ORIGINAL RESEARCH

Epidemiology of Malocclusion in 3,491 Subjects Attending Public Dental Service in Rome (Italy): Evaluation of the Orthodontic Treatment Need Index

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Abstract

Aim: The objective of this epidemiological survey is to investigate the dental-skeletal features of subjects attending the Public Dental Service in Unità Operativa Complessa (UOC) (Orthodontic Department of "La Sapienza University of Rome") and compare them with the existing body of evidence obtained from other surveys. Accordingly, the Index of Orthodontic Treatment Need (IOTN) was employed, in order to achieve a common framework to allow the shaping of public health prevention practices.

Materials and methods: A sample of 3,491 subjects in the Orthodontic Department of "La Sapienza-University of Rome" (UOC) was evaluated with the adoption of IOTN to define malocclusion severity.

Results: In the result analysis, it was observed that class II malocclusion was more frequent in the sample (40%), and a large part of the examined population also presented mandibular dental crowding (43%), increased overjet (41%), and increased overbite (38%). Only 26.44% (20.17% IOTN 4; 6.27% IOTN 5) had strong need for orthodontic treatment.

Conclusion: The realization of epidemiological investigations to establish priority for treatment need is, therefore, particularly useful, not only to estimate the prevalence of some clinical conditions in the observed population, but also to plan targeted interventions, such as interceptive and corrective therapies in growing children.

Clinical significance: These interventions could solve specific clinical situations and/or prevent their escalation. Only in this way, it is possible to avoid fragmentation of the limited resources available, using them for patients with an objective need.

Keywords: Dental anomalies, Epidemiological survey, Index of Orthodontic Treatment Need, Malocclusion, Orthodontics.

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Introduction

The National Health System (NHS) should apply specific criteria to guarantee the orthodontic treatment to those patients having more severe malocclusions. These criteria shall not be arbitrary, but based on standardized diagnostic evaluations.

In the 1950s, Massler and Frankel were the first to propose a standardized, mensurable method of occlusal assessment.[1]

In the 1960s, other indexes have been established, including the occlusal index (OI) by Summers, the treatment priority index (TPI) by Grainger, and the handicapping malocclusion assessment record (HMAR) by Salzmann.[2–4]

The characteristics of an "ideal index" are the "validity" (i.e., the ability to measure what is meant to be measured) and the "reproducibility" (i.e., the ability to reproduce the data or the original score, when they are detected again by the same examiner or by another examiner). The index should also be "easy-to-use," thus, allowing gathering patients' information easily, as well as guaranteeing the possibility of rapid recordings also by nonexpert examiners.

The Index of Orthodontic Treatment Need (IOTN—Brook and Shaw, 1989) grades malocclusion severity on the basis of a dental health component (DHC) and an esthetic component (AC).[5] Respectively, the two components describe the objective evaluation of the occlusal characteristics and the subject's esthetic self-perception.

The objective of the current epidemiological survey was to assess the dental-skeletal traits of subjects attending the Public Dental Service in UOC (Orthodontic Department of "La Sapienza University of Rome") and compare them with the existing body of evidence obtained from other surveys. Accordingly, the IOTN was employed, in order to achieve a common framework to allow the shaping of public health prevention practices.

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Materials and Methods

The survey was conducted in the Orthodontic Department of "La Sapienza-University of Rome", analyzing the IOTN-DHC components of 3,491 subjects over a period of 2015–2018. Visits were carried out using a probe, a small mirror, a white-light source, and a meter gauge, and they were performed by three operators enrolled in the Postgraduate School of Orthodontics ("La Sapienza—University of Rome"), adequately trained, and

calibrated in accordance with the procedures established by the WHO. First of all, a clinical anamnestic record was developed to collect each patient's personal data, general information, medical history (familiar, physiological, remote, and proximate) and special examinations, assessment of oral hygiene, and orthodontic record.

The Ethics Committee of the Policlinico "Umberto I" of Rome (Rif.3817/2015) has approved this study design in agreement with the guiding principles of the 1975 Declaration of Helsinki. A written informed consent was requested before proceeding with clinical exam and processing of personal data. In the case of underage subjects, the consent was signed by a parent or a legal guardian. Each patient was asked to bring a panoramic X-ray performed not sooner than 1 year.

Several occlusal and functional parameters necessary for the evaluation of oral health were detected, including

- Deciduous/mixed/permanent dentition
- Molar class (right)
- Molar class (left)
- Canine class (right)
- Canine class (left)
- Overjet
- Overbite
- Crossbite
- Crowding (in the maxillary and in the mandibular arch)
- Deviation of the midlines
- Presence of decay
- Agenesis
- Supernumerary teeth
- Temporomandibular joint (TMJ) disorders
- Oral/nasal breathing
- Dyslalia
- Oral habits

Considering the overall evaluations of clinical parameters detailed in Table 1, it was possible to assign each subject to a different degree (from 1 to 5) of DHC relating to the severity of malocclusion.

The sample was divided into four main groups, based on the subjects' age:

- Group 1: ≤12 years
- Group 2: >12 and ≤ 15 years
- Group 3: >15 and ≤ 18 years
- Group 4: >18 years

Then, based on the DHC grade, three levels of intervention and relative need for treatment were identified:

- Level 1: no need for treatment—including grades 1 and 2 of IOTN (mild dental malocclusions)
- Level 2: borderline need—grade 3 IOTN
- Level 3: high need for treatment—grades 4 and 5 (most severe malocclusions and craniofacial deformities).

The Wilson method with a 95% confidence interval was employed to compute statistical prevalence. Comparison of orthodontic requirements according to sex and age was fulfilled by the Chi-square test of Pearson. Statistical significance was contemplated for results with a p value of < 0.05. Calculations were performed by means of the software "Statistica 8.0—2007."

Results

The study was performed on 3,491 subjects (1,708 males and 1,783 females), divided into the abovementioned four age-groups:

- Group 1: 1,683 subjects
- Group 2: 1,089 subjects
- Group 3: 353 subjects
- Group 4: 366 subjects

Results for each variable, with the comprehensive IOTN-DHC grade, are detailed in Table 2.

For the significance analysis, data with a p value of <0.05 ("*" in Table 2) were considered statistically significant.

Accordingly, significant results from the comparison between male and female subjects are shown below:

- Dentition
- Lingual frenulum
- Molar class on the right side
- Upper dental crowding
- Overjet
- Overbite
- TMJ disorders
- Breathing

In the comparison among age-groups, the canine class on the right side ($p = 0.048$) and the presence of previous orthodontic treatments ($p = 0.049$) were statistically significant.

Based on the assessment of the DHCs, 436 subjects (12.49%) have been assigned to IOTN grade 1, 1,391 (39.85%) to grade 2, 470 (13.46%) to grade 3, 704 (20.17%) to grade 4, and 219 (6.27%) to grade 5 (Graph 1).

It has not been possible to identify the IOTN (grade 0) for 271 subjects (7.76%) because of the absence of radiographic examinations at the first access moment.

According to the index, 26.44% of the whole sample was classified as being in strong need for orthodontic treatment (i.e., IOTN grades 4 and 5, corresponding to the aforementioned third level of intervention and relative need for treatment).

Discussion

This prevalence rate of orthodontic treatment need was compared with that derived from the analysis of similar samples in the setting of most European studies.

Souames, in a survey including 9- to 12-year-old French schoolchildren, reported a percentage of 21.3%.[6]

Three British surveys on analogous populations reported higher figures: 32.7% (Brook and Shaw[5]), 33% (Burden and Holmes[7]), and 35% (Chestnutt et al.[8]).

A percentage of 39.5 resulted from studies on a comparable Swedish sample (Josefsson).[9]

Therefore, outcomes of the current study point toward a similarity with the need for orthodontic intervention among French study participants. Nevertheless, in general, this prevalence rate was lower than the one recorded among populations in the Northern Europe.

Several authors have conducted epidemiological studies in different countries on children, adolescents, and/or adults evaluating the IOTN. The collected data have confirmed the findings of the investigations in the present paper, in relations to the prevalence of subjects belonging to the third level of the DHC-IOTN.

This finding was also confirmed in a survey of 1999, in which it was found that 23.6% of the sample under analysis needed orthodontic treatment (the third level of DHC-IOTN).[10]

Class II malocclusion was present in over one-third (39%) of the examined population, crossbites in 34%, and class III malocclusion

Table 1: Dental components of IOTN

IOTN	*DHC*
1	• Extremely minor malocclusions, including displacements of less than 1 mm
2	• Increased overjet >3.5 mm but ≤6 mm (with competent lips) • Reverse overjet greater than 0 mm but ≤1 mm • Anterior or posterior crossbite with ≤1 mm discrepancy between the retruded contact position and the intercuspal position • Displacement of teeth >1 mm but ≤2 mm • Anterior or posterior open bite >1 mm but ≤2 mm • Increased overbite ≥3.5 mm (without gingival contact)
3	• Increased overjet >3.5 mm but ≤6 mm (incompetent lips) • Reverse overjet greater than 1 mm but ≤3.5 mm • Anterior or posterior crossbites with >1 mm but ≤2 mm discrepancy between the retruded contact position and the intercuspal position • Displacement of teeth >2 mm but ≤4 mm • Lateral or anterior open bite >2 mm but ≤4 mm • Increased and incomplete overbite without gingival or palatal trauma
4	• Increased overjet >6 mm but ≤9 mm • Reverse overjet >3.5 mm with no masticatory or speech difficulties • Anterior or posterior crossbites with >2 mm discrepancy between the retruded contact position and the intercuspal position • Severe displacements of teeth >4 • Extreme lateral or anterior open bites >4 mm • Increased and complete overbite with gingival or palatal trauma • Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for a prosthesis • Posterior lingual crossbite with no functional occlusal contact in one or more buccal segments • Reverse overjet >1 mm but <3.5 mm with recorded masticatory and speech difficulties • Partially erupted teeth, tipped and impacted against adjacent teeth • Existing supernumerary teeth
5	• Increased overjet >9 mm • Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant requiring pre-restorative orthodontics) • Impeded eruption of teeth (apart from third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth, and any pathological cause • Reverse overjet >3.5 mm with reported masticatory and speech difficulties • Defects of cleft lip and palate • Submerged deciduous teeth

in 10%. These results can be instrumental in planning an age-targeted treatment protocol for malocclusions.[11,12]

Some studies reported higher percentages because the survey would be carried out on an orthodontic population (i.e., younger or already preliminarily selected).[13]

The detection of occlusal abnormalities, especially in growing children, is the most important basis for the knowledge of malocclusions: only in this way, it will be possible to implement a proper social program of prevention, to reduce the severity of some occlusal disharmonies and simplify any subsequent phases of therapy.

So, the majority of the previous studies have been conducted on subjects in primary or mixed dentition, while investigations on samples in the permanent dentition are few and often limited to groups selected by specific criteria.[14]

Our results show that the majority of subjects (65.8%, corresponding to the first and second levels of intervention and relative need for treatment) have no need for treatment according to dental components of IOTN.

Despite the variability of clinical conditions, it is necessary to use standardized assessment parameters, thus, allowing the identification of those cases who will benefit from orthodontic treatment in public spending. Only in this way, it is possible to avoid fragmentation of the limited available resources, using them for patients with an objective need.

Two major limitations were found in the present survey. The sample population was numerically broad, but geographically localized. Hence, the results might not be applicable to other Italian and international realities. Furthermore, age subgroups were not numerically homogenous, possibly making some results more relevant according to their relative age prevalence (Graph 2).

Conclusion

The realization of epidemiological investigations to establish priority for treatment need is, therefore, particularly useful, not only to estimate the prevalence of some clinical conditions in the observed population,

Table 2: Results

Dentition																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Decidous	33	0.95%	(0.67–1.32)%	17	1.00%	16	0.94%	0.024*	12	0.71%	13	1.19%	3	0.85%	5	1.37%	0.604
Mixed	1767	50.62%	(48.96–52.271)%	904	52.93%	863	50.53%		866	50.70%	552	32.32%	177	10.36%	172	10.07%	
Permanent	1691	48.44%	(46.78–50.10)%	787	46.08%	904	52.93%		805	47.13%	524	30.68%	173	10.13%	189	11.07%	
Labial frenum																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Normal	2999	85.91%	(84.71–87.021)%	1477	86.48%	1522	85.36%	0.344	1427	84.79%	955	87.70%	299	84.70%	318	86.89%	0.149
Short	492	14.09%	(12.98–15.291)%	231	13.52%	261	14.64%		256	15.21%	134	12.30%	54	15.30%	48	13.11%	
Lingual frenum																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Normal	31.95	91.52%	(90.55–92.40)%	1545	90.46%	1650	92.54%	0.027*	1537	91.33%	1008	92.56%	317	89.80%	333	9.38%	0.004
Short	296	8.48%	(7.60–9.45)%	163	9.54%	133	7.46%		146	8.67%	81	7.44%	36	10.20%	33	9.02%	
Lips																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Competent	*2773*	*79.58%*	*(78.21–80.88)%*	*1337*	*78.28%*	*1441*	*80.82%*	*0.139*	*1335*	*79.32%*	*867*	*79.61%*	*285*	*80.74%*	*291*	*79.51%*	*0.507*
Incompetent	700	20.05%	(18.76–21.41)%	363	21.25%	337	18.90%		344	20.44%	215	19.74%	66	18.70%	75	20.49%	
Everted	13	0.37%	(0.22–0.64)%	8	0.47%	5	0.28%		4	0.24%	7	0.64%	2	0.57%	0	0.00%	
Molar class (right side)																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
I	1714	49.10%	(47.44–50.76)%	830	48.59%	884	49.58%	0.049*	839	49.85%	539	79.61%	162	45.89%	174	47.54%	0.730
II	1337	38.30%	(36.70–39.92)%	650	38.06%	687	38.53%		637	37.85%	406	19.74%	144	40.79%	150	40.98%	
III	363	10.40%	(9.43–11.45)%	198	11.59%	165	9.25%		167	9.92%	124	0.64%	37	10.48%	35	9.56%	
N.V.	77	2.21%	(1.77–2.75)%	30	1.76%	47	2.64%		40	2.38%	20	0.00%	10	2.83%	7	1.91%	
Molar class (left side)																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
I	1617	46.32%	(44.67–47.98)%	769	45.02%	848	47.56%	0.064	794	47.18%	497	45.64%	164	46.46%	162	44.26%	0.702
II	1391	39.85%	(38.24–41.48)%	679	39.75%	712	39.93%		659	39.16%	427	39.21%	148	41.93%	157	42.90%	
III	363	10.40%	(9.43–11.45)%	201	11.77%	162	9.09%		174	10.34%	124	11.39%	28	7.93%	37	10.11%	
N.V.	120	3.44%	(2.88–4.09)%	59	3.45%	61	3.42%		56	3.33%	41	3.76%	13	3.68%	10	2.73%	

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Canine class (right side)																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
I	1302	37.30%	(35.71–38.91)%	649	38.00%	653	36.62%	0.591	659	39.16%	376	34.53%	126	35.69%	141	38.52%	0.048*
II	1139	32.63%	(31.09–34.20)%	553	32.38%	586	32.87%		510	30.30%	372	34.16%	138	39.09%	119	32.51%	
III	246	7.05%	(6.24–7.94)%	126	7.38%	120	6.73%		114	6.77%	83	7.62%	21	5.95%	28	7.65%	
N.V.	804	23.03%	(21.66–24.46)%	380	22.25%	424	23.73%		400	23.77%	258	23.69%	68	19.26%	78	21.31%	
Canine class (left side)																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
I	1301	37.27%	(35.68–38.89)%	659	38.58%	642	36.01%	0.238	630	37.43%	411	37.74%	130	36.83%	130	35.52%	0.301
II	1147	32.86%	(31.32–34.43)%	559	32.73%	588	32.98%		542	32.20%	340	31.22%	135	38.24%	130	35.52%	
III	203	5.81%	(5.087–6.64)%	102	5.97%	101	5.66%		107	6.36%	63	5.79%	14	3.97%	19	5.19%	
N.V.	840	24.06%	(22.67–25.51)%	388	22.72%	452	25.35%		404	24.00%	275	25.25%	74	20.96%	87	23.77%	
Upper midline deviation																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	2797	80.12%	(78.76–81.41)%	1370	80.21%	1427	80.03%	0.896	1337	79.44%	893	82.00%	276	78.19%	291	79.51%	0.281
Present	694	19.88%	(18.59–21.24)%	338	19.79%	356	19.97%		346	20.56%	196	18.00%	77	21.81%	75	20.49%	
Lower midline deviation																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	1909	54.68%	(53.03–56.33)%	922	53.98%	987	55.36%	0.415	925	54.96%	588	53.99%	208	58.92%	188	51.37%	0.217
Present	1582	45.32%	(43.67–46.97)%	786	46.02%	796	44.64%		758	45.04%	501	46.01%	145	41.08%	178	48.63%	
Upper arch crowding																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	2423	69.417%	(67.86–70.91)%	1225	71.72%	1198	67.19%	0.004*	1157	68.75%	762	69.97%	250	70.82%	254	69.40%	0.839
Present	1068	30.59%	(29.09–32.14)%	483	28.28%	585	32.81%		526	31.25%	327	30.03%	103	29.18%	112	30.60%	
Lower arch crowding																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	1988	56.95%	(55.30–58.58)%	995	58.26%	993	55.69%	0.126	940	55.85%	619	56.84%	212	60.06%	217	52.29%	0.396
Present	1503	43.05%	(41.42–44.70)%	713	41.74%	790	44.31%		743	44.15%	470	43.16%	141	39.94%	149	40.71%	
Overjet																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Normal	1903	54.51%	(52.86–56.16)%	895	52.40%	1008	56.53%	0.001*	934	55.50%	573	52.62%	202	57.22%	194	53.01%	0.481
Increased	1430	40.96%	(39.34–42.60)%	713	41.74%	717	40.21%		682	40.52%	458	42.06%	135	38.24%	155	42.35%	
Decreased	158	4.53%	(3.88–5.267)%	100	5.85%	57	3.20%		67	3.98%	58	5.33%	16	4.53%	17	4.64%	

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Overbite																
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Normal	1929	55.26%	(53.60–56.90)%	900	52.69%	1029	57.71%	0.005*	941	55.91%	599	55.00%	199	56.37%	190	51.91%	0.873
Increased	1324	37.93%	(36.33–39.55)%	694	40.63%	630	35.33%		631	37.49%	413	37.92%	132	37.39%	148	40.44%	
Decreased	238	6.82%	(6.03–7.70)%	114	6.67%	124	6.95%		111	6.60%	77	7.07%	22	6.23%	28	7.65%	
Cross bite																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	2305	66.03%	(64.44–67.58)%	1118	65.46%	1187	66.57%	0.486	1121	66.61%	695	63.82%	233	66.01%	256	69.95%	0.163
Present	1186	33.97%	(32.42–35.56)%	590	34.54%	596	33.43%		562	33.39%	394	36.18%	120	33.99%	110	30.05%	
Dental caries																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	2086	59.75%	(58.12–61.37)%	1042	61.01%	1044	58.55%	0.139	998	59.30%	652	59.87%	217	61.47%	219	59.84%	0.900
Present	1405	40.25%	(38.63–41.88)%	666	39.99%	739	41.45%		685	40.70%	437	40.13%	136	38.53%	147	40.16%	
TMJ disorders																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	3017	86.42%	(85.25–87.52)%	1522	89.11%	1495	83.85%	0.001*	1462	86.87%	935	85.86%	300	84.99%	320	87.43%	0.678
Present	474	13.58%	(12.48–14.75)%	186	10.89%	288	16.15%		221	13.13%	154	14.14%	53	15.01%	46	12.57%	
Breathing																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Nasal	2045	58.58%	(56.94–60.20)%	961	56.26%	1084	60.80%	0.018*	988	58.70%	656	60.24%	205	58.07%	196	53.55%	0.410
Mixed	1095	31.37%	(29.85–32.93)%	559	32.73%	536	30.06%		533	31.67%	327	30.03%	110	31.16%	125	34.15%	
Oral	351	10.05%	(9.10–11.10)%	188	11.01%	163	9.14%		162	9.63%	106	9.73%	38	10.76%	45	12.30%	
Atypical swallowing																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	1908	54.65%	(53.00–56.30)%	930	54.45%	978	54.85%	0.812	911	54.13%	624	57.30%	192	54.39%	181	49.45%	0.064
Present	1583	45.35%	(43.70–47.00)%	778	45.55%	805	45.15%		772	45.87%	465	42.70%	161	45.61%	185	50.55%	
Dislalias																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	2504	71.73%	(70.21–73.20)%	1215	71.14%	1289	72.29%	0.448	1207	71.72%	805	73.92%	244	69.12%	248	67.76%	0.086
Present	987	28.27%	(26.80–29.79)%	493	28.86	494	27.71%		476	28.28%	284	26.08%	109	30.88%	118	32.24%	
Bad habits																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	1777	50.90%	(49.24–52.56)%	898	52.58%	879	49.30%	0.053	852	50.62%	546	50.14%	196	55.52%	183	50.00%	0.328
Present	1714	49.10%	(47.44–50.76)%	810	47.42%	904	50.70%		831	49.38%	543	49.86%	157	44.48%	183	50.00%	
Agenesis																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Absent	3352	96.02%	(95.32–96.62)%	1640	96.02%	1712	96.02%	0.999	1612	95.78%	1044	95.87%	343	97.17%	353	96.45%	0.635
Present	139	3.98%	(3.38–4.68)%	68	3.98%	71	3.98%		71	4.22%	45	4.13%	10	2.83%	13	3.55%	

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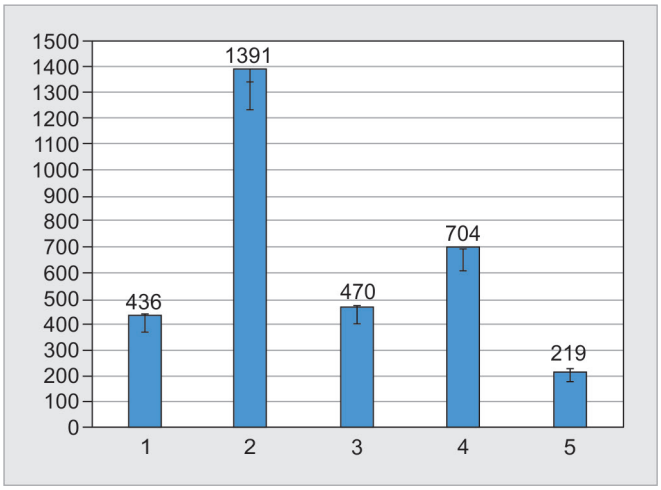
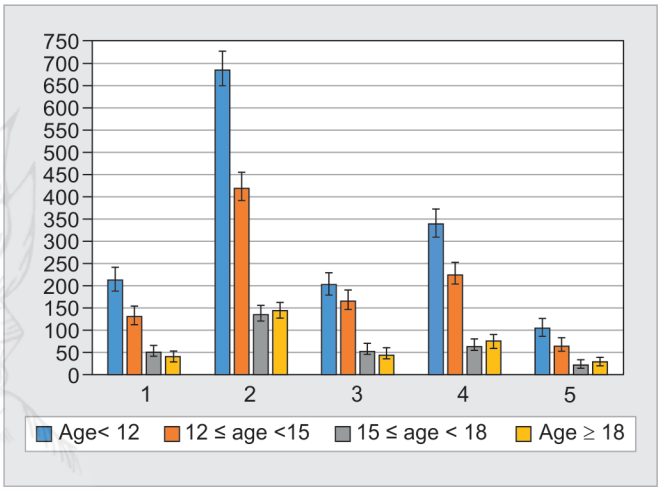
IOTN	*Prevalence*		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
1	436	12.49%	(11.43–13.63)%	190	11.12%	246	13.80%	0.098	213	12.66%	132	12.12%	51	14.45%	40	10.93%	0.546
2	1391	39.85%	(38.23–41.48)%	676	39.58%	715	40.10%		686	40.76%	422	38.75%	138	39.09%	145	39.62%	
3	470	13.46%	(12.37–14.64)%	250	14.64%	220	12.34%		203	12.06%	166	15.24%	55	15.58%	46	12.57%	
4	704	20.17%	(18.87–21.53)%	355	20.78%	349	19.57%		338	20.08%	225	20.66%	66	18.70%	75	20.49%	
5	219	6.27%	(15.52–7.13)%	104	6.09%	115	6.45%		104	6.18%	66	6.06%	22	6.23%	27	7.38%	
0	271	7.76%	(6.92–8.70)%	133	7.79%	138	7.74%		139	8.26%	78	7.16%	21	5.95%	33	9.02%	
Previous orthodontic therapy																	
	Prevalence		*95% CI*	*Male*		*Female*		*p*	*Age ≤ 12*		*12 < Age ≤ 15*		*15 < Age ≤ 18*		*Age > 18*		*p*
Yes but undeclared	646	18.50%	(17.25–19.83)%	300	17.56%	346	19.41%	0.534	310	18.42%	192	17.63%	63	17.85%	81	22.13%	0.049*
Mobile appliance	352	10.08%	(9.13–11.13)%	166	9.72%	186	10.13%		168	9.98%	108	9.92%	45	12.75%	31	8.47%	
Mobile + fixed	90	2.58%	(2.10–3.16)%	44	2.58%	46	2.58%		37	2.20%	32	2.94%	15	4.25%	6	1.64%	
Fixed appliance	85	2.43%	(1.973–3.00)%	40	2.34%	45	2.52%		49	2.91%	28	2.57%	2	0.57%	6	1.64%	
No	2318	66.40%	(64.82–67.95)%	1158	67.80%	1160	65.06%		1119	66.49%	729	66.94%	228	64.59%	242	66.12%	



Graph 1: Number of subjects of each IOTN grade. Vertical bars indicate the 95% CI



Graph 2: IOTN grades by age-groups. Vertical bars indicate the 95% CI

but also to plan targeted interventions, such as interceptive and corrective therapies in growing children. These interventions could solve specific clinical situations and/or prevent their escalation, with a better use of resources and a reduction in treatment times.

Therefore, it would be appropriate to use standardized metrics to be used as a discriminating factor for the development of a therapeutic intervention, especially in public facilities.

In addition, defining the nature and extent of community health problems provides the necessary foundation for health planning and scheduling.

Clinical Significances

- The use of IOTN could be included in screening programs in schools for epidemiological investigations, because it is quick and easy to use.[15]
- Patients with more severe diseases/disorders are immediately taken into care based on a criterion of priority treatment and not on a chronological one.
- The UOC is now able to promptly treat all patients with urgent need for therapy; in the order of a time criterion based on the first access to UOC, these patients may see delayed their access to care.

- Although it has some limitations, the IOTN allows us to identify people who need orthodontic treatment based on an objective clinical measure, with the possibility to establish a priority of treatment in relation to dental values (DHC).

Ethical Approval

This study was approved by the Ethics Committee of Sapienza University of Rome (Italy), RIF. 3817/2015.

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