Dental Treatment Needs and Related Risk Factors among School Children with Special Needs in Taiwan

Szu-Yu Hsiao 1,2, Ping-Ho Chen 2, Shan-Shan Huang 1, Cheng-Wei Yen 1, Shun-Te Huang 1,3, Shu-Yuan Yin 4 and Hsiu-Yueh Liu 3,5,*

1 Division of Pediatric Dentistry and Special Needs Dentistry, Department of Dentistry, Kaohsiung Medical University Hospital, Kaohsiung 807377, Taiwan; szyuhs@kmu.edu.tw (S.-Y.H.); 1070480@kmuh.org.tw (S.-S.H.); 1040474@kmuh.org.tw (C.-W.Y.); shunteh@kmu.edu.tw (S.-T.H.)
2 School of Dentistry, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung 807378, Taiwan; phchen@kmu.edu.tw
3 Department of Oral Hygiene, College of Dental Medicine, Kaohsiung Medical University, Kaohsiung 807378, Taiwan
4 Department of Nursing, Fooyin University, Kaohsiung 831301, Taiwan; EN006@fy.edu.tw
5 Department of Medical Research, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung 807377, Taiwan
* Correspondence: hyliu@kmu.edu.tw; Tel.: +886-7-3121101x2209x64; Fax: +886-7-3210637

Abstract: The purpose of this study was to assess dental treatment needs (TNs) and related risk factors of children with disabilities (CD). This cross-sectional study recruited 484 CD, 6 to 12 years of age, from 10 special education schools in Taiwan. Dental status and TNs were examined and evaluated by well-trained dentists and based on the criteria set by the World Health Organization (1997). The results indicated that 61.78% required restorative dental treatment due to their dental caries. On average, each participant had 2.72 teeth that required treatment, and 6.38 surfaces required restoration. One-quarter of the participants (24.79%) required 1- or 2-surface restoration, and one out of three (36.98%) had more complex TNs (including 3 or more surfaces to be filled, pulp care, extraction, and more specialized care). The significant risk factors associated with restorative TNs among CD were those whose parents had lower socioeconomic status, frequent sweets intake, insufficient tooth-brushing ability, and poor oral health. Most of the CD had extensive unmet TNs for their caries and required complex treatment to recover the function of their teeth. Encouraging parents/caregivers to take their children for dental treatment, promoting awareness of the importance of dental hygiene, giving assistance to brushing their teeth after eating, and controlling and/or modifying sweet diet habits are necessary to reduce CD’s dental caries, especially those with lower socioeconomic status parents/caregivers.

Keywords: disability; children; oral health; caries; dental treatment

1. Introduction

People with disabilities usually suffer from a significantly higher prevalence of poor dental hygiene, plaque accumulation, dental caries, gingivitis, and periodontal disease than the ordinary population, and it gets worse with increasing age [1–6]. The top three medical care departments most frequently visited by people with intelligence disabilities in Taiwan are internal medicine (24.4%), psychiatry (16.7%), and dentistry (13.8%), as opposed to surgery, family medicine, and obstetrics and gynecology, which are utilized mainly by the general population [7]. People with disabilities have higher dental treatment needs (TNs) caused by secondary conditions as opposed to the general population, who seek and receive healthcare services regularly. According to Healthy People 2010 in the USA, secondary conditions refer to the problems related to medical, social, emotional, family, or community problems that a person with a primary disabling condition may encounter in his/her life [8]. It often aggravates and/or lessens their life quality in terms of health.
of physical, psychosocial, and social functions and increases the burden of health care on their parents, family members, or other caregivers with limited resources. Koritsas & Iacono reported that people with disabilities experienced an average of 11.3 secondary conditions (including medical complications, psychiatric disorders, environmental and quality-of-life issues, and difficulties with access to medical care/centers) during their development [9]. Secondary conditions often cause significant limitations, including reading difficulties, communication, physical fitness–conditioning, personal hygiene–appearance, weight, dental and oral hygiene, and memory problems [9]. Dental and oral hygiene is one of the significant limitations which is caused by secondary conditions.

A previous study reported that the greatest unmet health needs of people with disabilities are unmet dental treatment [10]. Studies have shown that children with disabilities (CD) usually receive less restorative care compared to the general population [11–15]. People with disabilities cannot express their physical discomfort properly because of their physical, intellectual, and psychological barriers. Long-term neglect of TNs, with increasing severity and complexity of oral diseases, leads to delay of time-sensitive, necessary treatment [16]. A previous study reported that only 32.37% of decayed teeth received restorative treatment among 6- to 12-year-old CD, and it was significantly lower than the ordinary population (47.72%) in Taiwan [17–19]. It reveals that the dental TNs for those children are unmet.

Dental treatment is a basic component of rehabilitation for CD, and it is difficult for dentists to perform [20]. The majority of children with special needs can be adequately treated using non-pharmacologic behavior management such as the tell-show-do technique [14,21]. Disabled people who have extensive and severe dental problems very often cannot cooperate well during the dental treatment process, and the treatment has to be performed by pharmacological behavior management techniques such as nitrous oxide/oxygen sedation, oral sedation, or general anesthesia (GA) to achieve higher quality treatment [14,22,23]. In order to avoid oral diseases’ worsening and to provide CD with effective dental treatment services, it is helpful to provide appropriate baseline information regarding trends in unmet needs and related risk factors so as to make proper decisions to improve the oral health status of CD. Thus, the present study was carried out in an attempt to determine the unmet dental TNs and related factors of children with various disabilities in primary schools for CD in Taiwan.

2. Method

2.1. Study Design and Sample Characteristics

This cross-sectional study recruited 484 children, aged from 6 to 12 years old (mean age = 9.47 ± 2.06 years old), from 10 out of 18 special education primary schools in Taiwan. According to the definition of the Physically and Mentally Disabled Citizens Protection Act [24], people with disabilities refers to those who are limited or restricted from engagement in ordinary living activities and participation in society. All the participants have been evaluated by a committee composed of professionals from medicine, social work, special education, and employment counseling. After evaluation, they receive certificates that prove their classification and severity of disabilities after the processes of evaluation and assessment.

The CD were categorized according to their disability certificates in this study, which included vision disability (VD); hearing, voice or speech mechanism disability (HVD); intellectual disability (ID); and multiple disabilities (MD). MD means at least two or more types of impairment. The participants of this study included the certified MD children with ID and at least one or more co-occurring conditions. These conditions included vision disability, hearing mechanism disability, limb disability, etc.

2.2. Ethical Approval

This study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Kaohsiung Medical University Hospital (Protocol number: KMUH-IRB-950125). The study purpose, procedures, and contents of
the survey were explained to the parents or guardians of all CD, and written consent was obtained from parents or guardians who agreed to allow their children to participate.

2.3. Data Collection

2.3.1. Oral Examination

Examination of the oral health status of study participants was carried out using a disposable dental mirror (Prosperity Island Medical Dressing Co, Ltd., Changhua, Taiwan), a standard dental explorer (CP-11.5B6, Hu-Freidy, Chicago, IL, USA), and a flashlight, and with the help of nursing staff in the classroom, lobby, auditorium, or other open space of the schools. An oral examination of the oral health status of study participants was performed in accordance with the methods and criteria of the World Health Organization [25], carried out by six well-trained dentists (S.-T.H., S.-Y.H., C.-Y.J., B.-M.C., C.-C.C., R.-C.T.) who were evaluated prior to the survey by a senior dentist (gold standard: S.T.H.) with abundant clinical experience, and achieved acceptable reliability and inter-examiner agreement with a Kappa score between 0.80 and 0.84 (0.81, 0.84, 0.80, 0.80, and 0.82) between each two dentists.

The oral examination and records were determined on the basis of a maximum of 20–28 teeth for primary, mixed, or permanent dentition up to 12 years old. Unmet dental TNs were evaluated using dmt + DMT and dms + DMS indices to record numerically the number of unmet dental treatment teeth and surfaces. The dmt + DMT index is a sum of decayed teeth number (dt + DT) and missing teeth number (mt + MT) of mixed dentition. The dms + DMS index is a sum of decayed teeth surfaces (ds + DS) and missing surfaces (dm + DM) of mixed dentition. These two indices provide the consequences of untreated caries and present an aggregate value of current dental TNs.

Plaque and gingivitis indices were evaluated on 6 indicative surfaces (buccal side of 4 teeth and lingual side of 2 teeth) with the naked eye and a CPI explorer (CP-11.5B6, Hu-Freidy, Chicago, IL, USA). The 4 buccal surfaces selected for inspection were from 2 posterior teeth (tooth numbers 55 or 17/16 and 65 or 26/27) and 2 anterior teeth (tooth numbers 51 or 11 and 71 or 31). The 2 lingual surfaces selected for inspection were from 2 posterior teeth of the mandible (tooth numbers 85 or 47/46 and 75 or 36/37). The value of the poorest surface situation prevailed.

Plaque index (PI) was assessed according to criteria modified from Greene and Vermillion [26] and marked as: 0 = no plaque; 1 = plaque covering not more than one-third of the exposed tooth surface; 2 = plaque covering more than one-third, but not more than two-thirds, of the exposed tooth surface; and 3 = plaque covering more than two-thirds of the exposed tooth surface. The tooth surface with the worst plaque of six teeth was recorded as a whole-mouth oral hygiene score for each participant. Gingivitis index (GI) was assessed by inspection of the following and tendency toward spontaneously bleeding criteria: 0 = healthy; 1 = mild gingivitis—no bleeding on probing; 2 = moderate gingivitis—bleeding on probing; 3 = severe gingivitis—ulceration [27]. The most-inflamed gingival surface of six teeth was identified as a whole gingivitis severity score for each participant. The PI and GI were classified into yes (score ≥ 1) and no (score = 0) for statistical analysis, respectively.

The dental TNs of each child were categorized as simple, moderate, and complex based on the following criteria [12,28]: simple = child had no caries and required no restorative treatment, but required assistance with oral hygiene and preventive treatment such as oral hygiene instruction (OHI), scaling, application of topical fluoride, and/or fissure sealants; moderate = one or more teeth caries and required one and/or two surface restorations; complex = one or more teeth caries and required three or four surface restorations/stainless steel crowns, endodontic therapy/crown, extraction, and/or prosthodontics.

2.3.2. Questionnaire

The self-report questionnaire was completed by the parents or guardians of the participants. The questionnaire consisted of close-ended items and was constructed in three
parts: demographic data and family characteristics, sweet intake habits, and tooth-brushing habits of the participant. Sweet foods were considered as highly fermentable carbohydrates made with rich sugar to add a sweet taste such as chocolate, candy, cake, baked goods, ice cream, carbonated beverages, juice, milk with sugar, and chewing gum with sugar. The definition of the classification of parents’ educational and occupation levels referred to the publications of Liu et al. [18]. The parents’ educational levels were classified as follows: both low, one low and one high, or both high. The parents’ occupation levels were divided into both unskilled, one unskilled and one skilled, or both skilled.

2.4. Statistical Analysis

All data were analyzed with JMP version 14 (SAS Institute, Cary, NC, USA). Categorical variables in a group were compared using Pearson’s $\chi^2$ test and Fisher’s exact test and were presented as frequency and percentage, and the differences between numerical variables were analyzed using a $t$-test and one-way analysis of variance (ANOVA) and presented as the mean and standard deviation (SD). Both univariate and multivariate logistic regression models were estimated to assess the unadjusted and adjusted associations of a preset independent variable with TNs of dental caries. Only the independent variable, as the risk factor that was found to be significantly associated with dental TNs in the univariate logistic regression, was included in the multiple logistic regression models. A significance level of the $p$-value was set at 5%.

3. Results

The younger children had statistically significantly higher TNs of decayed teeth and surfaces than the older ones (all $p < 0.001$). We found that children with HVD had the highest TNs of teeth (3.48 ± 3.74) and surfaces (8.89 ± 11.57) compared to children with VD (1.87 ± 2.87 and 4.14 ± 8.59) ($p = 0.023$ and $p = 0.030$). The children with mild/moderate disabilities or with HVD had a statistically significantly higher decayed teeth and surfaces need for dental treatment than those with the other severities of disabilities or classifications of disabilities ($p = 0.017$ and $p = 0.016$). TN of surfaces statistically significantly decreased when the parents had higher educations or the parents’ occupations tended to be skilled ($p = 0.023$ and $p = 0.018$). The results also showed the CD who asked for sweets, frequently had sweets, had independent tooth-brushing abilities, or infrequently brushed their teeth every day tended to have statistically significantly higher decayed teeth and surfaces for treatment (all $p < 0.05$) (Table 1).

Table 1. Dental treatment needs of teeth and surfaces by demographics and dietary and tooth-brushing habits among children with disabilities.

| Variable                      | N  | Teeth for Treatment Need | $p$-Value | Surfaces for Treatment Need | $p$-Value |
|-------------------------------|----|--------------------------|-----------|-----------------------------|-----------|
|                               |    | Mean (SD)                |           | Mean (SD)                   |           |
| Total                         | 484| 2.72 (3.64)              |           | 6.38 (10.50)                |           |
| Age                           |    |                         |           |                             |           |
| 6–7 years old                 | 145| 4.23 (4.71)              | <0.001    | 10.32 (14.21)               | <0.001    |
| 8–9 years old                 | 126| 2.86 (3.48)              |           | 6.41 (9.72)                 |           |
| 10–12 years old               | 213| 1.71 (2.33)              |           | 3.69 (6.37)                 |           |
| Gender                        |    |                         |           |                             |           |
| Male                          | 297| 2.64 (3.49)              | 0.330     | 6.09 (10.35)                | 0.439     |
| Female                        | 187| 2.97 (3.87)              |           | 6.85 (10.74)                |           |
| Severity of disability        |    |                         |           |                             |           |
| Mild/moderate                 | 111| 3.51 (4.02)              | 0.023     | 8.69 (12.10)                | 0.018     |
| Severe/profound               | 373| 2.54 (3.50)              |           | 5.70 (9.89)                 |           |
| Classification of disability  |    |                         |           |                             |           |
| Vision disability             | 70 | 1.87 (2.87)              | 0.023     | 4.14 (8.59)                 | 0.030     |
| Hearing, voice, or speech disability | 87 | 3.48 (3.74) | 8.89 (11.57) | |
Table 1. Cont.

| Variable                                | N     | Teeth for Treatment Need | p-Value | Surfaces for Treatment Need | p-Value |
|-----------------------------------------|-------|--------------------------|---------|-----------------------------|---------|
|                                         | Mean  | (SD)                     |         | Mean                        | (SD)    |
| Intelligence disability                 | 115   | 2.82 (3.58)              | 6.78    | 10.69                       |
| Multiple disabilities                   | 212   | 2.74 (3.82)              | 5.88    | 10.37                       |
| Parents’ educational level              |       |                          |         |                             |
| Both low/one low, one high              | 250   | 2.96 (3.59)              | 0.039   | 7.22                        | (11.01) |
| Both high                               | 200   | 2.27 (3.34)              | 4.88    | 9.41                        |
| Parents’ occupation                     |       |                          |         |                             |
| Both unskilled                          | 196   | 2.98 (3.53)              | 0.065   | 7.17                        | (10.64) |
| One unskilled, one skilled              | 129   | 2.49 (3.15)              | 5.09    | (8.30)                      |
| Both skilled                            | 80    | 1.98 (3.06)              | 3.98    | (7.56)                      |
| Ask for sweets                          |       |                          |         |                             |
| No                                      | 304   | 2.32 (3.17)              | 0.001   | 5.12                        | (9.08)  |
| Yes                                     | 169   | 3.54 (4.26)              | 8.59    | (12.21)                     |
| Frequency of sweets intake              |       |                          |         |                             |
| Never/sometimes                         | 116   | 1.56 (2.29)              | <0.001  | 3.07                        | (6.15)  |
| At least once a week                    | 221   | 3.22 (4.11)              | 7.43    | (11.65)                     |
| At least once a day                     | 118   | 3.19 (3.60)              | 7.69    | (10.35)                     |
| Sweets as a reward in behavior control  |       |                          |         |                             |
| No                                      | 283   | 2.25 (3.05)              | 0.002   | 4.83                        | (8.66)  |
| Yes                                     | 171   | 3.41 (4.10)              | 8.24    | (11.79)                     |
| Appetite                                |       |                          |         |                             |
| Good                                    | 380   | 2.54 (3.46)              | 0.020   | 5.65                        | (9.93)  |
| Poor                                    | 104   | 3.59 (4.15)              | 9.07    | (12.06)                     |
| Tooth-brushing ability                  |       |                          |         |                             |
| Independent                             | 308   | 3.10 (3.83)              | 0.004   | 7.22                        | (11.03) |
| Dependent                               | 155   | 2.12 (3.13)              | 4.79    | (9.13)                      |
| Frequency of tooth-brushing each day    |       |                          |         |                             |
| Sometimes                               | 15    | 4.73 (5.87)              | 0.036   | 12.60                       | (17.82) |
| 1–2 times                               | 353   | 2.84 (3.59)              | 6.63    | (10.49)                     |
| ≥3 times, after meals                   | 95    | 2.22 (3.27)              | 4.62    | (8.48)                      |

Overall, one-fourth of the children needed moderate treatment for one or two surface fillings, and more than one-third of the children needed complex treatment such as three or more surface fillings, pulp care, or crowns (Table 2). Dental treatment modalities had a statistically significantly positive association with age, severity of disability, parents’ educational and occupation levels, asking for sweets, frequency of sweets intake, sweets as a reward for behavior control, and tooth-brushing ability of the participants (all $p < 0.05$). The dental TN modality of children with mild/moderate disability was statistically significantly more complex than those with severe/profound disability ($p = 0.009$). The higher the educational or occupational level of the parents, the less and simpler the dental TN modalities of their children ($p = 0.015$ and $p = 0.045$). Dental treatment modalities had a statistically significant positive association with the behaviors of asking for sweets and frequency of eating sweets ($p = 0.021$ and $p = 0.001$) among CD.

In order to better understand the participants, we further compared the oral status, demographics, sweet intake, and daily tooth-brushing habits among different disabilities, as shown in Table 3. We found the VD children had the lowest proportion of plaque and gingivitis ($p = 0.036$ and $p < 0.001$, respectively) than other disabled children. The MD children asked for sweets less, and their daily tooth-brushing is hard to perform by themselves. Less of the VD children’s behavior was controlled by giving sweets as a reward than the others. Compared with other disabled children, the HVD children had a statistically significantly lower rate (8.24%) of brushing their teeth three or more-than-three times a day ($p < 0.001$).
Table 2. Dental treatment modalities by demographics and dietary and tooth-brushing habits among children with disabilities.

| Variable                              | N   | Simple | Moderate | Complex | p-Value |
|---------------------------------------|-----|--------|----------|---------|---------|
|                                       |     |        |          |         |         |
| Total                                 | 484 | 185    | 120      | 179     |         |
|                                       |     | (38.22)| (24.79)  | (36.98) |         |
| Age                                   |     |        |          |         |         |
| 6-7 years old                         | 145 | 43     | 34       | 68      | 0.025   |
|                                       |     | (23.24)| (23.83)  | (37.99) |         |
| 8-9 years old                         | 126 | 48     | 32       | 46      | (25.70) |
|                                       |     | (25.95)| (26.67)  | (25.70) |         |
| 10-12 years old                       | 213 | 94     | 54       | 65      | (36.31) |
|                                       |     | (50.81)| (45.00)  | (36.31) |         |
| Gender                                |     |        |          |         |         |
| Male                                  | 297 | 118    | 74       | 105     | 0.602   |
|                                       |     | (36.22)| (61.67)  | (58.66) |         |
| Female                                | 187 | 67     | 46       | 74      | (41.34) |
|                                       |     | (36.22)| (38.33)  | (41.34) |         |
| Severity of disability               |     |        |          |         |         |
| Mild/moderate                         | 111 | 31     | 26       | 54      | 0.009   |
|                                       |     | (16.76)| (21.67)  | (30.17) |         |
| Severe/profound                       | 373 | 154    | 94       | 125     | (69.83) |
|                                       |     | (83.24)| (78.33)  | (30.17) |         |
| Classification of disability         |     |        |          |         |         |
| Vision disability                    | 70  | 33     | 16       | 21      | 0.909   |
|                                       |     | (17.84)| (13.33)  | (11.73) |         |
| Hearing, voice, or speech disability | 87  | 25     | 20       | 42      | (23.46) |
|                                       |     | (13.51)| (16.67)  | (23.46) |         |
| Intelligence disability              | 115 | 38     | 30       | 47      | (26.26) |
|                                       |     | (20.54)| (25.00)  | (26.26) |         |
| Multiple disabilities                | 212 | 89     | 54       | 69      | (38.55) |
|                                       |     | (48.11)| (45.00)  | (38.55) |         |
| Parents’ educational level           |     |        |          |         |         |
| Both low/one low, one high           | 250 | 83     | 62       | 105     | 0.015   |
|                                       |     | (47.43)| (57.41)  | (62.87) |         |
| Both high                            | 200 | 92     | 46       | 62      | (37.13) |
|                                       |     | (52.57)| (26.29)  | (37.13) |         |
| Parents’ occupation                  |     |        |          |         |         |
| Both unskilled                       | 196 | 62     | 54       | 80      | 0.045   |
|                                       |     | (40.79)| (52.94)  | (52.98) |         |
| One unskilled, one skilled           | 129 | 49     | 34       | 46      | (30.46) |
|                                       |     | (32.24)| (33.33)  | (30.46) |         |
| Both skilled                         | 80  | 41     | 14       | 25      | (16.56) |
|                                       |     | (26.97)| (13.73)  | (16.56) |         |
| Ask for sweets                        |     |        |          |         |         |
| No                                    | 304 | 130    | 73       | 101     | 0.021   |
|                                       |     | (71.43)| (63.48)  | (57.39) |         |
| Yes                                   | 169 | 52     | 42       | 75      | (42.61) |
|                                       |     | (28.57)| (36.52)  | (42.61) |         |
| Frequency of sweets intake            |     |        |          |         |         |
| Never/sometimes                       | 116 | 60     | 27       | 29      | (17.37) |
|                                       |     | (34.29)| (23.89)  | (17.37) |         |
| At least once a week                  | 221 | 75     | 64       | 82      | (49.10) |
|                                       |     | (42.86)| (56.64)  | (49.10) |         |
| At least once a day                   | 118 | 40     | 22       | 56      | (33.53) |
|                                       |     | (22.86)| (19.47)  | (33.53) |         |
| Sweets as a reward in behavior control|     |        |          |         |         |
| No                                    | 283 | 120    | 72       | 91      | 0.043   |
|                                       |     | (68.18)| (63.72)  | (55.15) |         |
| Yes                                   | 171 | 56     | 41       | 74      | (44.85) |
|                                       |     | (31.82)| (36.28)  | (44.85) |         |
| Appetite                              |     |        |          |         |         |
| Good                                  | 380 | 154    | 93       | 133     | 0.110   |
|                                       |     | (83.24)| (77.50)  | (74.30) |         |
| Poor                                  | 104 | 31     | 27       | 46      | (25.70) |
|                                       |     | (16.76)| (22.50)  | (25.70) |         |
| Tooth-brushing ability                |     |        |          |         |         |
| Independent                           | 308 | 104    | 80       | 124     | 0.010   |
|                                       |     | (58.10)| (71.43)  | (72.09) |         |
| Dependent                             | 155 | 75     | 32       | 48      | (27.91) |
|                                       |     | (41.90)| (28.57)  | (27.91) |         |
| Frequency of tooth-brushing each day  |     |        |          |         |         |
| Sometimes                             | 15  | 5      | 4        | 6       | (3.49)  |
|                                       |     | (2.79)| (3.57)   | (3.49)  |         |
| <3 times                              | 353 | 135    | 87       | 131     | (76.16) |
|                                       |     | (75.42)| (77.68)  | (76.16) |         |
| ≥3 times, after meals                 | 95  | 39     | 21       | 35      | (20.35) |

Multiple logistic regression models showed the major risk factors for restorative TNs among CD were their intake of sweets at least once a week (AOR = 2.45, 95% CI = 1.48–4.11, p = 0.001) or more frequently than those who never or sometimes consumed sweets. The other risk factors—significantly related to children’s poor oral health were having gingivitis (AOR = 1.94, 95% CI = 1.22–3.11, p = 0.006) and insufficient ability to brush their teeth without assistance from parents/caregivers (AOR = 1.95, 95% CI = 1.19–3.22, p = 0.008) (Table 4).
Table 3. Demographics, dietary and tooth-brushing habits, and oral hygiene status by classification of disability among children with disabilities.

| Variable                        | VD  | HVD | ID  | MD  | p-Value |
|---------------------------------|-----|-----|-----|-----|---------|
|                                | n  | %  | n  | %  | n  | %  | n  | %  |    |
| Total                           | 70 | 13.08 | 87 | 16.26 | 115 | 21.50 | 212 | 42.43 |    |
| Age                             |    |      |    |      |    |      |    |      |    |
| 6–7 years old                   | 13 | (18.57) | 26 | (29.89) | 34 | (29.57) | 75 | (33.96) | 0.256 |
| 8–9 years old                   | 25 | (35.71) | 22 | (25.29) | 27 | (23.48) | 52 | (24.53) |    |
| 10–12 years old                 | 32 | (45.71) | 39 | (44.83) | 54 | (46.96) | 88 | (41.51) |    |
| Gender                          |    |      |    |      |    |      |    |      |    |
| Male                            | 39 | (55.71) | 60 | (68.97) | 76 | (66.09) | 122 | (57.55) | 0.142 |
| Female                          | 31 | (44.29) | 27 | (31.03) | 39 | (33.91) | 90 | (42.45) |    |
| Severity of disability         |    |      |    |      |    |      |    |      |    |
| Mild/moderate                   | 6  | (8.57) | 27 | (31.03) | 67 | (58.26) | 11 | (5.19) | <0.001 |
| Severe/profound                 | 64 | (91.43) | 60 | (68.97) | 48 | (41.74) | 201 | (94.81) |    |
| Parents’ educational level      |    |      |    |      |    |      |    |      |    |
| Both low/one low, one high      | 38 | (55.88) | 55 | (68.75) | 72 | (69.23) | 85 | (42.93) | <0.001 |
| Both high                       | 30 | (44.12) | 25 | (31.25) | 32 | (30.77) | 113 | (57.07) |    |
| Parents’ occupation             |    |      |    |      |    |      |    |      |    |
| Both unskilled                  | 16 | (29.63) | 42 | (54.55) | 58 | (62.37) | 80 | (44.20) | 0.006 |
| One unskilled, one skilled      | 22 | (40.74) | 21 | (27.27) | 24 | (25.81) | 62 | (34.25) |    |
| Both skilled                    | 16 | (29.63) | 14 | (18.18) | 11 | (11.83) | 39 | (21.55) |    |
| Ask for sweets                  |    |      |    |      |    |      |    |      |    |
| No                              | 44 | (63.77) | 47 | (54.65) | 67 | (59.82) | 146 | (70.87) | 0.039 |
| Yes                             | 25 | (36.23) | 39 | (45.35) | 45 | (40.18) | 60 | (29.13) |    |
| Frequency of sweets intake      |    |      |    |      |    |      |    |      |    |
| Never/sometimes                 | 19 | (29.23) | 15 | (17.86) | 19 | (17.59) | 63 | (31.82) | 0.004 |
| At least once a week             | 37 | (56.92) | 46 | (54.76) | 50 | (46.30) | 88 | (44.44) |    |
| At least once a day              | 9  | (13.85) | 23 | (27.38) | 39 | (36.11) | 47 | (23.74) |    |
| Sweets as a reward in behavior  |    |      |    |      |    |      |    |      |    |
| control                         |    |      |    |      |    |      |    |      |    |
| No                              | 47 | (73.44) | 54 | (65.06) | 63 | (58.88) | 119 | (59.50) | 0.183 |
| Yes                             | 17 | (26.56) | 29 | (34.94) | 44 | (41.12) | 81 | (40.50) |    |
| Appetite                        |    |      |    |      |    |      |    |      |    |
| Good                            | 45 | (64.29) | 70 | (80.46) | 99 | (86.09) | 166 | (78.30) | 0.006 |
| Poor                            | 25 | (35.71) | 17 | (19.54) | 16 | (13.91) | 46 | (21.70) |    |
| Tooth-brushing ability          |    |      |    |      |    |      |    |      |    |
| Independent                     | 67 | (97.10) | 74 | (87.06) | 77 | (71.30) | 90 | (44.78) |    |
| Dependent                       | 2  | (2.90) | 11 | (12.94) | 31 | (28.70) | 111 | (55.22) | <0.001 |
| Frequency of tooth-brushing      |    |      |    |      |    |      |    |      |    |
| each day                        |    |      |    |      |    |      |    |      |    |
| Sometimes                       | 1  | (1.45) | 1  | (1.18) | 5  | (4.63) | 8  | (3.98) | <0.001 |
| <3 times                        | 35 | (50.72) | 77 | (90.59) | 88 | (81.48) | 153 | (76.12) |    |
| ≥3 times, after meals           | 33 | (47.83) | 7  | (8.24) | 15 | (13.89) | 40 | (19.90) |    |
| Plaque                          |    |      |    |      |    |      |    |      |    |
| Yes                             | 48 | (69.57) | 74 | (87.06) | 97 | (89.81) | 168 | (79.25) | 0.036 |
| No                              | 22 | (31.43) | 13 | (15.29) | 18 | (16.76) | 44 | (20.75) |    |
| Gingivitis                      |    |      |    |      |    |      |    |      |    |
| Yes                             | 22 | (31.43) | 52 | (59.77) | 68 | (59.13) | 92 | (42.45) | <0.001 |
| No                              | 48 | (68.57) | 35 | (40.23) | 47 | (40.87) | 120 | (57.55) |    |
Table 4. Logistic regression models of risk factors associated with restorative treatment needs among children with disabilities.

| Variable                                      | COR \(^a\) | 95% CI         | p-Value | AOR \(^b\) | 95% CI         | p-Value |
|-----------------------------------------------|------------|----------------|---------|------------|----------------|---------|
| Gender                                        |            |                |         |            |                |         |
| Female (vs. Male)                             | 1.18       | (0.81, 1.73)   | 0.390   | 1.17       | (0.73, 1.87)   | 0.517   |
| Age                                           |            |                |         |            |                |         |
| 6–7 years old (vs. 10–12 years old)           | 1.71       | (1.13, 2.61)   | 0.012   | 2.55       | (1.45, 4.58)   | 0.002   |
| 8–9 years old (vs. 10–12 years old)           | 1.01       | (0.66, 1.54)   | 0.973   | 1.25       | (0.71, 2.19)   | 0.439   |
| Severity of disability                        |            |                |         |            |                |         |
| Mild/moderate (vs. severe/profound)           | 1.81       | (1.15, 2.92)   | 0.012   |            |                |         |
| Classification of disability                 |            |                |         |            |                |         |
| Hearing, voice, or speech disability (vs. vision disability) | 1.67       | (1.02, 2.82)   | 0.046   |            |                |         |
| Intelligence disability (vs. vision disability) | 1.34       | (0.87, 2.10)   | 0.191   |            |                |         |
| Multiple disabilities (vs. vision disability) | 0.75       | (0.52, 1.09)   | 0.134   |            |                |         |
| Parents' educational level                   |            |                |         |            |                |         |
| Both low/one low, one high (vs. both high)    | 1.71       | (1.17, 2.52)   | 0.006   | 1.56       | (0.95, 2.59)   | 0.081   |
| Parents' occupation                          |            |                |         |            |                |         |
| Both unskilled/one unskilled, one skilled (vs. both skilled) | 2.03       | (1.24, 3.33)   | 0.005   | 1.86       | (1.04, 3.36)   | 0.037   |
| Ask for sweets                               |            |                |         |            |                |         |
| Yes (vs. no)                                  | 1.68       | (1.13, 2.51)   | 0.011   |            |                |         |
| Frequency of sweets intake                   |            |                |         |            |                |         |
| At least once a week (vs. never/sometimes)    | 1.86       | (1.23, 2.82)   | 0.003   | 2.45       | (1.48, 4.11)   | 0.001   |
| At least once a day (vs. never/sometimes)     | 1.90       | (0.56, 8.67)   | 0.339   | 4.01       | (0.97, 21.15)  | 0.070   |
| Sweets as a reward in behavior control       |            |                |         |            |                |         |
| Yes (vs. no)                                  | 1.51       | (1.02, 2.26)   | 0.041   |            |                |         |
| Appetite                                     |            |                |         |            |                |         |
| Poor (vs. good)                               | 1.60       | (1.01, 2.59)   | 0.047   |            |                |         |
| Tooth-brushing ability                        |            |                |         |            |                |         |
| Independent (vs. dependent)                   | 1.84       | (1.24, 2.73)   | 0.002   | 1.95       | (1.19, 3.22)   | 0.008   |
| Gingivitis                                   |            |                |         |            |                |         |
| Yes (vs. no)                                  | 2.01       | (1.39, 2.94)   | <0.001  | 1.94       | (1.22, 3.11)   | 0.006   |

\(^a\) COR: crude odds ratio. Data analysis by univariate logistic regression model. Dependent variable was with dental treatment needs.

\(^b\) AOR: adjusted odds ratio. Data analysis by multiple logistic regression model, adjusted participants' gender and age. Variables found with statistically significant associations in univariate logistic regression analysis were included in the multiple logistic regression models. Dependent variable was with treatment needs.

4. Discussion

The main findings of this study identified a higher caries prevalence and extensive unmet dental TNs among CD in special schools in Taiwan. High frequency of sweet intake and inadequate tooth-brushing ability were the critical risk factors attributed to CD' needs for extensive restorative care. Even though some CD have better independent abilities, they have the potential need for attention and assistance from their parents and/or caregivers to maintain and/or protect their oral hygiene with daily tooth-brushing behavior. This is beneficial to reduce the high dental caries treatment needed for their teeth and teeth surfaces.

The oral hygiene of CD is poor. This can be confirmed from our results that nearly 80% of CD had a mild-to-severe plaque index, and approximately 50% of them had gingivitis. Due to these CD being exposed to such a poor oral environment, 61.78% of them developed dental caries. If plaque is not completely removed from the teeth surfaces every day, a mild form of periodontal disease, which is called gingivitis, occurs. In our study, 47.93% of CD.
had inflammation and bleeding of the gums. This results make us more convinced that poor oral hygiene will affect subsequent oral diseases such as dental decay and gingivitis, which is consistent with previous findings [12,18,28]. However, good oral hygiene can be achieved via regular removal of plaque by thorough tooth-brushing every day. If the plaque declines, tooth decay and gingivitis will simultaneously diminish.

Dental caries remains a primary health problem among CD. Unmet decayed and missing teeth in 6–12-year-old Taiwanese CD, with a mean age of 9.47 years old, have decreased, with the mean caries experience index declining from 3.36 teeth (72.77%) in 2005 [17] to 2.72 teeth (61.78%) in our study (2021). The same index in 9-year-old children also declined from 2.70 (73.55%) in 2007 to 2.66 (47.09%) in 2012 [17,29] among the ordinary population. The decreasing value of caries experience index among CD (10.99%) in our study was less than in those without disabilities (26.46%) [17,29]. In comparison with other studies, the caries prevalence in this study (61.78%) is higher than the result in Australia (56%) but lower than that in Iran (73.6%) [12,28]. The studies of 5–16-year-old CD in Australia and Iran reported less unmet dental treatment teeth (1.53 and 2.09), which was half to two-thirds of our findings (2.75) [12,28]. Furthermore, we compared the treatment modalities and found the CD in the present study had a higher need of complex treatment (36.64%) than the CD in the Australian (21%) and Iranian (25.1%) studies [12,28]. Fewer CD had caries lesions in the present study than in Iran, but they needed more complex dental treatment. It appeared that the CD in our study tended to have more severe tooth caries and required higher dental TNs than CD from other countries [28].

The moderate and complex dental TNs among CD were unmet in this study. Most of the patients receiving dental treatment under GA were people with special needs [14,21,30], especially when the patient needed to have extensive and complicated treatment [31]. The most common treatments (extraction, restoration, and pulp therapy) under GA over the past 10 years in Taiwan are related to a high proportion of multiple dental caries (86.4%) [32,33]. Our result is consistent with other studies, wherein children who need to be treated under GA usually have a higher unmet decayed teeth treatment of more than 10 teeth [32,33]. There were two-thirds (59.87%) out of 36.98% of our participants who might need to be treated under GA due to their uncooperative behavior in specialist clinics or regional hospitals that have critical care facilities. If the CD receive their first dental treatment as early as possible, they can achieve more effective dental rehabilitation [32].

There was a clear negative correlation between decayed teeth and surfaces for complex restorative TNs and severity of disability. This observation is in line with previous studies that children with profound disabilities acquire partial or complete assistance from others as it pertains to maintaining their oral health due to lack of adequate manual dexterity ability [12,22]. However, this is not always true, according to our findings. Our results showed the complex restorative TNs in HVD (71.26%) were higher than MD (58.02%) and VD (52.86%), which was also contrary to the results of a study in Saudi Arabia [34]. The studies of 5–16-year-old children with HVD in Saudi Arabia had restorative TN of 66.02%, which was lower than MD and VD (76.93% and 74.29%) in the present study. In this study, the HVD and VD children had the better capability to learn oral hygiene skills and take care of themselves in comparison with other groups. However, HVD children had ordinal vision and tended to be more susceptible to the allure of various sweets than VD children. The HVD children also had a better independent ability to access, buy, and obtain sweets by themselves than other disability groups. If HVD children do not perform the positive behavior of cleaning their teeth after sweets under supervision by parents/caregivers, it is likely to result in the repercussions of increasing the risk of more caries teeth and surfaces and higher restorative TNs.

Obstacles blocking these participants from achieving lower TNs in this study are improper sweet habits and inadequate tooth-brushing behavior. Manual dexterity is not a guarantee of better oral health and lower TNs among CD. The effectiveness of brushing is limited if CD receive less brushing assistance or supervision when they brush their teeth [18,34–36]. The higher the education level the parents/caregivers had, the more
aware they were about how to sufficiently complete the oral care needs of the CD [18,36,37]. If parents have higher occupation levels, they will have the sufficient financial capacity to take care of their children’s oral hygiene to reach better oral health and decrease dental TNs [36,37]. However, the negative effect of caries TNs among CD from frequent sweets intake is superior to that from insufficient tooth-brushing ability [38]. The results of our study showed that frequent tooth-brushing could minimize the severity and prevalence of TN. The consumption of sweets in small amounts, along with other fermentable carbohydrates consumed frequently, will increase the caries risk and TNs, rather than large amounts eaten occasionally. Sweet limits, not only controlling the frequency, but also advising to give healthy or low-carcinogenic alternative foods such as fresh fruit and vegetables and/or low-carcinogenic foods by parents/caregivers contributed to a lower prevalence of untreated dental caries and TN rates among CD [39].

Before treatment, how to prevent and decrease the number and severity of TNs is important. Our study showed that tooth-brushing can, in part, diminish the association between giving sweets as a reward in behavior control, asking for sweets, and frequency of sweets intake on dental decay outcome in CDs [38]. Sticky foods with sugar and/or fermentable carbohydrates can stay in the oral environment for longer periods, thus increasing the potential and risk for tooth decay. Similar to ordinary children, having their children brush their teeth at least twice a day is deeply associated with parents’/caregivers’ self-efficacy or confidence [40]. More frequent tooth-brushing might compensate for the inadequate tooth-brushing ability of children, as seen in previous studies [18]. To address the high TNs among CD in the present study, we need to provide promotion courses to encourage the parents/caregivers with lower educational levels, especially those in unskilled occupation levels, to implement effective preventive measures such as brushing after eating and correctly choosing healthy snacks for their children.

There are several limitations to the present study. One is that we have difficulty concluding regarding the causation between dental TNs and related risk factors by self-reported questionnaires, as is the case in most observational cross-sectional studies. Second, the observations were assessed outside the dental clinic, with limited accessibility and difficulties for patients’ handling. Third, a small number of parents/caregivers might answer questions in such a way as to meet social expectations and thus cause answer bias. In addition, we collected the data from special schools, not including bedridden and homebound groups; therefore, our results may underestimate the real consideration of all disability groups and reflect the status of school CD. However, our findings may help to better understand the TNs of CD and propose some measures to improve their oral care.

5. Conclusions

The present findings illustrate TNs with an enormous need for restorative treatment, concentrated on 61.78% of CD. Improper sweet habits and inadequate tooth-brushing ability were found in the risk factors for having the highest odds of requiring restorative treatment. Study results reveal that oral problems among these children do not get much attention from their parents/caregivers, especially those with lower education or occupation levels. It is imperative to encourage low-educational-level parents/caregivers to take their children for dental treatment, teach them why and how to brush teeth after eating, and help them modify the sweet intake habits of their children to decrease their children’s caries and improve their children’s oral health.

Author Contributions: Conceptualization, S.-Y.H. and H.-Y.L.; methodology, P.-H.C. and S.-T.H.; software, P.-H.C.; validation, H.-Y.L.; formal analysis, S.-S.H. and C.-W.Y.; investigation, S.-Y.H. and S.-T.H.; data curation, S.-S.H. and C.-W.Y.; writing—original draft preparation, S.-Y.H. and S.-Y.Y.; writing—review and editing, H.-Y.L.; visualization, S.-Y.Y.; supervision, H.-Y.L.; project administration, H.-Y.L. The authors have confirmed that all authors meet the International Journal of Personalized Medicine criteria for authorship credit, as follows: (1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; (2) drafting the
article or revising it critically for important intellectual content; and (3) final approval of the version to be published. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the Bureau of Health Promotion, Department of Health, Taiwan.

**Informed Consent Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Kaohsiung Medical University Hospital (KMUH-IRB-950125). The participants’ legal representatives provided written informed consent for the participants’ involvement in the study.

**Acknowledgments:** The authors gratefully acknowledge the dentists from Tomlin children’s dental clinic and Dada clinics, nurses of special schools, children, and their parents for conducting oral examinations, cordial help, participation, and cooperation, respectively. We would like to express our sincere gratitude to the administrators and staff of the facilities for people with disabilities for their support and assistance, and to all the wonderful children with disabilities for their generous participation.

**Conflicts of Interest:** The authors declare no conflict of interest.

**References**

1. Scott, A.; March, L.; Stokes, M.L. A survey of oral health in a population of adults with developmental disabilities: Comparison with a national oral health survey of the general population. *Aust. Dent. J.* 1998, 43, 257–261. [CrossRef] [PubMed]
2. Tonge, B.; Einfeld, S. The trajectory of psychiatric disorders in young people with intellectual disabilities. *Aust. N. Z. J. Psychiatry* 2000, 34, 80–84. [CrossRef]
3. Lopez-Perez, R.; Borges-Yanez, S.A.; Jimenez-Garcia, G.; Maupome, G. Oral hygiene, gingivitis, and periodontitis in persons with Down syndrome. *Spec. Care Dent. 2002*, 22, 214–220. [CrossRef] [PubMed]
4. Salles, P.S.; Tannure, P.N.; Oliveira, C.A.; Souza, I.P.; Portela, M.B.; Castro, G.F. Dental needs and management of children with special health care needs according to type of disability. *J. Dent. Child. (Chic)* 2012, 79, 165–169.
5. Petrovic, B.B.; Peric, T.O.; Markovic, D.L.; Bajkin, B.B.; Petrovic, D.; Blagojevic, D.B.; Vujkov, S. Unmet oral health needs among persons with intellectual disability. *Res. Dev. Disabil.* 2016, 59, 370–377. [CrossRef] [PubMed]
6. Zhou, N.; Wong, H.; Wen, Y.; McGrath, C. Efficacy of caries and gingivitis prevention strategies among children and adolescents with intellectual disabilities: A systematic review and meta-analysis. *J. Intell. Disabil. Res.* 2019, 63, 507–518. [CrossRef] [PubMed]
7. Li, C.W.; Yen, C.F.; Lob, C.H.; Lee, T.N.; Lin, J.D. Medical Care and Affected Factors among People with Intellectual Disabilities in Taiwan: Outpatient Utilization in 2001. *J. Disabil. Res.* 2005, 3, 5–17.
8. US Department of Health and Human Services. *Healthy People 2010*, 2nd ed.; US Government Printing Office: Washington, DC, USA, 2000.
9. Koritsas, S.; Iacono, T. Secondary conditions in people with developmental disability. *Am. J. Intellect. Dev. Disabil.* 2011, 116, 36–47. [CrossRef]
10. Hennequin, M.; Faulks, D.; Roux, D. Accuracy of estimation of dental treatment need in special care patients. *J. Dent.* 2000, 28, 131–136. [CrossRef]
11. Cumella, S.; Ransford, N.; Lyons, J.; Burnham, H. Needs for oral care among people with intellectual disability not in contact with Community Dental Services. *J. Intell. Disabil. Res.* 2000, 44, 45–52. [CrossRef] [PubMed]
12. Desai, M.; Messer, L.B.; Calache, H. A study of the dental treatment needs of children with disabilities in Melbourne, Australia. *Aust. Dent. J.* 2001, 46, 41–50. [CrossRef] [PubMed]
13. Bradley, C.; McAlister, T. The oral health of children with Down syndrome in Ireland. *Spec. Care Dent.* 2004, 24, 55–60. [CrossRef] [PubMed]
14. Lee, P.Y.; Chou, M.Y.; Chen, Y.L.; Chen, L.P.; Huang, W.H. Comprehensive dental treatment under general anesthesia in healthy and disabled children. *Chang Gung Med. J.* 2009, 32, 636–642.
15. Huang, S.T.; Hurmg, S.J.; Liu, H.Y.; Chen, C.C.; Hu, W.C.; Tai, Y.C.; Hsiao, S.Y. The oral health status and treatment needs of institutionalized children with cerebral palsy in Taiwan. *J. Dent. Sci.* 2010, 5, 75–89. [CrossRef]
16. Weng, R.H.; Kung, P.T.; Tsai, W.C.; Chiang, H.H.; Chiu, L.T. The use of fluoride varnish and its determining factors among children with disability in Taiwan. *Res. Dev. Disabil.* 2011, 32, 583–592. [CrossRef] [PubMed]
17. Ministry of Health and Welfare. Oral Health Survey of Children and Adolescents in Taiwan (2003–2005). Available online: https://dep.mohw.gov.tw/DOMHAOH/cp-486-1917-107.html (accessed on 18 March 2021).
18. Liu, H.Y.; Chen, C.C.; Hu, W.C.; Tang, R.C.; Chen, C.C.; Tsai, C.C.; Huang, S.T. The impact of dietary and tooth-brushing habits to dental caries of special school children with disability. *Res. Dev. Disabil.* 2010, 31, 1160–1169. [CrossRef]
19. Liu, H.Y.; Hung, H.C.; Hsiao, S.Y.; Chen, H.S.; Yen, Y.Y.; Huang, S.T.; Chen, C.C.; Chen, P.H.; Chen, C.C.; Lin, P.C.; et al. Impact of 24-month fluoride tablet program on children with disabilities in a non-fluoridated country. *Res. Dev. Disabil.* 2013, 34, 2598–2605. [CrossRef] [PubMed]
20. Waldman, H.B.; Perlman, S.P. Disability and rehabilitation: Do we ever think about needed dental care? A case study: The USA. *Disabil. Rehabil.* 2010, 32, 947–951. [CrossRef]

21. Sari, M.; Ozmen, B.; Koyuturk, A.; Tokay, U. A retrospective comparison of dental treatment under general anesthesia on children with and without mental disabilities. *Niger. J. Clin. Pract.* 2014, 17, 361–365. [CrossRef]

22. Liu, H.Y.; Huang, S.T.; Hsiao, S.Y.; Chen, C.C.; Hu, W.C.; Yen, Y.Y. Dental caries associated with dietary and toothbrushing habits of 6- to 12-year-old mentally retarded children in Taiwan. *J. Dent. Sci.* 2009, 4, 61–74. [CrossRef]

23. Petrovic, B.; Markovic, D.; Peric, T. Evaluating the population with intellectual disability unable to comply with routine dental treatment using the International Classification of Functioning, Disability and Health. *Disabil. Rehabil.* 2011, 33, 1746–1754. [CrossRef] [PubMed]

24. Physically and Mentally Disabled Citizens Protection Act. Available online: https://law.moj.gov.tw/Eng/LawClass/LawAll.aspx?PCode=D0050046 (accessed on 18 March 2021).

25. World Health Organization. *Oral Health Surveys- Basic Methods*, 4th ed.; World Health Organization: Geneva, Switzerland, 1997.

26. Greene, J.C.; Vermillion, J.R. The simplified oral hygiene index. *J. Am. Dent. Assoc.* 1964, 68, 7–13. [CrossRef] [PubMed]

27. Löe, H. The Gingival Index, the Plaque Index and the Retention Index Systems. *J. Periodontol.* 1967, 38, 610–616. [CrossRef]

28. Ajami, B.A.; Shabzendedar, M.; Rezay, Y.A.; Asgary, M. Dental treatment needs of children with disabilities. *J. Dent. Res. Dent. Clin. Dent. Prospects* 2007, 1, 93–98.

29. Ministry of Health and Welfare. Oral Health Survey of Children and Adolescents in Taiwan (2010–2013). Available online: https://dep.mohw.gov.tw/DOMHAOH/cp-486-1917-107.html (accessed on 18 March 2021).

30. Wang, Y.C.; Lin, I.H.; Huang, C.H.; Fan, S.Z. Dental anesthesia for patients with special needs. *Acta Anaesthesiol. Taiwanica* 2012, 50, 122–125. [CrossRef]

31. Chen, Y.P.; Hsieh, C.Y.; Hsu, W.T.; Wu, F.Y.; Shih, W.Y. A 10-year trend of dental treatments under general anesthesia of children in Taipei Veterans General Hospital. *J. Clin. Med. Assoc.* 2017, 80, 262–268. [CrossRef]

32. Chen, C.Y.; Chen, Y.W.; Tsai, T.P.; Shih, W.Y. Oral health status of children with special health care needs receiving dental treatment under general anesthesia at the dental clinic of Taipei Veterans General Hospital in Taiwan. *J. Clin. Med. Assoc.* 2014, 77, 198–202. [CrossRef]

33. Al-Qahtani, Z.; Wyne, A.H. Caries experience and oral hygiene status of blind, deaf and mentally retarded female children in Riyadh, Saudi Arabia. *Odontostomatol. Trop.* 2004, 27, 37–40.

34. Chiwata, K.; Takeda, F. Daily living activities and oral condition among care facility residents with severe intellectual disabilities. Comparative analyses between residents receiving tooth-brushing assistance and those not receiving tooth-brushing assistance. *Nihon Koshu Eisei Zasshi* 2007, 54, 387–398.

35. Martens, L.; Marks, L.; Goffin, G.; Gizani, S.; Vinckier, F.; Declerck, D. Oral hygiene in 12-year-old disabled children in Flanders, Belgium, related to manual dexterity. *Community Dent. Oral Epidemiol.* 2000, 28, 73–80. [CrossRef]

36. Jaber, M.A. Dental caries experience, oral health status and treatment needs of dental patients with autism. *J. Appl. Oral Sci.* 2011, 19, 212–217. [CrossRef] [PubMed]

37. Liu, H.Y.; Chen, J.R.; Hsiao, S.Y.; Huang, S.T. Caregivers’ oral health knowledge, attitude and behavior toward their children with disabilities. *J. Dent. Sci.* 2017, 12, 388–395. [CrossRef]

38. Phanthavong, S.; Nonaka, D.; Phonaphone, T.; Kanda, K.; Sombouaphan, P.; Wake, N.; Sayavong, S.; Nakasone, T.; Phongsavath, K.; Arasaki, A. Oral health behavior of children and guardians’ beliefs about children’s dental caries in Vientiane, Lao People’s Democratic Republic (Lao PDR). *PLoS ONE* 2019, 14, e0211257. [CrossRef] [PubMed]