

Comparison of Caries Prevalence in Two Populations of Cleft Patients

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Objective: To assess and compare the oral and dental status and the level of oral health care among Polish and German patients with cleft lip and palate treated in Łódź and Erlangen, followed by an assessment of the level of realization of oral care procedures.

Design: Oral and dental status were assessed by the presence of dental plaque and caries lesions. Parents of each patient completed a questionnaire related to frequency of tooth brushing, frequency of dental visits, and the use of means with increased fluoride content.

Setting: Department of Dentistry for Developmental Ages, Medical University of Łódź, Łódź, Poland, and Department of Orthodontics, University of Erlangen-Nuremberg, Erlangen, Germany.

Patients and Intervention: Thirty-seven Polish patients were examined between February and April 2004. Sixty-three German patients were examined between October 2004 and August 2005.

Results: In Erlangen, decayed teeth = 1.625, missing teeth = 0.014, and filled teeth = 2.39. In Łódź, decayed teeth = 2.5, missing teeth = 0.09, and filled teeth = 0.75. Among the subjects with Approximal Plaque Index scores <40%, the Decayed-Missing-Filled-Teeth Index was significantly higher in Polish than in German patients. In the total population of patients, a positive correlation between the value of the API Index and caries intensity was recorded. Declared parents' answers did not copy the actual oral cavity status.

Conclusions: Caries prevalence in each group was much higher than in the general population and significantly higher among Polish than German cleft patients. Programs for cleft children promoting oral health, especially aimed at plaque control, are recommended in the early stages of the children's lives.

KEY WORDS: *caries, cleft, oral hygiene*

Although a decline in dental caries in the highly industrialized Western countries has been reported, children with cleft lip/alveolar process and/or palate remain in the high-risk group for dental caries (Wong and King, 1998; Marthaler, 2004). Oral hygiene control is hindered by features such as dental and arch segment irregularities, orthodontic appliances, and persisting soft tissue folds before palatoplasty, as well as scar tissue after cleft closure, hence creating a predisposition to higher caries incidence (Wong and King, 1998; da Silva Dalben et al., 2003; Quirynen et al., 2003). Severe malocclusion results in higher prevalence of dental caries in cleft lip and/or palate (CL±P) patients than in the general population (Wong and King, 1998).

General Outlook on Caries Intensity in Germany and in Poland

As stated in the Social Code of the Federal Republic of Germany (SGB V), the oral health in this country has improved considerably over the past years. Caries experience (Decayed-Missing-Filled-Teeth [DMFT] Index) decreased in 12-year-old children from 7.0 in 1973 to 1.2 in the year 2000 and achieved the World Health Organization (WHO) aim for the year 2000 (DMFT = 2.0). Germany also can boast of one of the lowest DMFT indices in Europe (Walter, 2003). In a study by Krämer (2005), a downward trend of caries intensity among Bavarian children was demonstrated. Since 1989, when the SGB V was changed, the premises for dental prophylaxis have been improved and the preventive measures against caries in Bavarian kindergartens and schools have been systematized and intensified. In 1995, the mean DMFT in the 6- to 12-year age group was still 1.61. Three years later, caries experience decreased to 1.07, and the decline continues (Krämer, 2005).

The results of caries decline in Germany compared with caries experience among Polish children are impressive. In spite of a slight decreasing tendency (0.1% per year), the mean

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DMFT Index for Polish 12-year-olds in the year 2002 was 3.8, which cannot yet be taken as a success (Wierzbicka et al., 2002). In the Łódź region, the DMFT Index achieved a level of 3.19 in 2003, compared with 2.97 in 2000. In primary teeth, the dmft scores were 5.11 in 5-year-olds and 5.24 for 6-year-olds (Rybarczyk-Townsend et al., 2005; Szydłowska-Walendowska et al., 2005).

Treatment Concept of Cleft Patients in Erlangen and in Łódź

Seven different departments cooperate within the Cleft Lip and Palate Center at the University of Erlangen–Nuremberg. Once a year, patients are recalled and checked by a multidisciplinary team (Andrä, 1998; Strobel-Schwarthoff and Hirschfelder, 2002/2003; Hirschfelder and Iserhardt, 2003/2004; Stec et al., 2007). In the case of Poland, a multi-specialist program of medical care for children with palatal and/or labial cleft was launched in nine Polish cities in 2001, one of which was Łódź (Małkiewicz, 2002).

In Poland, the caries preventive procedures are similar to those conducted in Germany, but according to the orders of each National Health Service, these procedures are allowed to be performed more frequently in Erlangen than in Łódź:

- General dental examination: Łódź, once a year; Erlangen, at least once every 3 months
- Instruction of oral hygiene procedures (proper brushing techniques, if necessary; decolorizing of dental plaque): Łódź, once a year; Erlangen, at least once every 3 months
- Professionally applied topical fluoridation of teeth: Łódź, once every 3 months; Erlangen, at least once every 3 months

Additionally, at the Medical University of Łódź, there are two departments where dental treatment in cleft children is performed: the Department of Dentistry for Developmental Ages, which takes care of caries prophylaxis and caries treatment, and the Department of Orthodontics, which is responsible only for orthodontic treatment. Hence, if the orthodontically treated patient has problems with oral hygiene, adequate instructions should be given on a separate visit to the other department. In Erlangen, all caries preventive procedures can be undertaken directly in the Department of Orthodontics (Stec et al., 2007).

The purpose of this research was to test whether the caries experience differed according to the different approach to managing children with CL ± P in the two locations.

SUBJECTS AND METHODS

One hundred individuals, ages 3.5 to 18 years, voluntarily participated in this study. Ethical principles for medical research involving human subjects, as outlined in the Declaration of Helsinki, were followed.

Thirty-seven patients (mean age = 13.7 years) were treated in the Department of Dentistry for Developmental Ages at the

TABLE 1 Sample Distribution by Cleft Type

Type of CL ± P	Unilateral		Bilateral	
	Łódź	Erlangen	Łódź	Erlangen
Incomplete	25	3	4	0
Complete	7	44	1	16
Total	32	47	5	16

Medical University of Łódź, Łódź, Poland, between February and April 2004. Sixty-three subjects (mean age = 13.6 years) were patients in the Cleft Palate Center of the University of Erlangen-Nuremberg, Erlangen, Germany, between October 2004 and February 2005.

Table 1 presents patients' distribution according to cleft type. The majority of subjects in both populations (18 in Łódź and 33 in Erlangen) were in a phase of active orthodontic treatment. Boys outnumbered girls in both groups. All patients were nonsyndromic.

Every child was examined for caries according to the criteria of the WHO Oral Health Country/Area Profile Program (1997). The clinical examination was performed by a single dentist using a dental chair, operating light, plane dental mirror, and a probe. Each diagnosis was checked by a second dentist. To avoid an uncertain diagnosis, the stages of caries that precede cavitation, as well as other conditions similar to the early stages of caries, were excluded. According to WHO criteria, the "mt" code was used for permanent or primary teeth that have been extracted because of caries. For missing primary teeth, this score was used only if the subject was at an age when normal exfoliation would not be a sufficient explanation for absence. To assess the oral hygiene status, the Approximal Plaque Index (API) of Lange (1986) was applied to all defined regions with aid of a probe and a MIRA-2-TON (Hager & Werken GmbH and Co., Duisburg, Germany) plaque disclosure solution (scores: "+" = plaque is present, "-" = absent). The following diagnostic criteria for oral hygiene were applied: optimal (API ≤ 40%), insufficient (70% > API > 40%), or dissatisfying (API > 70%).

Both samples were divided into two age groups: 6 to 12 years (42% of German population; 37% of Polish population) and 13 to 18 years (58% of German and 63% of Polish population).

In all subjects in Łódź, the surgical procedures were conducted in the Department of Plastic Surgery at the Medical University of Łódź, Łódź, Poland. The patients from Erlangen were operated on in the Department of Oral and Craniomaxillofacial Surgery at the University of Erlangen-Nuremberg, Erlangen, Germany. In both clinics, the general concept of treatment was similar. Although the preferable operation techniques were comparable, there were differences in timing of the cleft lip repair as well as closure of alveolus and palate (Stec et al., 2007).

Additionally, parents of each patient were asked to complete a questionnaire relating to frequency of tooth brushing (optimal answer: at least twice a day, after breakfast and before sleep), frequency of dental visits (optimal answer: at least once

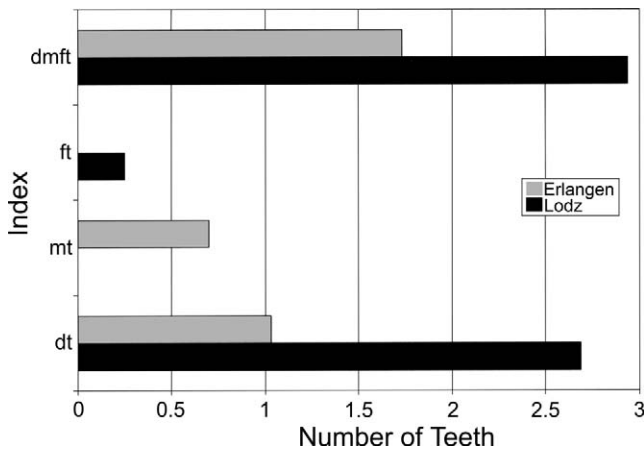


FIGURE 1 Comparison of caries intensity in deciduous dentition in two populations.

every 6 months), and the use of additional means with fluoride content other than toothpaste, such as gel, mouth rinse, or fluoridated salt (Ketkar et al., 2006).

STATISTICAL ANALYSIS

Chi-square test (χ^2), Yates corrected chi-square test (χ^2_Y), and Fisher's exact test were used for statistical analyses. The level of statistical significance was set at $p < .05$. The calculations were made with the STATGRAPHICS Plus 5.1 program (StatPoint, Inc., Herndon, VA).

RESULTS

Both groups of patients were comparable regarding gender and age. The majority of patients seen were boys: 20 of 37 in Łódź and 36 of 63 in Erlangen. The mean age in Erlangen was 12.1 years and in Łódź, 12.4 years (in both: minimum = 6.0, maximum = 18.0).

Although we are aware of the fact that different cleft types are genetically heterogeneous (Kot and Kruk-Jaromin, 2003; Calzoral et al., 2004; Cobourne, 2004), all patients were grouped together because they were comparable regarding gender and age. Additionally, no statistically significant difference in frequency of caries between the cleft types was found ($p > .05$).

There was no statistically significant difference in the number of decayed (d), missing (m), or filled (f) deciduous teeth between Poland (dmft = 2.9) and Germany (dmft = 1.7) (p

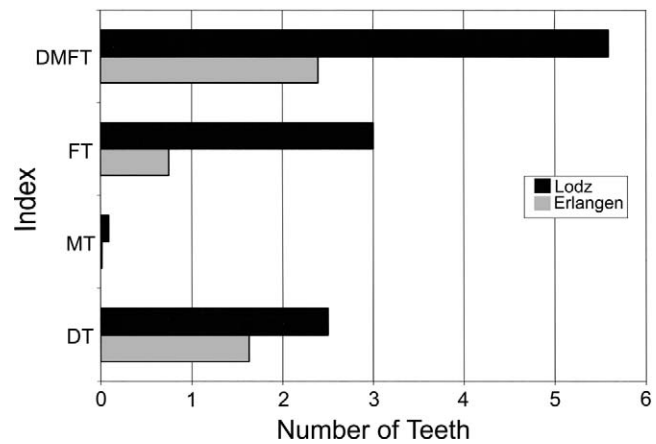


FIGURE 2 Comparison of caries intensity in permanent dentition in two populations.

$> .05$; Fig. 1). On average, 1.03 primary teeth needed a conservative treatment in Erlangen, compared with 2.69 teeth in Łódź. However, among German children there was no primary tooth treated (ft = 0), and at the same time an average of 0.7 tooth was extracted due to caries (to exclude cases of normally exfoliated teeth, a general dental history from parents and dentists was taken). In Łódź, treatment was undertaken (ft = 0.25), but no tooth was extracted (mt = 0.0). The mean dmft for the Polish 6- to 12-year-olds was 3.27, whereas the dmft for the 13- to 18-year-olds was 0.0. The mean dmft for the German 6- to 12-year-olds was 1.6, whereas the dmft for the 13- to 18-year-olds was 0.83.

In Erlangen, there was on average 1.625 permanent teeth affected by caries and in Łódź there were 2.5 decayed teeth per person. In Łódź as well as in Erlangen, there was a comparatively small amount of extractions due to caries (MT = 0.09 in Łódź; see Fig. 2). The mean DMFT for the Polish 6- to 12-year-olds was 4.1, whereas the dmft for the 13- to 18-year-olds was 7.125. The mean DMFT for German 6- to 12-year-olds was 1.6, whereas the dmft for the 13- to 18-year-olds was 3.2. Table 2 presents the total number of deciduous and permanent teeth in Łódź and Erlangen.

No correlation ($p > .05$) was observed between gender and caries experience in Erlangen or in Łódź. However, there were significantly ($p < .05$) more patients with DMFT scores greater than 4.5 and a positive caries history in Łódź compared with the number of patients from Erlangen.

No statistical correlation between presence of fissure sealant and caries experience was recorded in any of the groups ($p >$

TABLE 2 Presentation of Total Number of Deciduous and Permanent Teeth in Łódź and Erlangen

Age Group	Łódź				Erlangen			
	Deciduous Teeth		Permanent Teeth		Deciduous Teeth		Permanent Teeth	
	No. of Patients With Caries	No. of Caries Teeth	No. of Patients With Caries	No. of Caries Teeth	No. of Patients With Caries	No. of Caries Teeth	No. of Patients With Caries	No. of Caries Teeth
6–12 y	10	42	16	77	13	49	17	61
13–18 y	1	5	16	113	2	3	20	85
Total	11	47	32	190	15	52	37	146

TABLE 3 Correlation Between Oral Hygiene Status (API Index) and Caries Experience in Primary (dmf) and Secondary (DMF) Teeth†

API Index			<i>n</i>	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard Deviation</i>
≤40%	Erlangen	dmf	10	1.500	0.00	0.00	9.000	2.915
		DMF	19	1.263*	1.00	0.00	5.000	1.522
	Łódź	dmf	1	1.000	—	1.00	1.000	—
		DMF	7	7.143*	6.00	3.00	14.000	3.716
	Erlangen + Łódź	dmf	18	1.500*	0.00	0.00	9.000	2.640
		DMF	40	2.175*	1.00	0.00	14.000	2.986
40% < API <70%	Erlangen	dmf	0	—	—	—	—	—
		DMF	2	0.500	0.500	0.00	1.000	0.707
	Łódź	dmf	6	4.167	4.000	0.00	9.000	3.189
		DMF	9	4.667	5.000	0.00	7.000	2.598
	Erlangen + Łódź	dmf	7	4.000	3.000	0.00	9.000	2.944
		DMF	12	3.917*	4.500	0.00	7.000	2.746
≥70%	Erlangen	dmf	2	1.000	1.000	0.00	2.000	1.414
		DMF	7	5.571	6.000	0.00	11.000	4.198
	Łódź	dmf	9	2.333	1.000	0.00	11.000	3.674
		DMF	18	5.444	5.000	0.00	14.000	4.179
	Erlangen + Łódź	dmf	16	2.063*	1.000	0.00	11.000	3.255
		DMF	35	5.257*	5.000	0.00	14.000	3.898

† API = Approximal Plaque Index; d, D = decayed; m, M = missing; f, F = filled.
 * = Statistically significant (*p* < .001) comparisons.

.05). However, more patients had fissure sealants in Erlangen (46%) than in Łódź (24.3%).

Among the subjects with proper oral hygiene (API < 40 %), the mean DMFT value was significantly higher in Polish than in German patients. In the total population of patients (Łódź + Erlangen), a positive correlation ($\rho = 0.427$; $p = 0.001$) was recorded between the API Index and caries experience (see Table 3).

The prevalence of caries was not correlated with the active phase of orthodontic treatment either in Łódź or in Erlangen ($p > .05$).

As determined from the questionnaire, almost all patients from Erlangen and a majority from Łódź visited their dentist minimum once every 6 months (see Table 4). In Łódź and Erlangen, the DMFT index was significantly lower among those subjects who visited the dentist regularly ($p < .05$). In Erlangen and Łódź, the majority of patients’ guardians stated that their children brushed their teeth a minimum of twice a day, after breakfast and before sleep. Simultaneously, optimal oral hygiene (API ≤ 40%) was detected in 60% of patients

from Erlangen, but in only 19% of patients in Łódź. Caries experience differed significantly between the groups of “fluoride consumers” (patients who used additional means with fluoride content other than toothpaste, such as gel, mouth rinse, or fluoridated salt) and “nonconsumers,” comparing patients from Erlangen and Łódź ($p < .05$).

DISCUSSION

The fact that no statistically significant difference was found in the frequency of caries between the cleft types could be explained by the fact that alveolar deformations are more severe in bilateral cleft cases and milder in cleft lip cases. In other studies, caries rate in bilateral CL ± P was higher than in other cleft types. However, the etiology has been described as unclear (Ishida et al., 1989; Besseling and Dubois, 2004). In our study, the lack of a statistically significant difference in caries frequency between cleft types also may have been influenced by the smaller number of individuals with cleft types other than cleft lip, alveolus, and palate.

TABLE 4 Comparison of Dental Care in Erlangen and Łódź Declared by the Patients’ Guardians

		Erlangen		Łódź		Total		Statistical Results
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Toothbrushing	Correct*	52	88.1	17	50.0	69	74.2	$\chi^2 = 16.384$ $p = .00005$
	Incorrect	7	11.9	17	50.0	24	25.8	
	Total	59	100.0	34	100.0	93	100.0	
Fluoride intake	Yes	36	60.0	26	74.3	62	65.3	$\chi^2 = 1.990$ $p > .05$
	No	24	40.0	9	25.7	33	34.7	
	Total	60	100.0	35	100	95	100.0	
Visits to the dentist	Regular†	53	94.6	26	70.3	79	84.5	$\chi^2 = 8.531$ $p = .003491$
	Irregular	3	5.4	11	29.7	14	15.5	
	Total	56	100.0	37	100	93	100.0	

* Answer was classified as correct when respondents declared that teeth were brushed at least twice a day (in the morning after breakfast and in the evening before sleeping) for a minimum of 3 minutes.
 † Visits were classified as regular when the patient visited the dentist a minimum of once every 6 months.

Although a number of epidemiological studies of caries in cleft patients did not incorporate control groups, all reported high caries experience. Our results confirm the observations of other authors that cleft patients have greater caries mean scores than the general population does (Johnsen and Dixon, 1984; Dahllöf et al., 1989; Besseling and Dubois, 2004; Al-Wahadni et al., 2005). Besides structural defects of the oral cavity existing in this anomaly, the high prevalence of dental erosion and the high salivary levels of caries-associated microflora in children with cleft palate are mentioned as possible factors responsible for a higher incidence of caries (Malanczuk et al., 1999; Chapple and Nunn, 2001; da Silva Dalben et al., 2003). Paul and Brandt (1998) also suggested that the consequences of surgical repair of cleft lip and alveolus may influence the maintenance of oral hygiene. This agrees with our observations, because the treatment concepts for cleft patients in Erlangen and in Łódź are different (Stec et al., 2007).

Johnsen and Dixon (1984) and Paul and Brandt (1998) reported a higher prevalence of caries in cleft children, and Dahllöf et al. (1989) and Al-Wahadni et al. (2005) found no statistically significant difference in frequency of caries between cleft types. Our findings confirm those of Dahllöf et al. (1989), which might be explained by the similarity of Polish and German patient populations regarding gender, age, and cleft types (Paul and Brandt, 1998; Stec et al., 2007).

Whereas Paul and Brant (1998), Bokhout et al. (1997), and Chapple and Nunn (2001) reported a lower experience of caries, the study population of Gregg et al. (1999) had an increased experience of caries as compared with our results. However, we agree with Chapple and Nunn (2001), who pointed out that due to the wide range of children taking part in studies on cleft patients, it is difficult to compare the results of caries prevalence with other authors' observations.

The difference in dental caries experience in both examined groups is a reflection of caries in the whole population of Poland and Germany. This could be due partly to regional differences, particularly in cases in which these reflect differing fluoridation status (Chapple and Nunn, 2001). Although in both groups the DMFT Index was significantly lower among those subjects who visited the dentist regularly, "regular visitors" caries was relatively high in Poland, which may indicate the need for more frequent dental examinations in this group. The fact that the parents' answers did not coincide with the actual oral cavity status may suggest that Polish parents selected the correct answer on the questionnaire because they were aware of proper oral care, but they did not complete the proper oral care procedures. This highlights the parental over-indulgence discussed by other authors (Lin and Tsai, 1999; da Silva Dalben et al., 2003).

Other studies have suggested that the parents of children with specific health conditions, such as cleft, allow them to do anything, including engaging in unhealthy dietary habits. Furthermore, although parents may know proper oral care procedures, they may find it difficult to demand the children to perform them (Johnsen, 1982; Milnes, 1996). Turner et al. (1998) mentioned the lower priority of dental care for children

with CL ± P because the caretakers focus on the numerous medical procedures required to correct the birth defect. We agree with other authors who suggested that caries prevention in this group of children should underscore the need for good oral hygiene and the use of a fluoride-containing toothpaste (Chapple and Nunn, 2001; Ahluwalia et al., 2004; Besseling and Dubois, 2004; Al-Wahadni et al., 2005).

CONCLUSIONS

In conclusion, results of this study indicate that caries prevalence is much higher among Polish than German cleft patients, but the caries experience in each group is much higher than in the general Polish and German population. The explanation of the dissimilarity in caries experience between German and Polish children with CL ± P lies in the different methods of dental caries prophylaxis and caries treatment of the cleft patients. Parents of younger Polish and German children with developmental disturbances such as clefts should be more motivated to perform routine oral health care for their children. Programs for cleft children promoting oral health, especially aimed at plaque control, are recommended in the early stages of the child's life.

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