
	With bleeding	31(47)	12(48)	14(30)	9(27)	29(55)	23(30)	118(39)
	With calculus	24(36)	9(36)	26(56)	17(51)	16(30)	44(57)	136(45)
	With pockets >4 mm	2(3)	1(4)	1(2)	1(3)	2(4)	8(10)	15(5)
Need for periodontal therapy	None	9(14)	3(12)	5(11)	6(18)	6(11)	2(3)	31(10)
	Oral hygiene instruction (OHI) only	31(47)	12(48)	14(30)	9(27)	29(55)	23(30)	118(39)
	OHI plus scale and prophylaxis (S and P)	25(38)	9(36)	26(56)	17(51)	17(32)	45(48)	139(46)
	Periodontal surgery plus OHI pls S and P	1(1)	1(4)	1(2)	1(3)	1(2)	7(9)	12(4)
Occlusion <sup>‡</sup>	No malocclusion	9(14)	2(8)	2(4)	1(3)	4(7)	6(8)	24(8)
	Minor occlusal irregularities	20(30)	6(24)	11(24)	7(21)	12(23)	11(14)	67(22)
	Moderate to severe malocclusion	34(51)	16(64)	31(67)	24(73)	36(68)	52(67)	193(64)
	Severe dentofacial anomalies	3(4)	1(4)	2(4)	1(3)	1(2)	8(10)	16(5)
Need for orthodontic therapy	None	25(38)	7(28)	8(17)	6(18)	10(19)	13(17)	69(23)
	Removable appliance therapy	4(6)	1(4)	5(11)	2(6)	6(11)	4(5)	22(7)
	Fixed appliance therapy	34(51)	16(64)	31(67)	24(73)	36(68)	52(67)	193(64)
	Appliance therapy plus orthognathic surgery	3(4)	1(4)	2(4)	1(3)	1(2)	8(10)	16(5)

<sup>\*</sup>Classification of level of function of subjects: (A) = fully independent; (B) = required assistance for one to four activities, but not toothbrushing; (C) = required assistance with toothbrushing; (D) = required assistance with toothbrushing plus one other activity; (E) required assistance with toothbrushing plus two or three activities; (F) = fully dependent.

<sup>†</sup>Periodontal status classified according to Community Periodontal Index of Treatment Needs (CPITN).<sup>13</sup>

<sup>‡</sup>Malocclusion status classified according to the Index of Orthodontic Treatment Needs (IOTN).<sup>14</sup>

decayed component (mean d+D=1.4).<sup>19</sup> In contrast, the mean number of decayed teeth in non-disabled 12 year old Australian children was 0.4,<sup>17</sup> indicating a lower level of untreated caries.

The caries experience was attributed to disability-related factors, including medications, diet and inadequate oral hygiene. Several children were on long-term xerostomic or sweetened medications, increasing their caries susceptibility. It was observed by the clinical examiner that the children regularly consumed sweet snacks between meals and carbonated beverages (used by the staff at some schools as behavioural and accomplishment rewards), and retained food debris was seen frequently in the mouths at examination. Preventive strategies involving carers and school staff need reinforcement to reduce this caries experience, and the implementation of intensive preventive programmes has been shown to be successful in improving the oral health of those with disabilities.<sup>3,20,21</sup>

The preventive and restorative treatment needs of many children in the present study were unmet. Dental care for those with disabilities should be given higher priority in public dental funding. Factors contributing to the unmet treatment needs include inadequate funding and resources, insufficient trained dentists to treat individuals with disabilities, and complex treatment needs requiring specialist care or general anaesthesia.<sup>22</sup> High unmet needs may also be indicative of the barriers to dental care experienced by individuals with disabilities, such as lack of access, fear and lack of motivation.<sup>1</sup>

The poorer gingival health in the children studied supports findings of others,<sup>18,23</sup> attributing it to

environmental, systemic and local factors.<sup>1,2</sup> Many of the children were on anti-epileptic medications (including phenytoin), which can induce gingival hyperplasia.<sup>24</sup> Local factors such as malocclusion, lack of normal masticatory functions, and attrition due to bruxism were more prevalent in those with severe disabilities; these have been suggested to contribute to periodontal disease and optimal oral hygiene is of particular importance in this group to limit disease onset.<sup>2</sup> Obstacles preventing these individuals from achieving good oral hygiene are lack of supervision/assistance, carer apathy toward dental health, greater carer concern with the disability, and unavailability of trained dentists.<sup>24</sup> The proportion of children requiring periodontal treatment in the present study was very high (90 per cent), and the major need was scaling and prophylaxis plus oral hygiene advice. Since most children were amenable to treatment in the dental chair, this could be provided by trained dental auxiliaries who could provide preventive care (such as prophylaxis, scaling, topical applications of fluoride and chlorhexidine, and placement of fissure sealants).

A high prevalence of malocclusion (92 per cent) was observed, supporting observations of others.<sup>4,23,25,26</sup> Children with Down syndrome and cerebral palsy represented 9 per cent and 21 per cent of the sample, respectively. A tendency to a Class III type skeletal base relationship in children with Down syndrome and a tendency to a Class II incisor relationship in children with cerebral palsy was observed, supporting the findings of others.<sup>23,25</sup> The need for orthodontic treatment in children with disabilities has not changed since the survey of Melbourne institutions for the disabled by Crack *et al.* found it was

**Table 6. Overall treatment need recommendations for children, versus ability to brush their own teeth**

Overall treatment need and management recommendations	Distribution of children by level of function (%)*						Total n=300
	(A) n=66	(B) n=25	(C) n=46	(D) n=33	(E) n=53	(F) n=77	
Regular dental examination oral hygiene by carer	2(3)	2(8)	1(2)	2(6)	8(15)	4(5)	19(6)
Simple: positive behaviour, in dental chair, local anaesthesia	57(86)	15(60)	30(65)	19(58)	17(32)	29(38)	167(56)
Moderate: variable behaviour, in dental chair, restraint and local anaesthesia	5(7)	5(20)	6(13)	6(18)	13(24)	24(31)	59(20)
Complex: negative behaviour, in hospital, general anaesthesia	2(3)	3(12)	9(19)	6(18)	15(28)	20(26)	55(18)
	Can brush own teeth (A) and (B) n=91 (%)		Cannot brush own teeth (C), (D), (E) and (F) n=209 (%)			Total children n=300 (%)	
Regular dental examination, oral hygiene by carer	4(4)		15(7)			19(6)	
Simple: positive behaviour, in dental chair, local anaesthesia	72(79)		95(45)			167(56)	
Moderate: variable behaviour, in dental chair, restraint and local anaesthesia	10(11)		49(23)			59(20)	
Complex: negative behaviour, in hospital, general anaesthesia	5(5)		50(24)			55(18)	

\*Classification of level of function of subjects: (A) = fully independent; (B) = required assistance for one to four activities, but not toothbrushing; (C) = required assistance with toothbrushing; (D) = required assistance with toothbrushing plus one other activity; (E) required assistance with toothbrushing plus two or three activities; (F) = fully dependent.

unnecessary.<sup>7</sup> Malocclusion can complicate the child's disability, resulting in dental trauma (for example, a large overjet predisposes trauma in those with seizures), periodontal disease (promoted by crowding or eruption problems), functional problems (for example, mastication, drooling), speech impairment and even temporomandibular joint dysfunction.<sup>23,26</sup> Of note, although 70 per cent of the 300 children in the present study had malocclusion, only one child was undergoing orthodontic treatment at the time of the examination.

Although no assessment of orthodontic suitability was made, conventional treatment may not be feasible for many of those studied due to behaviour or medical problems where orthodontic treatment may pose an additional risk.<sup>22</sup> The child's cooperation is important in the treatment of severe skeletal malocclusion.<sup>24</sup> Removable orthodontic appliances require compliance and fixed appliances may require general anaesthesia for successful application in this population. There is a limit to the number of general anaesthetic exposures that should be given to such individuals within the time frame of orthodontic treatment. Decisions on orthodontic therapy should include consideration of the extent to which the malocclusion handicaps the individual. Many children with disabilities have been treated successfully, and the same methods of preparing these children for general dentistry can be used for orthodontic treatment. Even if an ideal orthodontic result is not possible, compromises can be achieved in guiding the developing occlusion for those with tooth-size/arch-size discrepancies or abnormal exfoliation or eruption patterns.<sup>24</sup> Well-timed extractions may produce an acceptable occlusion without other therapy or with the addition of a simple appliance.<sup>24</sup> A few children in the present study had severe dentofacial anomalies. In the past

this group was neglected, but with recent surgical advances significant changes have occurred in aesthetic techniques and the use of rigid fixation.<sup>25</sup> These procedures are now safer and more available for those with disabilities.<sup>27</sup> Recent European reports have shown successful use of biofunctional appliances at an early age for the management of malocclusion and drooling in children with cerebral palsy (Storhaug K, personal communication, September 1998).

Several studies have reported that treatment under general anaesthesia allows improved quality of restorative treatment for individuals with disabilities.<sup>7,23</sup> Observing that children with cerebral palsy had more poor quality restorations than the controls, Pope and Curzon commented that higher quality restorative treatment might have been achieved if it had been performed under general anaesthesia or by paediatric dentistry specialists.<sup>23</sup> General anaesthesia should be used for first-line treatment to address the restorative backlog; continuing efforts should be made thereafter to secure cooperation once the child has been rendered dentally fit and integrated into a preventive programme not reliant upon the use of general anaesthesia.<sup>5,22,24</sup>

In assessing the oral health status of those with disabilities, functional ability may be more important than the medical diagnosis.<sup>28</sup> The profoundness of the disability and its effect on the child's ability to accept dental treatment or use preventive measures may influence disease more than the disability.<sup>28</sup> For example, two patients with Down syndrome may appear similar and have similar intelligence but one may accept treatment readily while the other may need general anaesthesia for the simplest treatment. In the present study, the recommendations were based on the child's likely cooperation and the type

and amount of dental treatment required. The categories were subjective, and it may be that with behaviour management techniques, a child might accept treatment despite being assessed otherwise at examination.

This study showed a tendency for children who were more dependent on carers for self-care activities to have higher levels of disease and higher treatment needs. Those requiring toothbrushing assistance had poorer oral hygiene and more periodontal disease than those able to brush their teeth, reflecting the inadequacy with which oral care may be provided by carers.<sup>1,20,24</sup> However, oral hygiene is not the sole determinant of periodontal disease; dependency, disability type and host factors may also contribute.<sup>1</sup> Dependent children attending SDS were more severely disabled, and their compromised physical state may be associated with lower resistance to local periodontal irritants, such as plaque and calculus.<sup>1</sup> Irrespective of the function level, oral hygiene should be supervised or performed by a carer, otherwise it can take low priority among the daily activities performed at school and home.<sup>20</sup> It may be difficult to judge the skills of a child who can manage some tasks on his/her own and both carers and dentists may misjudge how much toothbrushing assistance is needed. This was evident in a study by Storhaug and Holst where partly dependent children had a tendency to higher adjusted DMFT than both the fully independent or fully dependent groups.<sup>20</sup> Children with mild to moderate disability can be instructed in oral hygiene and can perform such procedures with encouragement and motivation by staff.<sup>29</sup> Acknowledgement of the importance of oral health care does not ensure implementation of a preventive programme; a successful programme requires the best efforts of the children, staff and dental team.<sup>22</sup>

On the basis of this study, eight recommendations are made concerning the public dental health care of children and adolescent with disabilities.

1. Greater coordinated efforts should be made between the dental, medical, and social services to serve their needs.

2. Individualized recall visits by dental teams to schools should be introduced to perform preventive measures, particularly for those individuals at high risk for caries and/or periodontal diseases.

3. Trained dental auxiliaries should be utilized. Following examination, diagnosis and treatment planning by a dentist, a trained auxiliary could provide preventive care, simple restorations, fissure sealants, oral hygiene instruction and oral health promotion.

4. Access to general dental, specialist paediatric dental, and orthodontic services should be improved, and referral mechanisms established whereby high risk children can obtain priority

treatment.

5. Campaigns should be launched to decrease dental disease, including changing school diets to limit cariogenic intake, developing alternative rewards to sweets, instituting preventive training programmes for staff and other carers, and developing lay literature.

6. Education in the care of individuals with disabilities should be expanded in dental schools, and continuing education should be established for upgrading professional knowledge.

7. A national epidemiological survey should be conducted by experts in public dental health in order to prepare and implement a long-range public dental health care plan.

8. The efficacy of the implementation of this plan should be evaluated subsequently in terms of oral health of the recipients.

## Conclusions

Based on a survey of 300 children aged 9-13 years with disabilities attending special and special developmental schools in Melbourne, it is concluded that despite 41 per cent requiring simple treatment, the preventive, restorative, and periodontal treatment needs of many are unmet and their experience of caries, periodontal disease and malocclusion exceeds that of children without disabilities. Assessment of level of function could assist staff in triaging individuals for urgent dental examination. Following examination, diagnosis and treatment planning by a dentist, much of the preventive, simple restorative, and periodontal treatment could be performed by trained dental auxiliaries. Most children (70 per cent) required assistance with oral hygiene. Children more dependent on carers for self-care activities tended to have higher levels of dental disease and higher unmet needs. An epidemiological survey followed by the implementation and evaluation of a long-range public dental health care plan for children and adolescents with disabilities is needed urgently.

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