Coll. Antropol. **27** Suppl. 2 (2003) 75–82
UDC 616.311.2-002:616-056.7
Original scientific paper

Periodontal Conditions in Individuals with Down's Syndrome

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A B S T R A C T

Periodontal disease in Down's syndrome (DS) population seems to be a more common and serious problem than caries. The aim of this study was to assess the state of periodontal structures in patients with DS. The Community Periodontal Index of Treatment Needs was used for periodontal status assessment in 71 DS subjects aged 9–34 years. A control group consisted of 71 age- and sex-matched healthy individuals. Both groups were divided into three age groups: 9–15 (n=24); 16–25 (n=32); and 26–34 (n=15) years. The results showed a similar percentage of subjects with bleeding and calculus. The intact periodontium was significantly higher in control than in DS (16.9% vs. none; p<0.01). Deep pockets were more frequent in DS group than in the control group (14.1% vs. 1.4%; p<0.01). The mean number of sextants with healthy tissue was lower, and of those with bleeding, calculus and shallow pockets significantly higher in DS patients than in controls (p<0.01), so all DS subjects required some periodontal treatment (p<0.01). It can be concluded that the severity of periodontal disease and the treatment needs seem to be significantly greater in DS than in healthy subjects.

Key words: *Down's syndrome, periodontal diseases, periodontal index*

Introduction

Down's syndrome (DS) is caused by a chromosomal abnormality and is characterized by some physical, mental and medical features which can have a profound effect on oral health of these patients[1]. Association of periodontal disease and

Received for publication April 28, 2003

Down's syndrome has been demonstrated in as many as 90% of this specific population[2,3]. Periodontal disease in DS is a considerably more common and serious problem than caries[4–10]. The low prevalence of caries has been attributed to the low prevalence of aproximal caries, which Fine[11] has related to the high prevalence of periodontal lesions, i.e., to the competitive antagonism between cariogenic bacteria and those present in periodontium with pathological changes. Bell et al.[12] showed that tooth wear (attrition and erosion) was significantly more frequent in DS than the non-DS patients, so that could be another reason for low prevalence of caries in DS patients.

Considerable affection of the anterior mandibular and posterior maxillary region with periodontal disease is occasionally present in DS children below the age of six, which results in the loss of teeth, usually lower central incisors[2].

The stability of teeth and the prognosis of their preservation in the jaw are known to be influenced by the length, shape and direction of tooth roots. Snawder[13] reported on a significant reduction in the tooth root, and Škrinjarić et al.[14] on fused molar roots in DS patients, both of which favor the formation of periodontal pockets and impair tooth stability. This happens because such teeth are much more forcefully affected by detrimenal occlusion forces than the teeth with divergent roots. Ulseth et al.[15] attributed the increased prevalence of periodontitis to hypodontia, which also entails dental instability due to the loss of contact points. In addition to periodontitis, severe forms of gingivitis (ulcerative necrotic) also develop in as many as 30% of patients[6]. Beside local factors, such as macroglossia, malocclusion (Angle's type III, posterior cross bite), short and fused molar roots, bruxism and loss of normal masticatory function, the impaired chemotaxis of neutrophilic polymorphonuclears has been attributed even greater importance in the etiology, severity and progression of periodontal disease in Down's syndrome[16–18].

The aim of this study was to assess the periodontal conditions in 71 DS patients, using an objective and reproducible method; to compare the results with those obtained in an age- and sex-matched control group using the Community Periodontal Index of Treatment Needs (CPITN). The intention was also to evaluate and compare treatment needs in the two groups of subjects, and to obtain data required for proper planning of preventive measures and therapeutic procedures in the population of DS patients.

Patients and Methods

The study comprised 71 institutionalized DS patients, 39 males and 32 females, aged 9–34 (mean = 18.94) years, mean IQ 42, with clinically and karyotypically verified diagnosis of Down's syndrome. The control group consisted of 71 age- and sex-matched healthy subjects. All subjects were divided into the following age groups: group 1, 9–15 yrs (n=24); group 2, 16–25 yrs (n=32); and group 3, 26–34 yrs (n=15).

All subjects underwent an identical clinical examination and analysis of periodontal structures with periodontal probe (WHO recording – periodontal probe). Only permanent teeth were observed, to avoid possible errors in the interpretation of results due to delayed tooth eruption. The periodontal status and treatment needs were assessed by means of the Community Periodontal Index of Treatment Needs (CPITN) system.[19] In order to secure a fully objective evaluation of the periodontium, the recordings were based on the highest treatment need observed after examination of all permanent teeth in a sextant. CPITN recording were made using the following code numbers:

Code 0 = healthy periodontal tissue (H); Code 1 = bleeding after probing (B); Code 2 = supra- or subgingival calculus and/or overhang(s) of filling(s) or crown(s) (C); Code 3 = pathological pocket(s) 4 or 5 mm (P_1) – shallow pockets; Code 4 = pathological pocket(s) > 6 mm (P_2) – deep pockets; X = excluded sextant (X).

According to the highest code number recorded, the subjects and sextants were classified into the following treatment need categories:

TN 0 = no treatment needed; TN 1 = oral hygiene instruction; TN 2 = oral hygiene instruction and prophylaxis; TN 3 = oral hygiene instruction, prophylaxis, and complex treatment.

As there was no significant sex-related difference, combined data for both sexes were used to enhance the sample representativeness. The significance of differences between the groups for the parameters analyzed was determined by Student's t-test.

Results

The results showed a similar percentage of subjects with bleeding, calculus, and shallow pockets in the two groups, whereas the percentage of intact periodontium was significantly higher in the control than in DS group (16.9% vs. none; P<0.01). Deep periodontal pockets were significantly more common in DS than in the control group (14.1% vs. 1.4%; P< 0.001) (Figure 1).

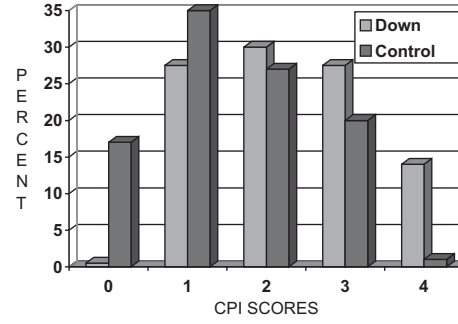

Fig. 1. Percentage distribution of Down's patients and control subjects according to highest CPI score (o – no periodontal disease; 1 – bleeding; 2 – calculus; 3 – shallow pockets; 4 – deep pockets).

The mean value of sextants with healty periodontal tissue was significantly lower in DS (mean = 0.1) than in control (mean = 1.7) subjects (p<0.01), whereas the proportion of bleeding, calculus, shallow and deep pockets was higher in DS than in control subjects (p<0.01 and p<0.05). There was no difference in the value of excluded sextants between the two groups of subjects (Table 1).

Only the parameter of shallow periodontal pockets yielded a statistically significant difference between the first and second DS age group. The prevalence of

TABLE 1
DIFFERENCES BETWEEN DOWN'S PATIENTS AND CONTROL SUBJECTS IN MEAN NUMBER OF MISSING SEXTANTS (X) WITH MAXIMUM CPI SCORE OF 0 THROUGH 4

Subjects	N	Mean number of sextants					
		No periodontal disease	Bleeding	Calculus	Shallow pockets	Deep pockets	Excluded; fewer than 2 teeth
Downs	71	0.1	5.7	2.8	1.3	0.3	0.3
Controls	71	1.7	4.2	1.4	0.3	0.0	0.1
		***	***	***	***	*	

* p < 0.05; *** p < 0.01

shallow pockets was significantly higher in subjects aged 16–25 years ($p<0.01$). Differences between the first and the third, and the second and the third DS age group were recorded for four parameters: calculus, shallow pockets, deep pockets and number of excluded sextants (X). The 26–34 age group had a significantly higher prevalence of calculus ($p<0.01$), and of shallow and deep periodontal pocket ($p<0.01$), and a significantly greater number of excluded sextants ($p<0.01$ and $p<0.05$) when compared to younger age groups (Table 2).

In the control group of subjects, differences were observed in the prevalence of healthy periodontium and bleeding between the first and the second age group. The 9–15 age group had a significantly higher proportion of healthy periodontal tissue than older age groups ($p<0.01$), whereas bleeding was more frequent in

TABLE 2
DIFFERENCES BETWEEN THREE AGE GROUPS OF DOWN'S PATIENTS IN MEAN NUMBER OF MISSING SEXTANTS (X) AND SEXTANTS WITH A MAXIMUM CPI SCORE OF 0 THROUGH 4

Subjects	Age (yr)	N	Mean numbers of sextants with CPI score					
			No peroiodontal disease	Bleeding	Calculus	Shallow pockets	Deep pockets	Excluded; fewer than 2 teeth
Down's	9–15	24	0.4	5.9	1.8	0.3	0.0	0.0
Down's	16–25	32	0.9	5.7	2.8	1.4 ***	0.2	0.3
Down's	9–15	24	0.4	5.9	1.8	0.3	0.0	0.0
Down's	26–34	15	0.0	5.3	4.2 ***	2.9 ***	0.9 ***	0.7 ***
Down's	16–25	32	0.9	5.7	2.8	1.4	0.2	0.3
Down's	26–34	15	0.0	5.3	4.2 **	2.9 ***	0.9 ***	0.7 *

* $p < 0.05$; ** $p < 0.02$; *** $p < 0.01$

TABLE 3
DIFFERENCES BETWEEN THREE AGE GROUPS OF CONTROL SUBJECTS IN MEAN NUMBER OF MISSING SEXTANTS WITH MAXIMUM CPI SCORE OF 0 THROUGH 4

Subjects	Age (yr)	N	Mean numbers of sextants with CPI score					
			No peroiodontal disease	Bleeding	Calculus	Shallow pockets	Deep pockets	Excluded; fewer than 2 teeth
Controls	9–15	24	2.7	3.3	0.5	0.0	0.0	0.0
Controls	16–25	32	1.5 ***	4.3 *	1.3	0.2	0.0	0.1
Controls	9–15	24	2.7	3.3	0.5	0.0	0.0	0.0
Controls	26–34	15	0.3 ***	5.3 ***	2.9 ***	1.2 **	0.1	0.4
Controls	16–25	32	1.5	4.3	1.3	0.2	0.0	0.1
Controls	26–34	15	0.3 **	5.3	2.9 ***	1.2 **	0.1	0.4

* $p < 0.05$; ** $p < 0.02$

the 16–25 age group ($p<0.05$). All parameters, with the exception of deep pockets and number of excluded sextants, yielded a statistically significant difference between the first and the third age group. Thus, healthy periodontium was more common in younger subjects ($p<0.01$), whereas all other parameters were more frequent in the 26–34 age group ($p<0.01$, $p<0.02$). The results obtained for the second and third control age group showed the healthy tissue to be more frequently found in younger subjects ($p<0.02$), and calculus and shallow periodontal pockets in the 26–34 age group ($p<0.01$ and $P<0.02$, respectively). Other parameters showed no significant difference (Table 3).

The results concerning the need of particular dental treatment, obtained in the group of DS patients and control subjects, showed a considerably higher percentage of DS subjects requiring instructions on oral hygiene, prophylaxis and complex treatment ($p<0.01$) (Figure 2).

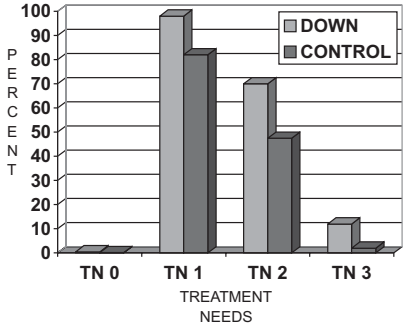

Fig. 2. Percentage of Down's patients and control subjects requiring no treatment (TN0), oral hygiene instruction (TN1), prophylaxis (TN2) and complex treatment (TN3).

Discussion and Conclusion

Previous studies on periodontal health in DS patients have generally based their assessment on indices and recording which do not reflect the same periodontal dimensions[20–23]. The aim of the present study was to assess the state of periodontal structures in detail. Therefore, we chose CPITN, since it is a reliable indicator of CPID status and treatment needs.

The results of our study showed none of the DS patients to have healthy periodontal tissue as opposed to control subjects where it was healthy (16.9%; $p<0.01$). The percentage of subjects with deep periodontal pockets was significantly higher in DS (14.1%) than in controls (1.4%; $p<0.01$) (Figure 1). The CPITN analysis of the mean value of affected sextants showed the prevalence of healthy periodontal tissue to be significantly higher in the control than in DS group ($p<0.01$), whereas bleeding, calculus, shallow and deep periodontal pockets as parameters of periodontal disease were more frequently recorded in DS subjects ($p<0.01$ and $p<0.05$) (Table 1).

The analysis of the results obtained in particular age groups of DS patients showed the periodontal involvement to increase with age (Table 2). In the control group, periodontium was significantly less affected, but the comparison between different age groups also revealed an increase with age (Table 3). Data on treatment needs showed the instructions on oral hygiene and prophylaxis as well as complete dental treatment to be indispensable in DS patients (Figure 2). Sakellari et al.[24] suggested that supragingival plaque in Down syndrome patients acts as a reservoir for reinfection of treated periodontium, so more adequate oral hygiene has to be applied by these patients.

Due to the use of various indices, our results are not directly comparable with those from other studies quoted herewith. However, all these studies, including the present one, point to a significantly higher periodontal involvement in

DS, which increases with age. Barr-Agholme et al.[25] indicated that the frequency of periodontitis among DS adolescents, mainly located on the lower incisors, markedly increased during a 7-yr period, although the severity and progression was limited.

A number of studies describe the reasons for increased susceptibility of DS patients to periodontal diseases[21,26–29]. The onset of periodontal disease occurs as early as the age of primary dentition, progressing rapidly to terminate with alveolar bone destruction and loss of teeth[22,26].

The mechanisms involved in the periodontal inflammatory processes in individuals with DS are not fully understood. It was previously considered that poor oral hygiene is generally responsible for the increased susceptibility to periodontal disease. However, now, macroglossia, malocclusion, short roots, loss of normal masticatory function, bruxism, gingival abnormalities, changes in saliva components and immune disorders are considered to play a considerable role[30,31].

Studies have shown an increased prevalence of fused molar roots in DS patients (65.1% in the maxilla and 40.5% in the mandible) as compared to normal subjects (40.5% in the maxilla and 21.1% in the mandible)[14], suggesting that such a high prevalence of molars with fused roots may also be a factor contributing to the high prevalence of periodontal disease in DS subjects[32,33]. Using a new method of rotating panoramic radiography with laser scanning, Kashima et al.[34] detected the presence of a vague bone structure with poor radio-opacity in DS, lacking the correlation with age. A modified response to insult, e.g. reduced chemotaxis, incomplete phagocytosis and modified immune response, has been recently attracting ever more attention as a factor in the etiology of periodontal disease in DS[35,36]. Yavuzyilmaz et al.[37] have demonstrated the significantly reduced neutrophil migration and chemotaxis. A shift from T to B lymphocyte predominance within the lesions has been assumed to be the main mechanism of progressive periodontal disease[29,36]. In addition, studies have shown Porphyromonas gingivalis (Bacteroides gingivalis) to be associated with the loss of epithelial attachment in adult periodontitis and in DS patients[38]. The correlation with Actinobacillus actinomycetemcomitans and the severity of the disease has also been established[5].

Also, genomes of the human cytomegalovirus and Epstein-Barr firus type 1 occur frequently in some diseases, as well as in DS. This fact suggested that herpesviruses may cause release of tissue-destructive cytokines, overgrowth of pathogenic periodontal bacteria, and initiation of cytotoxic or immunopathogenic events[39].

Reuland-Bosma et al.[40] found out recently, that no differences in the prevalence of distinct suspected periodontopahtic bacteria and bacterial subgingival composition between the DS group and the control group could be established. Because of the lack of differences in microflora between the DS group and the control group, a specific effect of the microbiological composition in the periodontal status of subjects with DS could be excluded in this population.

Some authors consider the high prevalence of periodontitis in DS to be attributable to the incomplete defense mechanism and host factors rather than to the action of any specific antigens[40,41].

The most recent studies suggested that plasminogen activators could play an important role in inducing extensive and rapid inflammation in the periodontal disease in individuals with DS, and that the overexpression of lipopolysaccharide-stimulated cyclooxygenase-2 induced a greater ability of fibroblasts to produce prostaglandin E2, and that these phenomena may be responsible for the se-

verer periodontal disease in DS patients[42,43].

The results obtained in this study showed the high prevalence of periodontal involvement in DS patients starting from the childhood (the youngest patient was 9 years old). This fact should stimulate the members of the dental team to be more efficient in planning the dental preventive and therapeutic procedures for this specific population, in order to achieve the optimum oral potential of persons with Down's syndrome.

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STANJE PARODONTA U OSOBA S DOWNOVIM SINDROMOM

S A Ž E T A K

Parodontna bolest u osoba s Downovim sindromom spominje se kao češći i ozbiljniji problem od samog karijesa. Cilj istraživanja bio je utvrđivanje stanja parodontnih struktura kod Downovog sindroma (DS). Primijenjen je Community Periodontal Index of Treatment Needs na 71 pacijentu s DS dobi od 9–34 godine. Kontrolna skupina sastojala se od 71 zdrave osobe jednake dobi i spola. Obje skupine bile su podijeljene u tri dobne grupe: 9–15; 16–25; i 26–34 godine. Rezultati su pokazali sličan postotak osoba s krvarenjem i kamencem. Intaktni parodont bio je veći u kontrolnoj grupi, nego kod DS (16.9% nasuprot 0.0%; $p<0.01$). Duboki džepovi su češći kod DS, nego kod kontrole (14.1% nasuprot 1.4%; $p<0.01$). Srednja vrijednost sekstanata sa zdravim parodontom bila je manja, a s krvarenjem, kamencem i plitkim džepovima značajno veća u pacijenata s DS, nego u kontrolnoj grupi ($p<0.01$). Svi ispitanici s DS potreban je tretman parodonta ($p<0.01$). Može se zaključiti da je izraženost parodontne bolesti i potreba za tretmanom signifikantno veća kod pacijenata s DS, nego u zdravih osoba.

Ključne riječi: Down sindrom, parodontna bolest, parodontni indeks