

Title: Degree of intellectual disability, manual dexterity and socio-demographic factors as determinants of periodontal status among intellectually disabled (ID) individuals.

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Running title- relation of IQ, manual dexterity on oral health

ABSTRACT

Objectifs : Cette étude vise à évaluer le degré de déficience intellectuelle, les facteurs sociodémographiques et dextérité manuelle comme des déterminants de l'État parodontal des personnes intellectuellement handicapées de (ID) de la partie nord-ouest de l'Inde.

Méthode : Une étude transversale du questionnaire en fonction a été réalisée entre 150 sujets via entrevue face à face par deux examinateurs ($k = 0,86$), portant sur le type de handicap, les facteurs sociodémographiques et les habitudes d'hygiène buccale. Examen clinique a été menée pour la dextérité manuelle et l'évaluation de la santé parodontale.

Résultats : Aucune différence statistiquement significative a été observée entre les sous-groupes ID en ce qui concerne le sexe, nombre de frères et sœurs, revenu, habitudes, visite chez le dentiste, raison de la visite chez le dentiste et la dextérité manuelle de brossage. La plaque moyenne, gingivales et scores indice CPITN des sujets gravement handicapés étaient significativement plus élevés.

Conclusion: La santé parodontale est un problème majeur pour les écoliers handicapés ; par conséquent, les programmes de promotion de la santé buccodentaire doivent viser des institutions et des parents d'enfants handicapés

Keywords – Intellectual disability, Socio-demographic factors, Manual dexterity, IQ, Periodontal status

INTRODUCTION

Over time, the concept of health has evolved from an individual concern to a worldwide social goal by the introduction of “Health for All by the Year 2000” given by the World Health Assembly in 1977 and is still valid today in spite of the general increase in wealth of all countries (WHO, 1979).

The disabled comprise a substantial section of the community and it is estimated that there are about 500 million people with disabilities worldwide (Watson N, 2000). The recent National Sample Survey Organization (NSSO, 2003) report suggests that the number of disabled persons in the country is estimated to be 18.49 million, accounting for about 1.8% of the total population. It is estimated that 6–10% of children in India are born to a special need group and that possibly one-third of the total population is comprised of children.

People with intellectual disabilities (ID) form a sub-group of the ‘special needs population’, who need ‘special care’ for everyday activities and are referred to as ‘care-recipients’ (Australian Institute of Health and Welfare, 2004). Children with special healthcare needs (SHCN) constitute a high-risk group; as they have limited ability to be advocates of their health and little is known about their oral health. American association on intellectual and developmental disability (AAIDD) defines Intellectual disability as a disability characterized by significant limitations in both intellectual functioning and in adaptive behaviour, which covers many everyday social and practical skills. The American Association of Mental Deficiency (AAMD) classifies retardation into four categories according to intelligence quotient (IQ): mild, moderate and severe or profound retardation. An individual is classified as having mild mental retardation if his or her IQ score is 50-70; moderate retardation, IQ 35- 50; severe / profound retardation, IQ below 35 (Goddard L et al, 2008). Developmental disabilities can develop due to a variety of conditions which include cerebral palsy, Down’s syndrome,

mental retardation, autism, seizure disorders, hearing and visual impairments, congenital defects, and even social or intellectual deprivation (Tesini DA and Fenton SJ, 1994).

Oral diseases can have a direct impact on the health of children and adolescents with certain systemic health problems or conditions. Poor oral hygiene and periodontal diseases represent major problems for the intellectual disabled children. The main factor related to gingival/periodontal problems in disabled individuals is the inadequacy of the plaque removal from the teeth. Motor coordination problems and muscular limitation in neuromuscular disabled individuals along with the difficulty in understanding the importance of oral hygiene in intellectually disabled individuals have resulted in the progression of inflammatory diseases (Nunn JH, 1987).

Although oral health care is becoming progressively an integrated part of overall medical care, still it is one of the greatest unattended health needs of the disabled people. In developing countries the situation is even worse with lack of both medical and oral health care facilities and absence of dental supervision for children with special needs. Hence, their health is of utmost importance for the overall development of the society.

Therefore, this study is aimed to access the periodontal status among these deprived strata and investigate the association of periodontal status with various socio-demographic (age, gender, parent's education, income) and clinical variables (IQ level and manual dexterity) among intellectual disabled individuals / care recipient from Northern Western part of India. It was hypothesized that low periodontal status would be associated with children who were severely disabled and have poor manual dexterity.

MATERIAL AND METHODOLOGY

A cross-sectional study was conducted among a cluster of care recipients aged 5, 12, 15 years (± 6 months) children enrolled in a special school at Sri Ganganagar city, Rajasthan, India. Data was obtained from all the care recipients present on the day of the examination along with their parents from March to May 2015. An invitation letter along with consent was sent to the parents for participation and written consent was obtained. The present study was cleared by the ethical committee of the Surendera Dental College & Research Institute.

The inclusion criterion for the present study was that all the care recipients that had parental consent/proxy consent. Those care recipients whose parents were unable to provide the required information or incomplete questionnaire, and those who did not cooperate in the clinical examination procedures were excluded. The initial sample consisted of 176 students which were enrolled in a school. All the parents of students were given the consent form out of which parents of fourteen care recipients did not give the consent to participate in the study. All care recipients who gave the consent were allotted dates for the examination and were invited to come along with their child to complete the Performa. Twelve participants gave incomplete Performa or required information.

The data was recorded during a face to face interview by two examiners. The Performa consisted of two sections. First section comprised of the information regarding type of disability, socio-demographic factors and oral hygiene habits. Second section comprised of test to access comprehension and manual dexterity along with indices evaluating periodontal health of the subject.

For the level of Intellectual disability I.Q. scores were obtained from medical and/or school records. Care recipient IQ scores were classified (by Goddard L et al, 2008) into Mild (IQ. 50-70), Moderate (IQ. 35-50), Severe or profound (IQ <35). The socio- demographic factors included information about child's age, gender and socioeconomic status of the family. The

socioeconomic status of the family was recorded according to the Kuppuswamy scale 2013 (Kumar RBP et al, 2013) which includes education, occupation and monthly family income of the parents respectively. Socioeconomic variables i.e. education score (illiterate, school level, graduate and postgraduate), occupation score (profession, clerical/shop-owner/farmer, unemployed), monthly family income (<10000, 10000-20000, >20000 in Rupees) and socioeconomic class was calculated according to the scores (Upper class, Upper middle, Middle/Lower middle, Upper Lower, Lower) were latter trichotomized according to the data collected and for the sake of analysis into (upper, middle and lower class). Further oral hygiene habits includes question regarding brushing frequency (once, twice or absent), mode of cleaning (self, mother cleaning or under supervision), visit to dentist in last twelve months (never, once or more than once), reasoning for visit (preventive or therapeutic).

After pilot testing on groups of disabled individuals comprehension and manual dexterity was measured using short form version of Bruininks–Oseretsky Test of Motor Proficiency (BOTMP- SF) (described by Wiart L and Darrah J 2012). Test consists of 14 items which includes six each gross and fine motor items and two both fine and gross motor items. Children were classified accordingly into good and poor manual dexterity.

Periodontal health of subjects was assessed by the Plaque index described by Loe H, 1967, Gingival index described by Loe H and Silness J, 1963 and Community Periodontal Index & Treatment Needs described by WHO and FDI(Ainamo JD et al, 1982).

Prior to the study, a team made up of two examiners participated in a training program which included intra-examiner and inter-examiner calibration exercises where minimum and maximum kappa values were agreed (0.81 and 0.86 respectively) between the examiners. A pilot study with 10 children and their parents/guardians was also performed to determine the applicability of the measure. Children were examined using Type III clinical examination and

CPITN probe was used. World Medical Association Declaration of Helsinki principles for Medical Research involving human subjects were followed to maintain the ethics.

Statistical analysis –The chi square and ANOVA test was used to compare between categorical variables. Logistic and linear regression analysis was executed to test the risk factors associated with periodontal disease status. The effect of each independent variable was assessed adjusting for that of all others in the model. Statistical analysis of the data was done using Statistical Package for Social Sciences (SPSS) version 20.

RESULTS

The total sample consists of 150 intellectually disabled care recipients, out of which 47.33%, 30% and 22.6% were mild, moderate and severely disabled respectively. In relation to socio-demographic factors majority of the care recipients had high income salary and belong to upper class with more than 70% of the mothers having high literacy level.

It was observed that 47% of severely disabled care recipients does not brush their teeth and this difference was found to be statistically significant ($p < 0.05$) when compared with mild disabled care recipients (13%). More than 70% of the severe disabled care recipients clean teeth under supervision of guardian. Statistically significant difference was observed among intellectual disabled subgroups with different variables stratified by gender, number of siblings, income, brushing habits, tooth cleaning, visit to dentist, reason for dental visit and manual dexterity. (Table 1)

Periodontal parameters when related to the degree of intellectual disability the mean plaque index of the moderately disabled care recipients was significantly higher than that of the mildly disabled care recipients. The severely disabled care recipients showed the highest plaque index with statistically significant difference when compared with the moderately disabled ($p=0.002$).

The mean gingival index of severely disabled care recipients was significantly highest when compared with the moderately and mildly disabled care recipients ($p=0.03$).

The care recipients with severe intellectual disability had significantly higher average CPITN scores than their counterparts ($p<0.001$). The detailed analysis of periodontal health parameters within these subgroups are shown in Table (2).

Logistic regression analysis was employed to determine the contribution of different risk factors to different periodontal parameters. The results of logistic regression showed that Males were more likely to have poor plaque index, as compared with females with an odds

ratio (OR) of 3.12. Care recipients who belong to middle (OR=6.86) and lower class (OR=8.14) likely to have poor plaque index than those of upper class. A significant association of moderate and severe disability to plaque index was observed with an odds ratio of 2.68 and 4.7 respectively. When various risk factors were accessed for association with gingival index in logistic regression analysis it was observed that care recipients who belong to middle (OR=2.56) and lower class (OR=4.51) are more likely to have severe gingivitis than those of upper class ($p<0.05$). The association between moderate and severe disability to gingival index was evident with an odds ratio of 1.90 and 2.68 respectively.

However while comparing all the risk factors with CPI, only brushing habit and visit to dentist shows significant association. There was no significant association of intellectual disability with CPI score but severe and moderate were more likely to be diseased than mild care recipients. The results of manual dexterity of the care recipient in logistic regression model showed that poor manual dexterity had poorer plaque index, gingival and community periodontal index than the care recipients having good manual dexterity with an odds ratio of 1.48, 1.03 and 1.08 respectively. (Table 3)

Table 4 represents Stepwise multiple linear regression analysis, which was executed to estimate the linear relationship between CPI and various independent variables, revealed that the best predictors in the descending order was ID, gender, SES, manual dexterity, brushing habits, number of sibling, visit to dentist. ID level explained 40.0% of the variance in the model and the cumulative variance provided by all the predictors (ID, gender, SES, manual dexterity, brushing habits, no of sibling, visit to dentist) was 81%.

DISCUSSION

Oral health and quality oral health care contribute to holistic health, which should be a right rather than a privilege (Clark CA and Vanek EP, 1987). That is why individuals with disabilities deserve the same opportunities for dental services as those who are healthy. Maintaining good oral health is particularly challenging among individuals with disabilities because of increased oral health risks due to underlying disease, limitations on access to care and competing demands. The lack of oral hygiene has been implicated as a fundamental factor in the development of periodontal diseases in mentally challenged individuals (Franks AS, Winter GB, 1974). Therefore, this study was conducted to assess the impact of various socio-demographic and clinical variables on the periodontal status among intellectual disabled population.

Stratification of quantified CPITN scores by age, degree of intellectual disability and SES allows identification of potential variables which must be considered in studies dealing with the periodontal status in intellectual disabled individuals. In this study meticulous periodontal examinations were difficult, due to low ability of concentration, communication problem, and hyperactive behaviour of the subjects. However, bleeding response and presence or absence of calculus was carefully recorded.

The process of developing gingival and periodontal diseases in ID does not differ from any non disabled individuals. The main factor related to gingival and periodontal diseases in care recipients is the physical inadequacy of the mechanical plaque removal from the teeth. Limited motor skills, lack of knowledge of oral hygiene, and effective brushing technique in ID have resulted in the progression of inflammatory diseases (Kadam NS *et al.*, 2014).

In the present study the majority of care recipients had visited dentist (82.6%). While studies conducted on similar population by Kadam NS et al and De Jongh et al, reported that most of the subjects had never visited to a dentist. This could be due to the low socio economic

status, parental education and along with the cost of dental care, which might have influenced dental service utilization in their study. In the present study majority of the parents of care recipients were highly educated and belong to upper social class which is being reflected in dental visit pattern.

According to the findings of this study 70.6% of the care recipients brush teeth regularly and out of these 28.6% brush their teeth by themselves while in 40% cases mothers do it for them, whereas in study conducted by NT Hashim *et al.* in 2012, 59.4% subjects are dependent on their mother for brushing. The proportion of care recipients with no periodontal disease in the present population was observed to be merely 12% which is far less with that of the general population of Rajasthan state, where the proportion of 12 and 15 year-old children without any signs of periodontal disease was 66.8% and 49.2%, respectively, this difference of disease prevalence between diseased and general population is also supported by a study conducted by Manish Jain *et al.*, 2009. In contrast to it a study conducted by Lucchese and Checchi in 1988 showed even less percentage with (5%) of ID subjects having healthy periodontal status. Mean CPI scores in the present study according to IQ scores are 0.99 ± 0.60 , 1.16 ± 0.57 and 1.56 ± 0.56 among mild, moderate and severe respectively. This implies that as the severity of IQ increases there is a significant increase in periodontal score also. Similar results have been shown earlier by Hashim NT et al and Nematollahi et al in their studies. Most of the care recipients require periodontal treatment needs. The most prevalent treatment need in this study was TN1 (57.33%). While in study conducted by Kadam NS *et al* TN2 (76.4%) was found to be most established treatment need. Denloye, (1999) in the study on intellectual disabled subjects observed that none of them had healthy periodontium and all the subjects need oral hygiene care. Bhavsar and Damle, (1995) in their study observed that the bleeding and calculus components were higher than the healthy components in all the groups and almost all the children requiring treatment in the form of prophylaxis and oral hygiene instructions. As many

studies support that severity of ID is directly proportional to worsening of periodontal condition, this may be due to the continuous neglect towards personal and oral hygiene. This was expected as while the degree of helplessness worsens, the ability of subjects to perform their daily activities reduces. Brown and Schodel in 1976 reviewed 32 studies of disabled children and reported that such patients tend to have poorer oral hygiene than their non-disabled counterparts. Most of these findings highlight the difficulties encountered by disabled individuals in maintaining an adequate level of oral hygiene. The reasons for poor oral hygiene in disabled children have been attributed to lack of motor skills (Full CA *et al*, 1977). Snyder et al in 1960 pointed out that the lack of manual coordination in disabled children is a prime factor responsible for their poor oral hygiene maintenance. Disabled children are generally incapable of obtaining an adequate oral hygiene level by manual brushing because of their limited motor skills and lack of knowledge of oral hygiene and effective brushing technique. Thus, the higher incidence of Periodontal Disease could be attributed to the lack of manual dexterity among these care recipients. The results of this study also show that manual dexterity is correlated to poor gingival and periodontal status. On the contrary only Shaw *et al*, 1989 assessed manual dexterity in a study but could not show any correlation of it with periodontal health. It has been suggested by the authors that complete plaque removal with a conventional toothbrush is not realistic for this group due to limited dexterity for using it (Mitsea AG *et al*, 2001; Gizani S *et al*, 1997 and Rao DB *et al*, 2001). According to some investigators, powered brushes are particularly well suited for people with reduced motor skills (Waldman HB, Perlman SP, 2000 and Jongenelis APJM, Wiedemann WA, 1997). On the other hand, many different types of specially designed manual toothbrushes have been developed. Among them is the triple-headed brush, which is designed to clean the oral, buccal and occlusal surfaces of the teeth with a single stroke and is recommended by (Dogan C *et al*, 2004) among individuals with limited manual skills.

The plaque and gingival index tend to increase with the severity of the intellectual disability. Mean plaque scores among care recipients was highest among severely intellectual disabled group (2.62 ± 0.65) followed by moderate and mild group. Similar results have been shown earlier by Martens et al., (2000), Rao et al., (2005), and Kawagushi and Nakashima, (1990).

Strength of the current study is that it has made an attempt to include motor skills as an important factor towards the periodontal health which has provided valuable data and has provided a platform for further extensive research towards improving the motor skills and evaluating its effect by a longitudinal study design.

Limitations of the current study is that to nullify the effect of socio-demographic factors involved in the study, the siblings of the ID children could have been included in the research but it was beyond the scope of the study. Another limitation is that due to cross sectional nature of the study, it did not allow assessment or track the changes in oral health assessment with advancing intellectual disability. So, further longitudinal studies are recommended in this direction.

CONCLUSION

The results have shown that poor periodontal health is a major problem for disabled school children and the oral health of disabled children assessment seemed to indicate a cumulative neglect of oral health. Oral health promotion programs should be aimed specifically in institutions and for parents of disabled children. Oral health promotion should focus on facilitating access and regular use of oral health services. Taking into consideration the multi factorial influence on oral health status of the present disabled population, oral health promotion and intervention programs should be targeted and concentrated towards these risk groups.

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Table 1: Socio-demographic factors in relation to intellectual disability among study population

Variables	Mild N (%)	Moderate N%	Severe N%	P- Value
Age				
5 years	27 (38.02)	16 (35.56)	13 (38.24)	0.73
12 years	18 (25.35)	15 (33.33)	11 (32.35)	
15 years	26 (36.62)	11 (24.44)	10 (29.41)	
Gender				
Male	19 (26.76)	42 (93.33)	26 (76.47)	<0.0001
Female	52 (73.24)	3 (6.67)	8 (23.53)	
No. Of siblings				
≤1	51 (71.83)	16 (35.56)	20 (58.82)	0.0006
≥2	20 (28.17)	29 (64.44)	14 (41.18)	
Income				
<10000	9 (12.68)	5(11.11)	11(32.35)	0.002
10000-20000	38(53.52)	17(37.78)	6(17.65)	
>20000	24(33.80)	23(51.11)	17(50)	
Mother Education				
Illiterate	6(8.45)	3(6.67)	4(11.76)	0.88
School level	12(16.90)	10(22.22)	7(20.59)	
Graduate, Postgraduate	53(74.65)	32(71.11)	23(67.65)	
SES				
Upper	28(39.44)	19(42.22)	10(29.41)	0.48
Middle	23(32.39)	17(37.78)	11(32.35)	
Lower	20(28.17)	9(20)	13(38.24)	
Brushing habits				
Yes	62(87.32)	26(57.78)	18(52.94)	0.0001
No	9(12.68)	19(42.22)	16(47.06)	
Frequency of tooth brushing				
Once A Day	58(81.69)	25(55.56)	17(50)	0.37
Twice A Day	4(5.63)	1(2.22)	1(2.94)	
>Twice A Day	0	0	0	
Tooth cleaning				
Self	23(32.39)	17(37.78)	3(8.82)	<0.0001
Mother cleaning	44(61.97)	9(20)	7(20.59)	
Under supervision	4(5.63)	19(42.22)	24(70.59)	
Visit to dentist				
Never	3 (4.23)	10(22.22)	13(38.24)	<0.0001
Once	52 (73.24)	16(35.56)	7(20.59)	
≥Twice	16 (22.54)	19(42.22)	14(41.18)	
Reason for dental visit				
Preventive	31 (43.66)	14(31.11)	5(14.71)	0.21
Therapeutic	37 (52.11)	21 (46.67)	16(47.06)	
Manual dexterity				
Good	61 (85.92)	23 (51.11)	10 (29.41)	<0.0001
Poor	10 (14.08)	22 (48.89)	24 (70.59)	

TABLE 2- Represents clinical variables with respect to intellectual disability

Variables	Mild (Mean±SD)	Moderate (Mean±SD)	Severe (Mean±SD)	p value
Plaque Index (PII score)	2.17 ± 0.70	2.51 ± 0.63	2.62 ± 0.65	0.002
Gingival Index (GI score)	2.13 ± 0.68	2.36 ± 0.61	2.45 ± 0.62	0.03
CPITN score	0.99 ± 0.60	1.16 ± 0.57	1.56 ± 0.56	<0.0001
CPI SCORES & TREATMENT NEEDS				
	N (%)	N (%)	N (%)	0.0003
Healthy	13 (18.30)	4 (8.89)	1 (2.94)	
Bleeding	46 (64.79)	27 (60)	13 (38.24)	
Calculus	12 (16.90)	14 (31.11)	20 (58.82)	
TREATMENT NEEDS				
	N (%)	N (%)	N (%)	0.0003
TN 0	13 (18.30)	4 (8.89)	1 (2.94)	
TN 1	46 (64.79)	27 (60)	13 (38.24)	
TN 2a	12 (16.90)	14 (31.11)	20 (58.82)	

Table 3- Association of Intellectual disability with socio-demographic factors, periodontal status and treatment needs

Variables	Plaque index			Gingival index			CPI Index		
	Poor	OR (CI)	P Value	Severe	OR (CI)	P value	Disease d	OR (CI)	P value
AGE									
5 years	21	1		16	1		48	1	
12 years	24	1.29(0.5 8-2.85)	0.53	19	1.90(0.8 3-4.37)	0.13	38	1.30(0.3 9-4.29)	0.67
15 years	29	1.48(0.6 9-3.20)	0.31	24	2.31(1.0 3-5.15)	0.04	46	1.92(0.5 4-6.80)	0.31
Gender									
Male	53	3.12(1.5 8-6.14)	0.001	41	2.23 (1.12- 4.44)	0.02	69	1.89 (0.89- 4.0)	0.1
Female	21	1		18	1		43	1	
Socioeconomic class									
Upper	14	1		13	1		47	1	
Middle	32	6.86 (3.04- 15.49)	<0.0001	22	2.56 (1.12- 5.9)	0.001	46	1.96 (0.62- 6.17)	0.25
Lower	28	8.14 (3.42- 17.40)	<0.0001	24	4.51 (1.89- 10.77)	0.0007	39	2.77 (0.71- 10.76)	0.14
Manual dexterity									
Good	43	1	0.26	22	1	0.99	49	1	0.88
Poor	31	1.48(0.7 6 – 2.86)		37	1.03 (0.51- 1.98)		83	1.08 (0.39- 2.96)	
Brushing habits									
Yes	34	1	<0.0001	26	1		65		
No	40	11.18 (5.32- 19.1)		33	12.53 (5.74- 22.69)	<0.0001	41	8.62 (2.51- 29.66)	0.0006
No. Of sibling									
≤1	41	1	0.53	32	1		73	1	
≥2	33	1.23 (0.64- 2.36)		27	1.01 (0.53- 1.92)	0.98	59	2.83 (0.88- 9.05)	0.08
Visit to dentist									
Never	21	9.35 (4.12- 18.33)	<0.0001	18	7.77 (2.67- 22.65)	0.0002	25	7.24 (0.88- 24.79)	0.0004
Once	41	4.92 (2.26- 10.7)	0.0001	30	2.30 (1.02- 5.2)	0.04	69	3.33 (1.14- 9.71)	0.03
≥Twice	12	1		11	1		38	1	
Intellectual Disability									
Mild	24	1		21	1		59	1	
Moderate	26	2.68 (1.24- 5.78)	0.01	20	1.90 (0.87- 4.15)	0.11	41	2.08 (0.63- 6.92)	0.23
Severe	24	4.7 (1.94- 11.41)	0.0006	18	2.68 (1.15- 6.23)	0.02	32	3.25 (0.69- 15.45)	0.14

Table 4- Multiple linear regression model for CPI

Model	R	R ²	Adjusted R ²	SE	R ² change	P
1	0.61 ^a	0.40	0.40	3.57	0.40	0.001
2	0.64 ^b	0.44	0.44	3.59	0.04	0.001
3	0.68 ^c	0.50	0.50	3.60	0.06	0.001
4	0.73 ^d	0.57	0.57	3.62	0.07	0.001
5	0.77 ^e	0.63	0.63	3.63	0.06	0.001
6	0.83 ^f	0.71	0.71	3.66	0.08	0.001
7	0.90 ^g	0.81	0.81	3.68	0.10	0.001

^a Predictors: ID

^b Predictors: ID, gender

^c Predictors: ID, gender, SES

^d Predictors: ID, gender, SES, manual dexterity

^e Predictors: ID, gender, SES, manual dexterity, brushing habits

^f Predictors: ID, gender, SES, manual dexterity, brushing habits, no of sibling

^g Predictors: ID, gender, SES, manual dexterity, brushing habits, no of sibling, visit to dentist