Prevalence of caries and dental malocclusions in the apulian paediatric population: an epidemiological study

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Abstract

Aim The purpose of this epidemiological study was to assess the prevalence of malocclusion, its association with caries experience, and level of oral hygiene in the Apulian population.

Materials and methods Study design: A total of 530 paediatric patients (267 girls, 263 boys), aged 8–10 years (±SD 1.2) were randomly selected from primary schools in Apulia (Italy). The Decayed, Missing and Filled Teeth (DMFT/dmtf) index), the Dental Aesthetic Index (DAI), recorded according to the WHO criteria, were used by two calibrated examiners to diagnose dental caries and malocclusion, respectively.

Results Except for the presence of dental calculus, Class II malocclusion, open bite and dental crowding, ($p>0.05$), all variables in the negative binomial regression showed a significant relationship with the incidence rate of caries in deciduous teeth. Statistics: Children were clinically examined in a community dental office. Statistical analysis was carried out using R version 3.5.1.

Conclusions The study outcomes underline the need for preventive care programmes to improve oral health conditions as well as to decrease oral pathology risk factors in the Apulia region.

KEYWORD Dental caries, Malocclusion, Normal occlusion, Oral hygiene status, Paediatric dental patients.

Introduction

Oral health is a fundamental part of general health and no one can be considered completely healthy while there is active disease in the oral cavity as "Health is a state of complete physical, mental and social wellbeing and not merely an absence of disease or infirmity" [Gondivkar et al., 2017].

Dental caries is a multifactorial transmissible, chronic and degenerative infectious disease, which affects and damages dental hard tissues. It is one of the most common pathologies, particularly in the paediatric age [Folayan et al., 2018; Giugliano et al., 2018; Marcenes et al., 2013; Paglia et al., 2016].

To detect malocclusion among children, the choice of a population ranging between 8 to 10 years of age is important, because several children develop problems during this mixed dentition stage [Petersen, 2008]. Furthermore, sometimes newly erupted permanent teeth have sharp edges.

The relationship between malocclusions (mainly crowding) and prevalence of dental caries is an important concept but present in very few epidemiological studies. This association is due to the increased susceptibility to plaque retention among the crowded teeth, which results in caries development [Arora et al., 2015].

On October 10, 2008, the Italian Ministry of Labour, Health and Social Policies published the first edition of the "National guidelines for the promotion of oral health and prevention of oral diseases in developmental age", followed by an update in November 2013 [Giannattasio et al., 2015]. These guidelines suggest to define the population in developmental age at risk of decay (http://www.salute.gov.it/imgs/C_17_pubblicazioni_2073_allegato.pdf). Moreover, the WHO urges the implementation of National epidemiological studies to monitor the state of oral health in specific population groups, divided by age [Petersen, 2008]. Previous epidemiological studies carried out in different regions of Italy indicate that the prevalence of caries at the beginning of primary school (6 years) is around 30%, while that in middle school (12 years) is between 47% and 62% (Table 1).

The present study arises from a project to activate a dental community care preventive programme and an epidemiological evaluation in the paediatric population of the Apulia Region

(Italy). The programme was promoted by the AReS (Regional Health Agency) with the collaboration of the University Aldo Moro of Bari (Italy).

The aim was to establish the frequencies of the different occlusal traits associated to caries experience and level of oral hygiene among paediatric patients.

Materials and methods

Pilot study and examiner calibration

A total of 530 paediatric patients (267 girls, 263 boys), aged 8–10 years (±SD 1.2) were randomly selected from primary schools of the Apulia Region.

The intraoral examination and orthodontic evaluation were carried out by four blinded calibrated examiners who worked in pair: the first two visited and the second two collected data. Before undertaking clinical examinations, the examiners took part in a course on methods of clinical research, paediatric dentistry and orthodontic diagnosis, according to the WHO recommendations.

A written consent was obtained from the children's parents and guardians before starting clinical examinations, in accordance with the Helsinki Declaration of 1975, as revised in 2000.

The students were examined on the dental chair, with the use of a dental mirror and probe, for measuring the following parameters: Dental Aesthetic Index (DAI) (overjet, missing teeth, diastema, anterior open bite, anterior spacing, largest anterior irregularity - mandible and maxilla -, anterior-posterior molar relationship), and decayed (d for primary teeth, D for permanent teeth), missing (m for primary teeth, M for permanent teeth), or filled (f for primary teeth, F for permanent teeth) index (dmft/DMFT) for mixed dentition, according to WHO recommendations [WHO, 2013]. Oral hygiene was assessed by using the Visible Plaque Index (VPI) as described by Ainamo and Bay [1975]. The index was calculated as the percentage of teeth with visible plaque on the buccal or lingual surface of each tooth.

The possibilities of correlations between dental anomalies causing plaque accumulation and caries scores were also studied. In accordance with the WHO guidelines dental crowding, considered to be one of the most important orthodontic anomaly causing plaque retention, was also examined in the maxillary and mandibular incisor regions [Szyszka-Sommerfeld and Buczkowska-Radlińska, 2010].

The data collected by the Provincial Pilot dental community offices selected by AReS, refer to the period between 2012 and 2013, following the indications provided in a specific form (Fig. 1).

Statistical analysis

Statistical analysis was carried out using R version 3.5.1 (released on 2018-07-02).

Continuous variables were reported as mean standard deviation (±SD), categorical ones as absolute and relative frequencies. The primary outcome was the number of decayed deciduous teeth.

Predictors were entered into a multivariable negative binomial regression model for caries of deciduous teeth, in order to evaluate the association between the variables and the number of dental caries through the estimation of Incidence Rate Ratios (IRR).

A rootogram was used to assess the goodness-of-fit of the negative binomial model. Statistical significance α was fixed to 0.05.

Results

Baseline characteristics of patients are reported in Table 2.

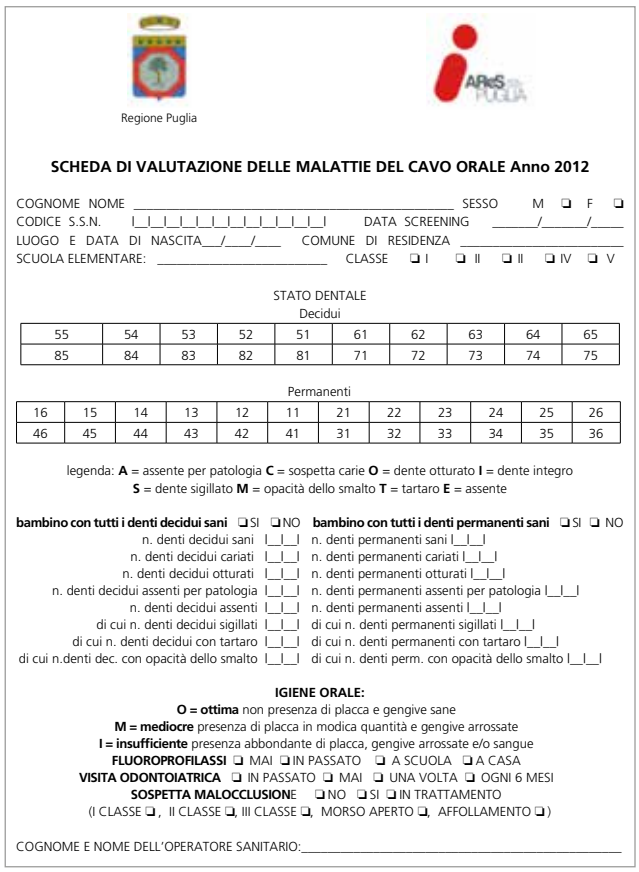
Except for presence of dental calculus, malocclusion of Class II, open bite and dental crowding (p>0.05), all variables in the negative binomial regression (Table 3) showed a significant relationship with the incidence rate of caries of deciduous teeth: number of total deciduous teeth (IRR=1.09, 95%CI=1.03-1.16, p=0.011), poor oral hygiene (IRR=10.71, 95%CI=3.31-48.30, p<0.001), insufficient oral hygiene (IRR=40.39, 95%CI=11.74-189.97, p<0.001) and presence of partially retained dental sealants (IRR=1.72, 95%CI=1.18-2.53, p=0.006) as risk factors, while fluorine prophylaxis (IRR=0.58, 95%CI=0.38-0.88, p=0.012) and malocclusion of Class III (IRR=0.28, 95%CI=0.07-1.04, p=0.049) as protective factors.

Discussion

Dental caries is a disease of the mineralised tissues of teeth.

Region	Age(Range)	Caries Prevalence {%)	dmft/ DMFT	Reference
Friuli	5/ 12	33/70	dmft1.47; DMFT 2.46	Sacher 1995
Veneto	6/ 12	29/ Nd	drnft 1.2; DMFT 2.1	Basso T. 2000
Abruzzo	3/ 4/5	13.28/ 18.95/26.9	Nel	Ferro B. 2004
Lazio	7/9/ 11	Nel / Nel /46.5	dft1.75/2.11; D~IFT1.19	Perinetti, 2005
Calabria	3- 5	27.3	dft 1.1	Petti S. 2000
Sardegna	6/ 12	47.1 /52.7	drnft 2.1 / D~IFT 1.5	Angeli Ilo IF 1998
Sardegna	12	61.6	Nel	Campus G. 2001
Sicilia	2.5- 6.5	29.9	drnfs:t 3.26	Campus G. 2004
Sicilia	6/13	57.7/75.2	Nd	Termini C. 1993

TABLE 1 Epidemiological community dentistry studies carried out in different regions of Italy.



Regione Puglia

SCHEDA DI VALUTAZIONE DELLE MALATTIE DEL CAVO ORALE Anno 2012

COGNOME NOME _____ SESSO M ❑ F ❑
CODICE S.S.N. I_I_I_I_I_I_I_I_I_I_I_I_I_I_I_I DATA SCREENING _____/_____/_____
LUOGO E DATA DI NASCITA___/____/____ COMUNE DI RESIDENZA _____
SCUOLA ELEMENTARE: _____ CLASSE ❑ I ❑ II ❑ II ❑ IV ❑ V

STATO DENTALE
Decidui

55	54	53	52	51	61	62	63	64	65
85	84	83	82	81	71	72	73	74	75

Permanenti

16	15	14	13	12	11	21	22	23	24	25	26
46	45	44	43	42	41	31	32	33	34	35	36

legenda: **A** = assente per patologia **C** = sospetta carie **O** = dente otturato **I** = dente integro
S = dente sigillato **M** = opacità dello smalto **T** = tartaro **E** = assente

bambino con tutti i denti decidui sani ❑SI ❑NO **bambino con tutti i denti permanenti sani** ❑SI ❑ NO
n. denti decidui sani I__I__I n. denti permanenti sani I__I__I
n. denti decidui cariati I__I__I n. denti permanenti cariati I__I__I
n. denti decidui otturati I__I__I n. denti permanenti otturati I__I__I
n. denti decidui assenti per patologia I__I__I n. denti permanenti assenti per patologia I__I__I
n. denti decidui assenti I__I__I n. denti permanenti assenti I__I__I
di cui n. denti decidui sigillati I__I__I di cui n. denti permanenti sigillati I__I__I
di cui n. denti decidui con tartaro I__I__I di cui n. denti permanenti con tartaro I__I__I
di cui n.denti dec. con opacità dello smalto I__I__I di cui n. denti perm. con opacità dello smalto I__I__I

IGIENE ORALE:
O = ottima non presenza di placca e gengive sane
M = mediocre presenza di placca in modica quantità e gengive arrossate
I = insufficiente presenza abbondante di placca, gengive arrossate e/o sangue
FLUOROPROFILASSI ❑ MAI ❑IN PASSATO ❑ A SCUOLA ❑A CASA
VISITA ODONTOIATRICA ❑ IN PASSATO ❑ MAI ❑ UNA VOLTA ❑ OGNI 6 MESI
SOSPETTA MALOCCLUSIONE ❑NO ❑SI ❑IN TRATTAMENTO
(I CLASSE ❑, II CLASSE ❑, III CLASSE ❑, MORSO APERTO ❑, AFFOLLAMENTO ❑)

COGNOME E NOME DELL'OPERATORE SANITARIO:_____

FIG. 1 Dental screening form for oral diseases.

n=530	
Age, mean (±SD)	9.1 (1.2)
Gender, n (%)	..
Female	267 (50.4)
Male	263 (49.6)
Calendar year, n (%)	
2012	56 (10.6)
2013	474 (89.4)
Deciduous tooth, mean (±SD)	..
Healthy	10.11 (4.2)
Carious	1.2 (2.0)
Total	11.3 (4.0)
Oral Hygiene, n (%)	..
Optimal	29 (5.5)
Poor	438 (82.6)
Insufficient	63 (11.9)
Fluorine prophylaxis, n (%)	118 (22.3)
Dental calculus ablation, n (%)	527 (99.4)
Dental sealants, n (%)	..
0	308 (58.1)
1	5 (0.9)
2	18 (3.4)
3	30 (5.7)
4	169 (31.9)
Occlusion class, n (%)	..
Class I: Neutrocclusion	344 (64.9)
Class II: Distocclusion	79 (14.9)
Class III: Mesiocclusion	11 (2.1)
Open Bite	24 (4.5)
Dental Crowding	72 (13.6)

TABLE 2 Baseline characteristics of patients.

It usually has a chronic course and is caused by external factors which can be modified. Current opinions about the contribution of malocclusions to the aetiology of dental caries are conflicting [Banu et al., 2018; Martins et al., 2018].

A recent Cochrane review showed that maintenance of oral health and hygiene is crucial for the prevention of caries and periodontal disease [de Silva et al. 2016; ElSalhy et al., 2016].

Recently, some reports presented in international scientific literature provide evidence of low certainty suggesting that community-based oral health promotion interventions, that combine oral health education with supervised toothbrushing or professional preventive oral care, can reduce dental caries in children. Other interventions, such as those that aim to promote access to fluoride, buccal surfaces sealing, improve children's diets or provide oral health education alone, show only limited impact [Cianetti et al., 2016; Giugliano et al., 2018; Paglia et al., 2016; Vallogini et al., 2017].

Moreover there is no clear indication on the most effective time to intervene during childhood [de Silva et al. 2016; Chertok et al., 2018; Thomson et al., 2016; Orton et al., 2018; Northridg et al., 2017].

Future directions may include the incorporation of a section on oral health in the curriculum for Family Medicine and Paediatric residency, or an oral health assessment on the checklist when children attend medical clinics for their vaccinations [Lai B et al., 2018]. In fact, tooth decay remains a substantial problem in young children and it is made worse by existing barriers that prevent them from obtaining dental care. Because most children are exposed to medical care but not to dental care at an early age, primary care medical providers have the opportunity to play an important role in helping children and their families gain access to dental care. This important interface between medical and dental practitioners has received only superficial studies [dela Cruz et al., 2004].

Caries and the premature loss of deciduous teeth may lead to malocclusion in the permanent dentition [Northway et al., 1984; Baskaradoss et al., 2013; Singh et al., 2011].

The relationship between malocclusion, DMFT/dmtf and DAI in addition to VPI scores is an important finding of the present aepidemiological survey. Several population-based indices have been developed to assess malocclusions, such as the commonly used DAI and Index of Orthodontic Treatment Need (IOTN) [Manzanera et al., 2010; Kaygisiz et al., 2016; Onyeaso et al., 2007]. Both the DAI and the IOTN include aesthetic and anatomic components of malocclusion, but the IOTN is reportedly more accurate [Baskaradoss et al., 2007; Gábris et al., 2006]. However, the DAI was preferred in this study because several studies have used this index to report the prevalence of malocclusions. This enables comparability of findings among similar studies [Cirulli et al., 2015].

	IRR (95%CI)	p value
Deciduous tooth	1.09 (1.03-1.16)	0.011
Oral Hygiene	..	..
Optimal	1.00 (ref)	(ref)
Poor	10.71 (3.31-48.30)	<0.001
Insufficient	40.39 (11.74-189.97)	<0.001
Fluorine prophylaxis	0.58 (0.38-0.88)	0.012
Dental calculus ablation	0.60 (0.06-3.51)	0.633
Dental sealants	1.72 (1.18-2.53)	0.006
Occlusion class	..	..
Class I: Neutrocclusion	1.00 (ref)	(ref)
Class II: Distocclusion	1.08 (0.70-1.69)	0.728
Class III: Mesiocclusion	0.28 (0.07-1.04)	0.049
Open Bite	0.84 (0.40-1.84)	0.659
Dental Crowding	0.96 (0.62-1.52)	0.868

TABLE 3 Multivariable negative binomial regression for caries of deciduous tooth (Mutually adjusted and adjusted for age, sex and calendar year of detection). IRR=Incidence Rate Ratio.

It is important to recognise the limitations of the present study. The first limitation is inherent to a cross-sectional design, in which exposure and outcome are determined simultaneously and the time sequence is often impossible to define. Secondly, the perception of quality of life was not investigated. However, socioeconomic factors, such as type of school, parents schooling and monthly household income, were associated with the quality of life of the children and their families (parents and guardians). Thus, development of a definite instrument such as a questionnaire for measuring the impact of specific conditions could be useful [Cirulli et al., 2015; Scarpelli et al., 2013; Carvalho et al., 2013; Ballini et al., 2010].

Conclusions

There is slight evidence in the literature that oral health education alone is effective in preventing dental caries, even though selected studies have reported improvements in gingival health, oral hygiene behaviours and oral cleaning.

Besides to supporting enhanced dental health outcomes, regular dental care is associated with improved overall health and well-being. Use of dental care services can serve as a proxy for oral health behaviour. Oral health surveillance in mixed dentition population should be a primary goal for clinical interventions.

Oral health education campaigns in schools should be addressed to dental caries, malocclusions, periodontal diseases and harmful teeth cleaning materials.

Authors' contributions

D.D.V. made substantial contributions to the conception and design of the study, diagnosis and coordination, supervised the manuscript and gave final approval of the version to be published. S.T. and O.V.G. analysed and interpreted the data. N.C. and S.C. were involved in clinical evaluation of participants. L.P. gave a scientific contribution. A.B. conceived the study and contributed to data analysis and interpretation, bibliographic research and drafted, reviewed and completed the manuscript. All authors approved the final version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

Authors contribution

N. Cirulli and S. Cantore equally contributed as co-first authors.

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