

Aspects Regarding the Medical Data Processing - The Statistical Study of Malocclusions

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Abstract

An important aspect in the analysis of medical data is represented by its statistical processing, which gives useful directions in finding the diagnosis and the most adequate treatment, especially when the amount of statistical data is very large and it is in time extended. We gave an example in this paper, by presenting a statistical evaluation on a consignment of patients who have addressed the Dental Ambulatory for Children (Iași) for orthodontic consulting over a period of 10 years (2000 – 2010). The study has been performed on 375 patients (157 boys and 218 girls), with ages between 4-24 years and malocclusions. The diagnosis was established by clinical and paraclinical exams (cast and radiological measurements). Both removable and fixed appliances were used in conducting the treatment. The patients in need of orthodontic treatment presented malocclusion I-st Class 63.2%, II-nd Class 28.3%, and III-rd Class 5.8%. The group and isolated malocclusion proportion varied on the basis of the clinical manifestations associated to the malocclusion class. Based on age, the patients were applied with prophylactic treatment 3%, interceptive treatment 5% and curative 92%. The Spearman correlations performed on the batch of patients proved the existence of a weak directly proportional influence between the diagnosis of malocclusion and the therapeutic results ($\rho = 0.136$, $p = 0.008$), respectively the surgical – orthodontic treatment and the therapeutic results ($\rho = 0.235$, $p = 0.000$), a strong directly proportional influence of the type of appliance over the therapeutic results ($\rho = 0.635$, $p = 0.000$) and a moderate inverse proportional influence of the treatment chosen to be carried out over the therapeutic results ($\rho = -0.306$, $p = 0.000$). The results regarding prevalence of malocclusion types are comparable with those from the literature. The correlations that were carried out were based on medical reasoning. All these results are useful to depict the general characteristics of the Dental Ambulatory’s potential patients and, as a consequence, to easily establish the most accurate treatment.

Keywords: Malocclusion; Children; Prevalence; Correlations.

Introduction

The nowadays dental-facial orthodontics and orthopedics are increasingly becoming an important health service, which sets out and maintains one’s physical and psychiatric balance. This service practices preventive procedures which anticipate the malocclusion’s evolution, interceptive procedures which remove or reduce the malocclusion’s severity and corrective procedures for the

malocclusion's treatment [1, 2].

In order to establish the right diagnosis and to prescribe the most accurate treatment, the orthodontist has to deal with a large amount of data concerning the patient's general and oral status of health, most often expressed in quantitative form, which must be analyzed and integrated in the appropriate context given by the specialized literature. In this framework, it is also useful for the orthodontist to know the population subset to which his patient belongs from a statistical point of view, because in this way he finds the directions for the general treatment scheme, which will be individualized later.

That is why in orthodontics, as well as in the other medical specialties, an important stage of the hospital activity is represented by the appropriate management of medical data and the achieving of periodic statistics which give helpful information not only about the economic efficiency of the hospital, but also from a medical point of view. Using this statistical information we can establish the patient's general profile, which can be used as a reference point to identify the diagnosis and the best treatment for new clinical cases.

Material and Method

We achieved a statistical evaluation on a sample of patients who have addressed the Dental ambulatory for children (Iași) for orthodontic consulting over a period of 10 years (2000 – 2010). The study has been performed on 375 patients (157 boys and 218 girls) with ages between 5-24 years who were diagnosed with malocclusions (Figure 1).

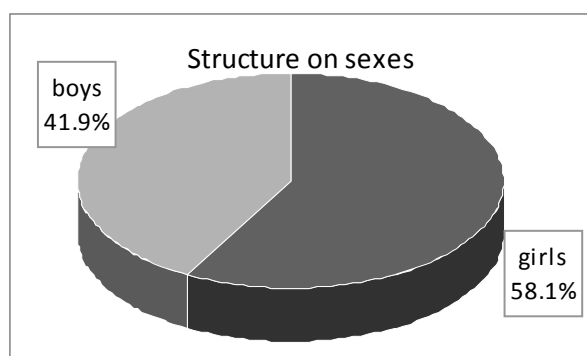


Figure 1. The sample's structure by gender

The patients came from the urban environment in a proportion of 85.6% and from the rural environment in a proportion of 14.4%. Amongst these patients 71.7% live in Iași and 28.3% in other counties.

The diagnosis was established by clinical and paraclinical exams (cast and radiological measurements). Both removable and fixed appliances were used in conducting the treatment.

In order to establish the malocclusions' diagnosis we used the Angle classification, which is based on the theory of the first permanent superior molar fixity compared with the first permanent inferior molar in the sagittal direction. I-st Class Angle is characterized by neutral sagittal molar occlusion and malocclusions localized in the frontal area (isolated or grouped dental anomalies and frontal occlusal disorders). II-nd Class Angle is characterized by distal sagittal molar occlusion and has two clinical forms: one with space and one with crowding. III-rd Class Angle is characterized by mesial sagittal molar occlusion. Transitory malocclusions are those which do not require orthodontic treatment, because are solved together with the growing of maxillary basis and the development of eruption and dental occlusion.

The database was created using MS Excel and the statistical evaluation was completed in SPSS 16.0 software [3]. Descriptive statistics and bivariate correlations were carried out regarding the variables of interest, in order to depict the possible influences between them. Taking in

consideration the fact that most of the analyzed variables are categorical, we calculated the corresponding frequencies distributions, and in order to find the percentages confidence level, we performed bootstrapping with 1000 samples. Also, in order to find the influences between variables we calculated the Spearman rho correlation coefficient, which is the appropriate choice for categorical ordinal variables, as in our case.

Results

The patients in need of orthodontic treatment were diagnosed with malocclusion I-st Class Angle 63.2%, II-nd Class Angle 28.3% and III-rd Class Angle 5.8%. From the overall malocclusions, 2.7% were transitory malocclusions, which have set in place once the teeth grew (Table 1, Figure 2).

Table 1. Confidence Intervals for the Frequencies Distribution on Malocclusion Types

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	I-st Class Angle	237	-0.1	2.5	57.9	68.0
	II-nd Class Angle	106	0.1	2.3	24.0	33.1
	III-rd Class Angle	22	0.0	1.2	3.7	8.5
	Transitory Anomalies	10	0.0	0.8	1.3	4.5
	Total	375	0.0	0.0	100.0	100.0

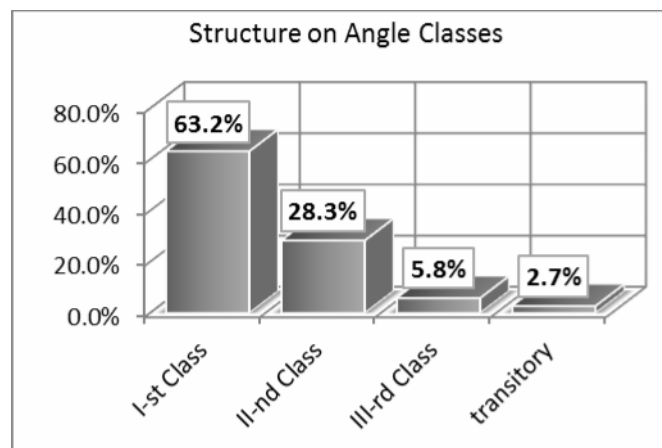


Figure 2. The sample’s structure on Angle Classes

The group and the isolated malocclusion proportion varied on the basis of the clinical manifestations associated to the malocclusion class. The prevalence of the isolated dental malocclusions was: malocclusions of number in 8.3% (supernumerary tooth and hypodontia), on shape in 1.3%, of volume in 8.8% (microdontia and macrodontia), of position in 82.9%, of eruption (impacted teeth, ectopic eruption, transmigration) in 14.7% and of structure in 32.0% (Table 2, Figure 3) – We also recorded cases with associated malocclusions.

The prevalence of group malocclusion was: midline diastema 5.6% and dental crowding 67.5%; there were also 26.9% of cases without group malocclusions (Table 3, Figure 4).

The malocclusions were caused by general factors 18.7%, dysfunctional factors 28.5% and local factors 52.8% (Table 4, Figure 5).

The patients received prophylactic treatment 3.2%, interceptive treatment 5.9% and corrective treatment 90.9% based on age (Table 5, Figure 6).

Table 2. Confidence Intervals for the Frequencies Distribution on Isolated Dental Malocclusion Types

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	without anomalies	29	0.0	1.3	5.3	10.4
	number	31	0.0	1.5	5.6	11.2
	shape	5	0.0	0.6	0.3	2.7
	volume	33	0.0	1.5	5.9	11.7
	position	311	0.1	1.9	79.2	86.7
	eruption	55	0.0	1.8	11.2	18.4
	structure	120	-0.1	2.4	26.9	36.8

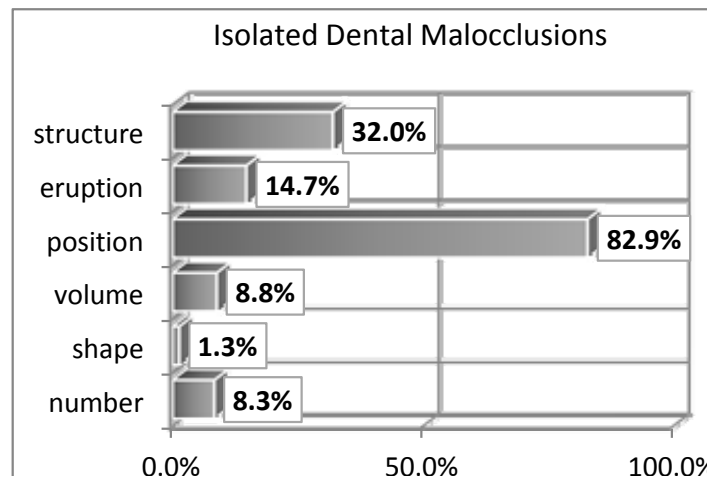


Figure 3. The Prevalence of the Isolated Dental Malocclusions

Table 3. Confidence Intervals for the Frequencies Distribution on Group Malocclusion Types

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	without	101	0.0	2.3	22.7	31.5
	midline diastema	21	-0.1	1.2	3.5	8.0
	dental crowding	253	0.0	2.4	62.7	72.3
	Total	375	0.0	0.0	100.0	100.0

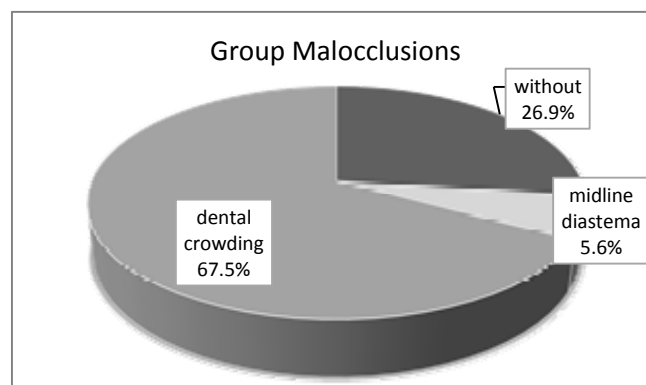


Figure 4. The Prevalence of the Group Malocclusions

Table 4. Confidence Intervals for the Frequencies Distribution on Malocclusions Causes

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	general factors	70	0.0	2.1	14.7	22.9
	dysfunctional factors	107	0.1	2.3	24.3	33.1
	local factors	198	0.0	2.6	47.5	57.9
	Total	375	0.0	0.0	100.0	100.0

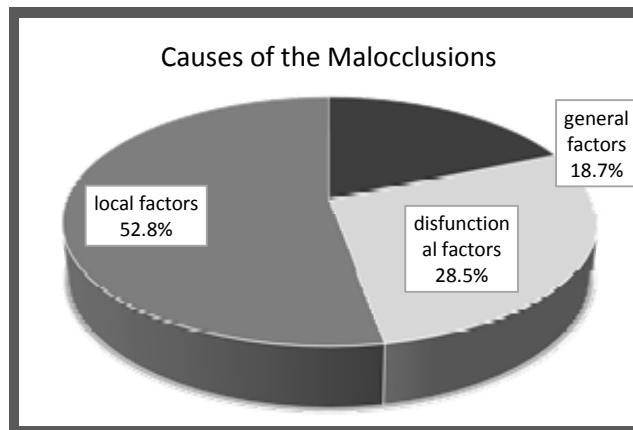


Figure 5. The Causes of the Malocclusions

Table 5. Confidence Intervals for the Frequencies Distribution on Types of Orthodontic Treatment

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	prophylactic	12	0.0	0.9	1.6	5.1
	interceptive	22	-0.1	1.2	3.5	8.3
	corrective	341	0.1	1.4	88.0	93.9
	Total	375	0.0	0.0	100.0	100.0

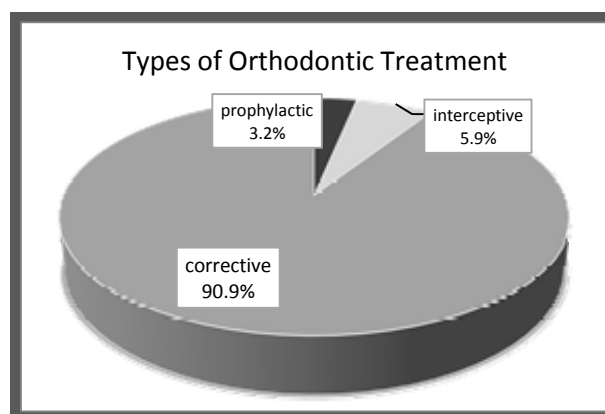
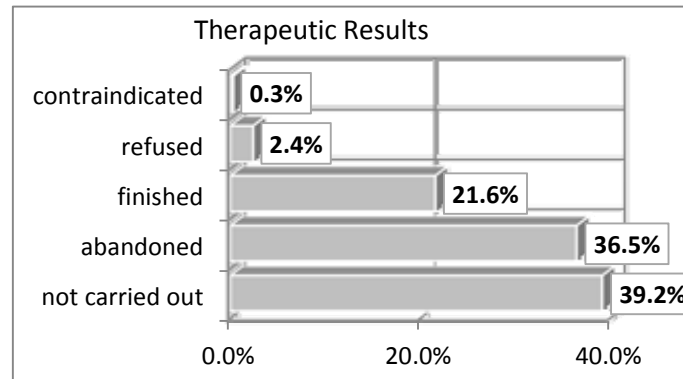


Figure 6. The orthodontic treatment received

The therapeutic results varied according to the patients' acceptance, also if the patient finished or he abandoned the orthodontic treatment: the treatment was not carried out in 39.2% of the cases, it was abandoned in 36.5%, it was finished in 21.6%, the patient refused the treatment in 2.4% of the cases and the treatment was contraindicated in 0.3% (Table 6, Figure 7).

Table 6. Confidence Intervals for the Frequencies Distribution on Therapeutic Results

		Frequency	Bootstrap for Percent			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Valid	not carried out	147	0.0	2.6	34.4	44.3
	abandoned	137	0.0	2.5	31.5	41.3
	finished	81	0.0	2.1	17.6	25.6
	refused	9	0.0	0.8	1.1	4.0
	contraindicated	1	0.0	0.3	0.0	0.8
	Total	375	0.0	0.0	100.0	100.0

**Figure 7.** The Therapeutic Results Obtained

The Spearman correlations calculated on the sample of patients proved the existence of a significant, but weak directly proportional influence of the diagnosis of the malocclusions over the therapeutic results ($\rho = 0.136$, $p = 0.008$). There was also a significant moderate inverse proportional influence of the types of treatment used over the therapeutic results ($\rho = -0.306$, $p = 0.000$). The Spearman correlations made on the sample of the patients proved also the existence of a significant strong directly proportional influence of the type of appliance over the therapeutic results ($\rho = 0.635$, $p = 0.000$). There was also a significant, but weak directly proportional influence of the surgical-orthodontic treatment that was carried out over the therapeutic results ($\rho = 0.235$, $p = 0.000$).

Discussion

Malocclusions are capable to produce a series of functional, aesthetical and psychological imbalances. Malocclusions can also be the cause of poor dental hygiene, tooth decay, periodontal disease, traumatic occlusion and dental fracture [4]. Disorders that come around in the case of malocclusion can be aesthetic, masticatory, of speech, of dysfunction of temporo-mandibular joint and social integration [5].

This statistical study was developed in a period of 10 years, and gave us significant information to establish the general profile of our patients, which will be further described.

The common patient of our Clinic is, therefore, a child or a young adult from urban area, and most probably from Iasi city, having malocclusion I-st Angle Class (63.2%), of position (82.9% chances) or structure (32.0% chances). When we are dealing with group malocclusion, it is almost sure that we have the diagnosis of dental crowding (67.5% of cases).

Our results show a small prevalence for skeletal malocclusions of II-nd and III-rd Angle Class, which means that the treatment planning is not difficult for orthodontics. However, the increased dental associated and group malocclusion prevalence imposes more steps for orthodontic treatment to achieve the therapeutic objectives. The prevalence results of the malocclusions are comparable

with those from the literature, but they are specific to the geographic region.

The etiological factors for malocclusions are in great proportion local (52.8% from all cases), fact which proves that their solving is easier than removing the dysfunctional and the general factors. The general factors require the cooperation with other disciplines of medicine and postponing some orthodontic treatment.

The main problem of our patients is the small amount of finished treatments (21.6%), especially compared with our expectations. Most of the patients avoid wearing the appliances (39.2%) or abandon them too early (36.5%), which makes the treatment useless. This situation is mostly caused by the low orthodontic sanitary education of the population which attends the health system of public orthodontics, mainly because the primary orthodontics is sporadically applied in collectivities [6], and seems to be, in fact, the most important challenge we have to deal with. The therapeutic results obtained refer to the population which attended the public orthodontic health service provided by the National Health Assurance System.

The calculation of Spearman correlations based on medical reasoning were carried out to verify, with positive results, if in the studied sample of patients there was a connection between the diagnosis of the malocclusions, the type of orthodontic treatment that was applied, the type of orthodontic appliance and the obtained therapeutic results.

Conclusions

The statistical analysis of medical data is important, as a stage in their management, in order to create the common patient's profile and to emphasize the most important problems and difficulties.

In our case we found that, even if the treatment planning is not very difficult, because the most patients have malocclusion I-st Angle Class, a very serious problem of our patients is the high rate of abandoned appliances, which make the treatment useless (almost 75% from the total number of cases). The solution is to implement populational programs for the orthodontic sanitary education, to show the severity of malocclusions and their consequences and the importance of the orthodontic appliances. Also, the patient's motivation and compliance should be encouraged individually, by the treating orthodontist, before and during the orthodontic treatment.

Conflict of Interest

The author declares that he has no conflict of interest.

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