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Prevention in Dental Medicine. Case Studies and Explanations Regarding the Cost-Benefit Ratio

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Abstract

In this article, we set out to highlight the advantages of prevention in the field of dental medicine and what the minimum costs are in this case, as well as how they increase the more a condition is not detected in time and resolved quickly when it occurs, if the patient does not go to the dentist for a consultation once every six months or at least once a year. We will then exemplify by presenting specific cases encountered with different patients, depending on the severity of the disease and what the costs are for solving the problems that appeared in the oral cavity. For the study of the activities in the dentist's office we chose the cluster analysis mathematical model.

Keywords

Prevention, endodontics, orthodontics, dento-alveolar surgery, cluster analysis mathematical model

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1. Introduction

Oral health is a *quality of life* issue. Starting from this desideratum, preventive dentistry: (1) changed the way dentistry is practiced; (2) brought global economic and social benefits (3) led to the dissapearance of pain for children and to a life free of major events in terms of oral health problems for adults; (4) it improved the quality of life of individuals more than any other "discovery" in the field of dental health.

Until the end of the 19th century, dental medicine was based, almost exclusively, on restorative and prosthetic treatments. The treatments were expensive and difficult to access for most of the population. In the first half of the 20th century, scientific research led to a better understanding of the processes of oral dental pathology. Once the factors involved in the aetiology of oral cavity diseases have been clarified, dental medicine acquired a new orientation, moving towards the search for the most appropriate methods to prevent these diseases, a context in which the importance given to oral hygiene has increased. An essential moment in the evolution of oral dental prevention was the discovery of the cavity preventive role of fluoride, which revolutionized dental medicine globally. Research on the interference of fluoride with the cavity development process has resulted in: (1) Adding fluoride to drinking water; (2) Development of systemic fluoride transmission products; (3) Development and dissemination of products for topical fluoride applications.

A second key moment in the evolution of oral dental prevention begins in the 1960s when, following the experiences of L.M. Silverstone, the classic definition of the cavity development process changed, turning from an "*irreversible destructive process*" into a *curable process* by remineralisation therapy applied in the early stages of enamel cavities, even extended to the enamel-dentin junction, the boundary between reversible and irreversible being the appearance of the cavity. Since this period, research in dentistry has become almost synonymous with research into the development mechanism of dental cavities, how fluoride interacts with dental structures at the initiation moment of cavity lesions, and the main ways in which the initiation and evolution of the cavity process can be interrupted. In other words, since this period of time, oral dental prevention has become the main concern of most researchers and many practitioners.

2. Literature review

2.1. Oral dental prevention

Preventive dentistry is considered to be an integral part of dental medicine that deals with the study and application of protection measures and early individual and collective treatments in order to ensure and maintain the integrity of human oral dental structures.

At the same time, *preventive dentistry* is the branch of dental medicine that deals with the prevention of the diseases of oral dental structures, intercepting all oral dental diseases and stopping their progression, as well as preventing and limiting the complications and disabilities of these diseases after their occurrence, and promoting oral dental rehabilitation.

The aims of oral dental prevention: *(*1) Avoidance of tooth decay, periodontitis, oral cancer and dento-maxillary abnormalities; (2) Interception and treatment of the initial stages of oral dental diseases; (3) Controlling the spread of these diseases; (4) Limiting complications and side effects; (5) Promoting the rehabilitation of the oral dental system.

While *prevention* includes measures designed to prevent the occurrence of a phenomenon, of an oral dental disease, *prophylaxis* deals with the study and application of preventive treatment methods. Oral dental prevention addresses: (1) all oral dental diseases, the most common being dental cavities, periodontopathy, dento-maxillary anomalies and oro-maxillo-facial cancer; (2) all practitioners, regardless of the field of activity: pedodontics, orthodontics, periodontology, endodontics, prosthetics. Generally, the stages of oral dental prevention are divided into 3 levels:

Primary - which aims to prevent the occurrence of oral dental diseases

Secondary – whose goal is the early treatment of oral dental diseases and the decrease of the disease rate. The diseases already installed but in their incipient stages are treated, their evolution and extension being hindered.

Tertiary – whose aims are limiting the complications of diseases already installed and the complex treatment of diseases of the oral cavity through the lens of prevention.

Primary prevention is a prepathogenic stage, while secondary and tertiary prevention are pathogenic stages.

2.2. Oral dental prophylaxis

The methods of each stage (prophylaxis) can be applied both at the community level (collective prophylaxis) and at the individual level (individual prophylaxis).

Collective prophylaxis is addressed to communities and must give priority to prophylactic measures that ensure maximum efficiency with minimal investment to population groups as large as possible. It includes specific and non-specific actions organized, guided and controlled by the doctor, for different communities (kindergartens, schools) and supported by teachers and parents as well as national and/or local regional forums.

Individual prophylaxis includes all preventive measures performed by a particular subject at the indication and under the control of the doctor, or performed by the doctor (professional prophylaxis).

In more detail, levels 1, 2 and 3 of prevention can be subdivided as follows (Table 1).

Table 1. Levels of prevention

Primary prevention		**Secondary prevention**	**Tertiary prevention**	
Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**
1. General health promotion to increase disease resistance ("primordial" prevention) 2. Increasing the educational level of the population	Specific prophylaxis measures	Early diagnosis and treatment of the initial stages of the disease	Limiting the complications and disabilities caused by disease	- Restoring the integrity of oral dental structures. - Preventing the complete loss of dento-maxillary apparatus functions. - Oral dental rehabilitation.

2.2.1. Primary prophylaxis of dental cavities

It *aims* to prevent the occurrence of the cavity process by: (1) increasing the strength of dental structures; (2) influencing the endogenous and exogenous role of food; (3) eliminating the main etiological factors of cavities (bacterial plaque, diet, factors related to the host organism and time) especially of the microbial factor. (4) cavity risk assessment. Prophylactic measures applied before tooth formation are known as *dispositional or endogenous prophylaxis* - level 1.

Because the development of dental structures begins in the 6th intrauterine week and continues until the age of 13-14 years (if molar III is not taken into account), the primary prophylaxis of dental cavities in young children and adolescents begins with the pregnant woman and continues with the nursing mother.

Prophylactic measures applied after tooth eruption (during post-eruptive or late enamel maturation) are *expository or exogenous prophylactic measures*.

2.2.2. Primary prevention of dental cavities

The primary prevention of dental cavities is achieved by:

a) *specific measures*: *(1)* control of bacterial plaque formation by ensuring proper *oral dental hygiene*, in order to reduce the action of the microbial etiological factor (cannot be completely removed); (2) endogenous and exogenous fluoride prophylaxis; (3) sealing grooves and fissures; (4) food hygiene (diet control and the application of measures that influence the diet - both endogenous and exogenous role - in a cavity preventing sense.

b) *non-specific measures:* (1) general health control; (2) health education on oral dental health; (3) removal of the main risk factors for cavities.

Secondary prevention of dental cavities *aims* for: (1) intercepting the cavity process as early as possible; (2) the elimination of factors that favour the appearance of new carious lesions; (3) dental health education; (4) establishing the degree of cavity risk; (5) hospitalization. *The prophylactic measures* applied in the secondary prevention of dental cavities consist of: (1) early diagnosis of carious lesions; (2) treatment of initial carious lesions by: remineralisation (topical applications of fluorinated substances); preventive restorations with resins - expanded sealing; minimally invasive odontal therapy; (3) establishing the sequence of periodic controls according to the degree of individual risk.

Tertiary prevention of dental cavities addresses the complex curative treatments of multiple odontal conditions that include: (a) curative treatment of current odontal injuries; (b) treatment of root lesions; (c) complete adjunct and/or conjunct prosthetic treatment.

Prophylactic measures aim to: (1) maintain the results obtained through treatment; (2) maintain a proper hygiene of the oral cavity (and of the prosthetic works performed), in order to increase the reliability of the odontal and prosthetic treatments performed; (3) preventing the complete loss of functional capacity of the dento-maxillary apparatus.

3. Methodology of research

We specify that in the case studies we will use some preliminary notions in the field of dentistry and economics, explicitly presented in the tabels.

3.1. Case study no. 1. The simple and complicated dental cavities

The dental cavity is one of the most common chronic destructive diseases of dental hard tissues, being through its complications the most common cause of tooth loss. It affects about 90% of the population and is manifested by the destruction and loss of dental hard tissue under the action of a combination of factors. Among them, we mention:

First of all, external factors: poor oral hygiene, excessive consumption of high-sugar foods and carbonated drinks, stress, smoking.

Secondly, favourable factors: (1) the acidic pH of the oral cavity; (2) the deficient intake of fluoride during tooth formation; (3) the lack of saliva; (4) the teeth in the lateral area are affected more often due to their accentuated occlusal landscape and poor access to brushing; (5) in the back areas, before the actual cavity appears, dental plaque appears, which is defined as a thin biofilm on the surface of the teeth formed by food debris, saliva and bacteria. Of the latter, the most important are *Streptococcus mutans* and *Lactobacillus*.

This biofilm (dental plaque) accumulates on the teeth and gums especially in places from which it is difficult to remove, such as: (1) the grooves and fissures on the occlusal surfaces of the molars and premolars as well as the oral faces of the front teeth; (2) in the interdental spaces.

The food residues in dental plaque, rich in sugars and carbohydrates, along with the bacteria mentioned above, turn sugars and carbohydrates from food waste into acids through a process called acid fermentation. The longer the biofilm stays in contact with the tooth surfaces, the acids resulting from this fermentation will affect the hard structures of the teeth (enamel and dentin) resulting in their demineralization. As the demineralization continues for a long time, the hard structures of the teeth will lose large amounts of mineral substances (fluorine, calcium), of these structures remaining only the organic matrix of soft consistency. Due to this fact, the organic matrix will disintegrate leaving behind a cavity, this being the dental cavity. Dental cavities can be of two types: (a) The simple cavity that strictly affects the hard structures of the tooth (enamel and dentin); (b) The complicated cavity, which, in addition to affecting the hard structures, also affects the pulp chamber.

Treatment options:

a) For simple cavities, the most common and easiest treatment option is the dental obstruction (“so-called filling”), which may be simpler or more complicated to perform depending on the classification of the cavity. The most common materials

used for fillings in modern dentistry are composite resins which are physiognomic materials with a colour and consistency close to that of the natural tooth. As for its location: (1) on the occlusal surface; (2) interdentally; (3) on the frontal area.

The rates charged for simple dental cavities, depending on the materials used, can vary between 50 and 250 lei. Depending on the classic method of execution (rotary tools, cutters and hand tools) or with laser, the rates vary between 450 lei and up to 900 lei.

b) In the case of complicated cavities, things are a little different. Due to the damage to the pulp chamber, the degree of difficulty of the treatment automatically increases the number of manoeuvres performed and the materials used as well. In this situation regarding complicated cavities with pulp chamber damage, the first thing to do after removing hard structures (altered dentin) is to proceed to the actual treatment of the pulp chamber. This is done as follows: (1) the entire contents of the pulp chamber are removed (the pulp of the tooth with all its structures); (2) mechanical treatment of root canals on a tooth in order to fill them, which can be from 1 to 4 to even 6 root canals on a tooth; (3) root canal filling to apical constriction (root tip) with sealing paste and gutta-percha; (4) after the canal filling, the tooth is reinforced with fiberglass or prefabricated metal screw-style pivots (dentatus type), because a tooth that has lost its vitality becomes brittle over time and can fracture relatively easily; (5) we then proceed to the effective reconstruction of the dental crown with several treatment options depending on the severity of the situation, such as:

a) composite resins in the form of obstructions (“filling”);

b) inlay or onlay-type dental inlays that can be metallic (usually made of noble 20 and 22 carat gold alloys), composite resins, ceramic or zirconium oxide;

c) with coating crowns, this being the most recommended method for teeth that have lost their vitality, which in turn can be of several types: metallic, metal-ceramic, semi-physiognomic (Weisser type crowns), metal-composite or metal- ceramic, totally physiognomic metal-ceramic or Jacket type which can be of composite resins, aluminium-ceramic, pressed ceramic or zirconium oxide.

The rates charged may be:

a) for simple cavities the treatment is performed by filling with composite resins, where the tariffs vary between 150 lei and up to 250 lei;

b) for complicated cavities, endodontic treatment depends on the tooth and the number of its roots, and the tariffs can vary between 150 lei and up to 700-800 lei;

c) Fiberglass or dentatus pivot reinforcement can have rates ranging from 200 to 400 lei;

d) Ceramic or zirconium oxide that varies between 450 lei and 800 lei;

e) Metal coating crowns where the rates can be between 150 lei and up to 250 lei;

f) Semi-physiognomic or totally physiognomic metal-composite that have tariffs between 300 and up to 450 lei;

g) Metal-ceramic crowns with rates between 500 lei and up to 700 lei;

h) Totally physiognomic Jacket type crowns, completely ceramic or made of zirconium oxide, with rates between 850 lei and up to 1300 lei.

3.2. Case study no. 2. Lack of a tooth (molar no. 1 or 6-year-old molar)

We have a patient who is missing lower or upper molar no. 1. The methodology for restoring the missing tooth includes 2 options:

Option 1 – to make a dental implant

Option 2 – to perform a dental bridge prosthesis

Option 1 depends on the following conditions: (1) good hygiene and oral health of the patient; (2) the existence of a sufficient supply of hard and soft tissue (the existence of the minimum bone support on which a dental implant can be placed and the quality of the soft tissue covering the bone); (3) the condition of the teeth adjacent to the edentulous gap (neighbouring and antagonistic teeth).

They must be in good condition without cavities, without periodontal pockets, and to not have migrated horizontally, vertically or on both planes. Then, if all the conditions are met, we move to the insertion of the implant in the surgical stage. An immediate temporary work can be done in some cases, and, at least four months after the surgical stage, the final prosthesis is applied on a ceramic, metal-ceramic or zirconium support.

Option 2: For the absence of lower or upper molar no. 1, being the area where the masticatory force is greatest, its prosthesis requires special attention from the dentist because the adjacent teeth must withstand both the pressure exerted on them by the antagonistic teeth during the mastication process, as well as pressure from the area of the missing tooth, in this case molar no. 1. Therefore, in this particular case, molar no. 2 and both premolars must be taken as pillars for the dental bridge prosthesis (so three teeth for prosthesis of one). First, the prosthetic field and antagonistic teeth are evaluated. In order to make a dental bridge in this case, the three abutment teeth that have previously been devitalized must be sanded, canal treatments made and they must be reinforced with metal or fiberglass pivots. After these steps, we proceed to the execution of the dental bridge made of ceramic material, which can be placed on a metal or on a zirconium oxide support. *The rates charged* for each option are as follows:

Option 1 - Radiographic investigations, computed tomography, medical tests, general dental consultation, surgical stage and prosthetic stage: Monthly oral hygiene – about 50 lei; Radiographic investigation – 25 lei; CT scan – 400 lei; Medical tests – 100 lei; General dental consultation – 150 lei; Surgical stage – 2000 lei; Prosthetic stage – 1300 lei with ceramic crown on zirconium; Total: 4250 lei.

Option 2 – Radiographic investigation, general consultation, costs on devitalizing and filling dental canals (pre-prosthetic stage) and pro-prosthetic stage (the execution itself of the prosthetic work which includes the work performed by the dentist and dental laboratory). Monthly oral hygiene about – 50 lei; Radiographic investigation – 25 lei; General dental consultation – 150 lei; Costs on devitalizing and filling channels – 300 lei/per tooth; Prosthetic stage – 600 lei/per tooth on metal-ceramic support or 1300 lei/per tooth with ceramic crown on zirconium; Total: 1675 lei.

3.3. Case study no. 3. Periodontitis

Periodontitis is a disease of the dento-maxillary apparatus that affects the tissues that support the teeth. These are the free gingival margin, the periodontal ligaments and the alveolar bone. The most common cause of periodontal disease is poor hygiene, smoking, excess alcohol, narcotics, poor diet and some body dysfunctions such as: decompensated diabetes; obesity; hyperlipidaemias; the daily stress to which the patient is subjected. The first sign of periodontal disease is gingival inflammation and bleeding when brushing in the early stages, and can lead to increased tooth mobility with gingival retraction and root exposure, dentinal hyperesthesia (sensitive teeth) and even gum pus. In the more advanced stages, the teeth become mobile to the touch, causing chewing disorders, which becomes more difficult and painful, reaching major imbalances of the entire dento-maxillary apparatus.

The first stage of periodontal disease is gingivitis. This is a completely reversible condition. The determining cause of gingivitis is the lack of rigorous hygiene and the invasion of dental and sub-gingival surfaces by plaque causing an inflammatory process. Over time, this bacterial plaque calcifies with minerals from saliva and food and turns into plaque. Plaque itself is not pathogenic, but having a rough surface creates an ideal environment for the retention of microorganisms. Not removing the plaque periodically leads to its excessive accumulation leading in some serious cases even to the total coverage of the teeth. However, dental plaque is not the determining etiological factor of the destructive periodontal disease. Dental plaque is always covered by a layer of bacterial plaque that is not yet mineralized. So it turns out that dental plaque is a factor in periodontal inflammation in that it plays a mechanical role in keeping the bacterial plaque in close, even irritating due to its increasing its volume, contact with the tissues of the marginal periodontium, and prevents access to safely clean bacterial plaque. Dental plaque is therefore an important favourable factor in the production of periodontal disease.

Another factor in the production of chronic marginal periodontitis is occlusal trauma. Occlusal trauma occurs when the tooth is subjected to demands that are non-physiological by intensity, duration, frequency and direction, and which manifest by periodontal pain, and can be acute or chronic.

The *acute* one can be direct by accidental interposing during chewing hard objects or fragments such as foreign bodies (pips, walnut shells, bones) or by excessive clamping between the teeth of metal objects such as wire, nails, etc. to bend them, to remove the glass lids, etc., or indirectly, by accidental blows applied to the mandible while the subject holds a hard object between his teeth.

Chronic occlusal trauma is more common and results from bruxism, clenching of the teeth, overuse of the teeth that border the edentulous spaces. Primary occlusal trauma results from aggressive occlusal forces such as accelerated eruptions of teeth without the antagonistic ones and the occurrence of occlusal blockage, obstructions or high prosthetic works, incorrectly designed and made orthodontic dental bridges that develop excessive forces harmful to the marginal periodontium. Occlusal trauma is followed by changes in the marginal periodontium, increased dental mobility, widening of the dento-alveolar space.

Other factors are especially dental cavities, even more so those of the package that retain food debris and plaque causing inflammation of the gingival margin, and interdental caries that act by retention of food debris and plaque having a harmful impact on the interdental papilla. Edentations can also be a cause of periodontal disease by removing the contiguity of the dental arches, interrupting the continuity of the system of supra-alveolar ligaments that form a connecting strap between the teeth. The horizontal migration of the teeth that border the edentulous gaps lead to the appearance of spaces between the teeth and traumatic impact on the interdental papillae. Another factor favouring the production of chronic marginal periodontitis is dento-maxillary anomalies. These can be crowded dento-alveolar inconsistencies that favour the retention of food debris and bacterial plaque making it difficult to clean and self-clean. Also, in these cases the anatomical conditions present thin interdental septa and low volume interdental papillae, these having a deficient blood circulation unfavourable to a good periodontal dentition.

The primary prevention of periodontal disease aims to prevent chronic marginal periodontitis. Prophylactic measures include:

a) Specific methods: (1) control of bacterial plaque formation; (2) control of the formation of supra- and especially sub-gingival plaque; (3) removal of dental plaque;

b) Non-specific methods: (1) control of general health; (2) health education on oral dental health; (3) diet control; (4) removal of the main risk factors for periodontal disease.

Secondary prevention of periodontal disease treats the initial stages of chronic marginal periodontitis - gingivitis and chronic superficial marginal periodontitis - and prevents the progression of the disease. Measures applied in periodontal secondary prophylaxis include: (1) specific antimicrobial and anti-inflammatory treatment; (2) removal of bacterial plaque and supra- and sub-gingival plaque; (3) training patients on oral hygiene and general health; (4) removal of local (bacterial plaque, dental plaque, occlusal trauma, dental cavities, edentulousness, dento-maxillary abnormalities, parafunctions, vicious habits) and general (nervous system disorders, endocrine disorders, immune deficiencies, nutritional deficiencies, cardiovascular diseases, haematological or hepatic) risk factors of periodontal disease.

Periodontal *tertiary prevention* addresses complex periodontal curative treatments of deep marginal periodontitis that include: (1) surgical treatment; (2) occlusal balancing treatment; (3) treatment of structural and functional rehabilitation of the marginal periodontium by biostimulation; (4) treatment of complications.

Prophylactic measures are aimed at: (1) maintaining the results obtained via treatment; (2) prevention of the complete loss of functional capacity of the dento-maxillary apparatus.

4. Prevention of oro-maxillo-facial cancer (OMF)

a) The primary *prevention of oro-maxillo-facial cancer* encompasses:

Specific measures: (1) suppression of chronic irritations of the oral mucosa: incorrect, unadapted fillings, with sharp or overflowing edges, traumatic prosthetic works; (2) control of bacterial plaque formation.

Non-specific measures: (1) control of general health; (2) health education on oral dental health; (3) elimination of major risk factors (tobacco, alcohol).

b) The secondary *prevention of oro-maxillo-facial cancer* encompasses: (1) early diagnosis and treatment of onset lesions of oral cancer; (2) periodic oncological control; (3) specialized surgical treatment - any ulcerative lesion that does not have a tendency toward spontaneous healing or following a non-specific anti-inflammatory treatment within 14-21 days requires a specialized surgical examination.

c) Tertiary prevention involves the approval of a surgeon. It addresses the manufacture, wearing and sanitization of special prostheses in the field of O.M.F surgery (obturators, maxillary prostheses), as well as the sanitization of the oral cavity and periodic oncological controls.

Table 2. Rates practiced in periodontology

Dental Service - Periodontology – Plaque Removal	Fee
Periodontology specialist consultation (includes periodontics)	150 lei
Complete professional plaque removal with ultrasound + professional brushing	220 lei
Cursory professional plaque removal with ultrasound + professional brushing	160 lei
Air flow	100 lei
Complete initial antimicrobial treatment (plaque removal with ultrasound (US), air flow, professional brushing, antiseptic application)	350 lei

Sub-gingival curettage in closed field/tooth	60 lei
Sub-gingival curettage in closed field/ hemi-arcade	350 lei
Sub-gingival curettage in closed field/arcade	500 lei
Sub-gingival curettage in open field (flap operation)/tooth	300 lei
Sub-gingival curettage in open field (flap operation)/hemi-arcade or group of 4-5 teeth	1000 lei
Application of regenerative material (3 grams)	900 lei
Application of regenerative material (7 grams)	1500 lei
Gingivectomy (group of 1-6 teeth)	350 lei
Treatment of gingival/tooth retractions	300 lei
Treatment of multiple gingival retractions/group of teeth	500 lei
Autograft collection of soft tissue	900 lei
Periimplantitis treatment (flap, curettage, surface treatment)	600 lei
Coronary elongation with bone/tooth remodelling	300 lei
Treatment of ulcer-necrotic gingivitis	150 lei
Emergency treatment of periodontal abscess	150 lei
Fiberglass sextant immobilization	600 lei
Application of antiseptic substance	50 lei
Periodontology specialist consultation (includes periodontics)	150 lei
Complete professional plaque removal with ultrasound + professional brushing	220 i

5. Presentation of the "Cluster Analysis" mathematical model applied for the analysis of treatments in a dentist's office

The analysed treatments are listed below, along with the codes used in the computer program for the cluster analysis:

(1) CS1, treatment of simple cavities on the occlusal surface; (2) CS2, analogous to the interdental area; (3) CS3, analogous to the frontal area; (4) CSI1, treatment of simple cavities on the occlusal surface with laser; (5) CSI2, analogous for laser treatment for the interdental area; (6) CSI3, analogous for laser treatment on the frontal area; (7) CC1, endodontic; (8) CC2, fiberglass pivot or dentatus reinforcement; (9) CC3, ceramic or zirconium oxide; (10) CC 4, metal coating crowns; (11) CC5, semi-physiognomic metal-composite; (12) CC6, totally physiognomic metal-composite; (13) CC 7, Jacket-type crown; (14) ID, dental implant; (15) PP, bridge prosthesis; (16) DP1, complete professional plaque removal with US + professional brushing; (17) DP2, cursory professional plaque removal with US + professional brushing; (18) DP3, complete antimicrobial treatment; (19) CH1, sub-gingival curettage in closed field/tooth; (20) CH2, sub-gingival curettage in closed field/ hemi-arcade; (21) CH3, analogous/arcade; (22) CH4, Sub-gingival curettage in open field (flap operation)/tooth; (23) CH5, analogous/hemi-arcade or group of 4-5 teeth; (24) AM1, application of regenerative material (3 grams); (25) AM2, analogous (7 grams); (26) GV, Gingivectomy (group < 6 teeth); (27) RT1, treatment of gingival/tooth retractions; (28) RT2, analogous multiple; (29) RA, autograft collection; (30) PI, periimplantitis treatment; (31) AC, Coronary elongation with bone/tooth remodelling; (32) GG, treatment of necrotic gingivitis; (33) AP, emergency treatment of periodontal abscess.

5.1. The Cluster Analysis Method

For the study of the activities in the dentist's office we chose the cluster analysis mathematical model. The model divides these activities into groups (clusters) that are useful and rational. If the groups are rational and understood, these clusters capture the natural structure of the data. In some cases, cluster analysis is just a starting point for another method such as data integration and synthesis. With the aim of either understanding the processes in a dentist's office or continuing the analysis, this method can have many applications for solving many problems.

Clustering for understanding classes: they are groups of objects that have common characteristics and will play an important role in the analysis done on the multitude of people, both inside and outside the dentist's office. Indeed, people judge based on the classification of objects into groups, larger or smaller, more or less similar. Often, people assign a new object to a class from the multitude of classes they have already designed and are accustomed to. This is actually the classification process. As an example, children from an early age can recognize car brands, categories of objects in their class or in the apartment in which they live, animals, plants, etc.

Clustering for utility: Cluster analysis provides an abstracting from individual objects to clusters, based on data that characterizes the set of objects under study. Each cluster is characterized by a centroid prototype, which is a real or imaginary object with the representative characteristics of the group. Prototypes can be used as a basis for *data analysis* or *data processing*. To solve the cluster analysis problem for a dentist's office we used the statistiXL statistics program that allows hierarchical clustering. This is a powerful statistics program that runs under Excel, a Microsoft Office program. Excel has the property to meet the needs of those who request a robust, flexible, easy to handle package for statistical analysis.

Likewise, Excel allows easy manipulation of input data and fast and efficient calculations. The statistiXL program naturally extends the wide range of functions that Excel can perform using spreadsheets.

The clustering program in statistiXL uses arrays of data stored in the form of matrixes to classify objects, described in report to matrix data lines, into groups according to attribute values (array columns). No a priori hypothesis is made regarding these groups. Even if such information is known, the program does not request, use or ignore it. Cluster analysis seeks to separate data into disjoint groups, forming a dendogram based on all objects in the analysis, and with a single class at the top. The technique used is *agglomeration clustering*, which begins by identifying the "closest" objects that are grouped in the same class. In each iteration, the procedure identifies the closest objects and/or clusters. The dendogram (tree chart) is the means by which the clustering process is graphically presented. The dendogram appears as having at its base 33 clusters (classes) each having a single object represented by an individualized treatment. The dendogram shows how these clusters combine (merge) to reach the root (one single class). The order in which the 33 initial objects are represented in the dendogram is the one in which they are grouped in clusters, because from the graphic point of view it would have been too complicated to present the grouping of objects in the original order. The classification performed by statisti XL is intrinsic, in the sense that each attribute is considered to be of equal importance. Another feature of the classification is that it is hierarchical, in the sense that those clusters that are closer to the base have fewer objects and are therefore more homogeneous. The data used are polythetics, with more attributes, equally weighted.

The agglomerative method of automatic classification starts with the 33 objects, and at each intervention two elements are joined, the number of existing groups decreasing each time until only one element is left. The procedure is based on the matrix of the distances between the 33 elements. Successively, two elements/groups are combined based on the merger strategy. Finally, a dendogram (a diagram of the branching tree) is obtained, which graphically summarizes the cluster analysis process.

The agglomeration method starts with a matrix of similarity or dissimilarity coefficients, correlation coefficients, the Euclidean matrix. A decisive point in the quality of the cluster analysis process is the way of choosing the most appropriate technique for obtaining the initial matrix and for determining the procedure that combines the elements/clusters in groups.

Clustering strategies begin by considering $\frac{n(n-1)}{2}$ measures of cabinet treatments analysed in pairs formed from the n objects. In our study n=33. The closest 2 analysed elements will become the first grouping obtained. Next, n-1 elements remain to be analysed, a/n-1 being in fact the obtained cluster. This matrix of distances is constructed again. The process is repeated interactively until only one element remains and so it is no longer possible to build a matrix of distances. There are many techniques for merging groups. Among them are the nearest neighbour, the group average, the centroid, the sum of the squares. These techniques rearrange the elements in multidimensional space in several ways. The two groups with the shortest distance (highest similarity) are merged. The relation of the merged group with all the other groups is then recalculated using the combinatorial algorithm. The process continues until only one group remains.

5.2. Cluster analysis input data

Input data consists of a matrix with 33 lines, one for each of the activities considered in the study.

Each element under study is characterized by the following information: (1) Hours of work dentist MM; (2) Hours of work assistant MA; (3) Hours of work technician MT; (4) Hours of general dentist's office equipment EG; (5) Hours of special equipment ES; (6) Value of materials VM; (7) Value of consumables VC; (8) Treatment fee TT.

5.3. The results obtained by using the statistiXL software

The matrix of input data appears as a table with 33 rows, one for each treatment analysed, and 8 columns, representing their characteristics.

This input data is represented in table 3. The distance between two analysed elements Ti and Tj is given by the following formula:

$$d(Ti,Tj)=\sqrt{(MMj-MMi)^2+(MAj-MAi)^2+(MTj-MTi)^2+(EGj-EGi)^2+(ESj-ESi)^2+(VMj-VMi)^2+(VCj-VCi)^2+(TTj-TTi^2}$$

Table 3. Input data matrix

		MM	MA	MT	EG	ES	VM	VC	TT
1	CS1	2.5	3.2	0.2	3.5	0.5	10	5	70
2	CS2	3.2	3.7	0.2	4.1	0.6	12	6	100
3	CS3	2.1	2.9	0.2	3	0.4	20	5	150
4	CSL1	1.1	1.2	0.8	2.4	2.2	8	5	600
5	CSL2	1.5	1.7	1	3.2	2.9	9	6	750
6	CSL3	0.9	1.2	1	2.7	2.2	7	5	550
7	CC1	4.9	6.2	0.5	5	0.9	18	7	200
8	CC2	4.4	5.1	2	6	0.8	20	8	300
9	CC3	5	6	4	7	0.9	30	18	700
10	CC4	2	3	2	3.6	0.4	18	6	200
11	CC5	3.8	4.1	3.2	3.8	0.9	21	8	300
12	CC6	4.1	4.3	4.4	2.7	1.4	22	8	450
13	CC7	5	7	8	4.1	2.8	60	11	1100
14	ID	12	16	18	12	15	1300	90	4250
15	PP	9	10	12	6	11	1300	50	1675
16	DP1	0.2	1	0.4	2	1	8	6	240
17	DP2	0.2	0.8	0.3	1.5	1	4	4	180
18	DP3	0.4	1.2	0.5	1.9	1.8	9	7	350
19	CH1	0.9	3	0.8	3.5	0.5	12	5	60
20	CH2	1.8	6	0.9	6.3	1	14	9	350
21	CH3	1.9	8	1.4	8	2	19	14	500
22	CH4	1.5	5	1	4	1.1	112	10	300
23	CH5	5	12	3	12	4	300	30	1000
24	AM1	3	2	1	5	4	450	20	900
25	AM2	6	4	2	8	7	850	40	1500
26	GV	1	0.5	0.5	3	4	100	12	350
27	RT1	1.9	1.1	0.4	3	3	70	9	300
28	RT2	3.6	1.9	0.9	6	5	90	12	500
29	RA	3	6	0.8	4	5	20	10	900
30	PI	2	8	1	2	4	15	10	600
31	AC	4	2	3	5	3	14	8	300
32	GG	2	1	0.4	3	1	8	5	150
33	AP	0.6	0.4	0.2	1	0.2	5	4	50

The matrix of distances obtained by applying this formula (Euclidean distance) is represented in Table 4.

Table 4. Distance matrix (Euclidean Distance)

	CS1	CS2	CS3	CSL1	CSL2	CSL3	CC1	CC2	CC3
CS1		30.102	80.626	530.014	680.009	480.021	130.328	230.273	630.484
CS2	30.102		50.676	500.033	650.017	450.047	100.235	200.196	600.416
CS3	80.626	50.676		450.169	600.109	400.222	50.310	150.105	550.289
CSL1	530.014	500.033	450.169		150.012	50.012	400.190	300.326	103.558
CSL2	680.009	650.017	600.109	150.012		200.016	550.110	450.176	56.064
CSL3	480.021	450.047	400.222	50.012	200.016		350.247	250.438	152.535
CC1	130.328	100.235	50.310	400.190	550.110	350.247		100.049	500.281
CC2	230.273	200.196	150.105	300.326	450.176	250.438	100.049		400.258
CC3	630.484	600.416	550.289	103.558	56.064	152.535	500.281	400.258	
CC4	130.263	100.207	50.086	400.139	550.082	350.188	4.910	100.120	500.322
CC5	230.308	200.237	150.081	300.338	450.187	250.459	100.122	2.941	400.246
CC6	380.231	350.179	300.063	150.789	300.334	101.322	250.084	150.072	250.373
CC7	1031.273	1001.204	950.910	502.836	353.859	552.672	901.022	801.035	401.221
ID	4375.452	4346.184	4296.104	3872.968	3731.563	3920.453	4248.954	4153.107	3771.094
PP	2059.732	2035.148	1991.584	1681.449	1588.887	1714.599	1954.805	1879.106	1601.483
DP1	170.052	140.132	90.849	360.005	510.008	310.008	41.942	61.653	460.775
DP2	110.238	80.575	34.171	420.024	570.034	370.019	25.856	121.373	520.928

	CS1	CS2	CS3	CSL1	CSL2	CSL3	CC1	CC2	CC3
DP3	280.032	250.061	200.335	250.012	400.007	200.023	150.455	51.704	350.921
CH1	10.342	40.094	90.366	540.022	690.013	490.032	140.245	240.203	640.423
CH2	280.087	250.051	200.184	250.184	400.082	200.258	150.105	50.457	350.510
CH3	430.243	400.190	350.196	101.393	250.455	52.920	300.122	200.144	200.399
CH4	251.663	223.655	176.057	317.584	461.671	271.234	137.329	92.095	408.435
CH5	974.577	945.343	895.387	496.106	384.653	537.774	848.617	754.307	403.876
AM1	939.543	912.171	864.664	534.419	466.030	564.790	822.693	738.287	465.238
AM2	1658.856	1632.013	1585.154	1232.995	1127.388	1270.614	1543.816	1459.442	1145.832
GV	294.230	265.156	215.567	266.491	410.268	220.685	171.203	94.711	357.100
RT1	237.755	208.299	158.196	306.369	454.127	257.851	112.922	50.395	402.179
RT2	437.469	407.611	357.047	129.617	262.895	97.286	308.621	212.004	209.003
RA	830.093	800.066	750.039	300.343	150.542	350.330	700.025	600.025	200.509
PI	530.083	500.062	450.101	11.158	150.315	51.383	400.061	300.117	101.713
AC	230.098	200.065	150.227	300.110	450.047	250.156	100.230	7.253	400.478
GG	80.060	50.271	12.166	450.003	600.006	400.005	51.415	150.623	550.650
AP	21.066	50.798	101.186	550.016	700.025	500.013	150.820	250.612	650.709

CC4	CC5	CC6	CC7	ID	PP	DP1	DP2	DP3	CH1
130.263	230.308	380.231	1031.273	4375.452	2059.732	170.052	110.238	280.032	10.342
100.207	200.237	350.179	1001.204	4346.184	2035.148	140.132	80.575	250.061	40.094
50.086	150.081	300.063	950.910	4296.104	1991.584	90.849	34.171	200.335	90.366
400.139	300.338	150.789	502.836	3872.968	1681.449	360.005	420.024	250.012	540.022
550.082	450.187	300.334	353.859	3731.563	1588.887	510.008	570.034	400.007	690.013
350.188	250.459	101.322	552.672	3920.453	1714.599	310.008	370.019	200.023	490.032
4.910	100.122	250.084	901.022	4248.954	1954.805	41.942	25.856	150.455	140.245
100.120	2.941	150.072	801.035	4153.107	1879.106	61.653	121.373	51.704	240.203
500.322	400.246	250.373	401.221	3771.094	1601.483	460.775	520.928	350.921	640.423
	100.096	250.067	901.031	4248.987	1954.840	41.385	24.814	150.316	140.142
100.096		150.013	800.979	4152.801	1878.424	61.698	121.419	51.737	240.220
250.067	150.013		651.136	4010.070	1770.845	210.577	270.714	101.041	390.173
901.031	800.979	651.136		3386.264	1367.427	861.657	921.800	751.820	1041.168
4248.987	4152.801	4010.070	3386.264		2575.336	4213.952	4272.341	4109.076	4384.420
1954.840	1878.424	1770.845	1367.427	2575.336		1931.537	1979.186	1850.551	2066.289
41.385	61.698	210.577	861.657	4213.952	1931.537		60.169	110.012	180.067
24.814	121.419	270.714	921.800	4272.341	1979.186	60.169		170.103	120.311
150.316	51.737	101.041	751.820	4109.076	1850.551	110.012	170.103		290.036
140.142	240.220	390.173	1041.168	4384.420	2066.289	180.067	120.311	290.036	
150.143	50.687	100.492	751.458	4107.442	1846.996	110.414	170.523	8.612	290.065
300.187	200.202	51.000	601.465	3963.567	1738.716	260.528	320.662	150.783	440.203
137.324	91.082	174.999	801.731	4125.654	1817.656	120.225	161.636	114.625	260.058
848.690	753.967	616.785	260.912	3400.957	1206.736	814.678	872.334	712.714	983.543
822.702	737.703	621.175	438.476	3456.969	1150.781	794.473	847.115	705.104	947.464
1543.846	1458.878	1337.601	886.013	2787.116	483.105	1515.862	1568.291	1425.123	1666.481
171.122	93.783	127.067	751.145	4081.293	1788.131	143.565	195.428	91.175	303.170
112.811	49.270	157.603	800.130	4137.973	1845.411	86.377	137.077	78.930	246.964
308.629	211.681	84.747	600.823	3941.241	1687.135	272.772	331.526	170.657	446.954
700.038	600.027	450.044	204.114	3587.191	1496.944	660.161	720.243	550.159	840.073
400.083	300.127	150.299	502.086	3870.504	1675.914	360.176	420.264	250.198	540.069
100.173	7.703	150.263	801.359	4154.961	1883.194	60.623	120.646	50.566	240.077
51.071	150.663	300.394	951.497	4299.698	1999.322	90.029	30.373	200.024	90.121
150.638	250.626	400.443	1051.529	4396.072	2078.511	190.040	130.009	300.049	12.789

CH2	CH3	CH4	CH5	AM1	AM2	GV	RT1	RT2	RA
280.087	430.243	251.663	974.577	939.543	1658.856	294.230	237.755	437.469	830.093
250.051	400.190	223.655	945.343	912.171	1632.013	265.156	208.299	407.611	800.066
200.184	350.196	176.057	895.387	864.664	1585.154	215.567	158.196	357.047	750.039
250.184	101.393	317.584	496.106	534.419	1232.995	266.491	306.369	129.617	300.343
400.082	250.455	461.671	384.653	466.030	1127.388	410.268	454.127	262.895	150.542
200.258	52.920	271.234	537.774	564.790	1270.614	220.685	257.851	97.286	350.330
150.105	300.122	137.329	848.617	822.693	1543.816	171.203	112.922	308.621	700.025
50.457	200.144	92.095	754.307	738.287	1459.442	94.711	50.395	212.004	600.025
350.510	200.399	408.435	403.876	465.238	1145.832	357.100	402.179	209.003	200.509
150.143	300.187	137.324	848.690	822.702	1543.846	171.122	112.811	308.629	700.038
50.687	200.202	91.082	753.967	737.703	1458.878	93.783	49.270	211.681	600.027
100.492	51.000	174.999	616.785	621.175	1337.601	127.067	157.603	84.747	450.044
751.458	601.465	801.731	260.912	438.476	886.013	751.145	800.130	600.823	204.114
4107.442	3963.567	4125.654	3400.957	3456.969	2787.116	4081.293	4137.973	3941.241	3587.191
1846.996	1738.716	1817.656	1206.736	1150.781	483.105	1788.131	1845.411	1687.135	1496.944
110.414	260.528	120.225	814.678	794.473	1515.862	143.565	86.377	272.772	660.161
170.523	320.662	161.636	872.334	847.115	1568.291	195.428	137.077	331.526	720.243
8.612	150.783	114.625	712.714	705.104	1425.123	91.175	78.930	170.657	550.159
290.065	440.203	260.058	983.543	947.464	1666.481	303.170	246.964	446.954	840.073
	150.194	110.052	710.513	701.958	1422.118	86.348	75.334	168.289	550.054
150.194		220.661	573.816	588.088	1300.498	170.739	206.641	71.403	400.059
110.052	220.661		725.177	688.741	1409.119	51.751	42.253	201.299	607.028
710.513	573.816	725.177		180.989	743.432	680.485	737.264	542.742	298.178
701.958	588.088	688.741	180.989		721.410	651.977	710.302	538.207	430.137
1422.118	1300.498	1409.119	743.432	721.410		1373.265	1431.583	1256.345	1024.614
86.348	170.739	51.751	680.485	651.977	1373.265		58.405	150.396	555.824
75.334	206.641	42.253	737.264	710.302	1431.583	58.405		201.062	602.106
168.289	71.403	201.299	542.742	538.207	1256.345	150.396	201.062		406.110
550.054	400.059	607.028	298.178	430.137	1024.614	555.824	602.106	406.110	
250.067	100.360	315.326	491.685	528.556	1228.089	264.173	305.084	125.243	300.058
50.318	200.285	98.142	756.592	741.786	1462.858	99.672	56.151	214.013	600.056
200.220	350.397	182.643	899.231	870.692	1591.470	220.280	162.370	359.585	750.141
300.280	450.454	272.061	995.238	959.594	1678.679	314.814	258.387	458.093	850.194

PI	AC	GG	AP	Clustering Strategy				
530.083	230.098	80.060	21.066	**Cluster**	**1st Item**	**2nd Item**	**Distance**	**Cluster**
500.062	200.065	50.271	50.798	**1**	CC5	CC2	2.941	**1**
450.101	150.227	12.166	101.186	**2**	CC4	CC1	4.910	**2**
11.158	300.110	450.003	550.016	**3**	Cluster 1	AC	7.253	**3**
150.315	450.047	600.006	700.025	**4**	CH2	DP3	8.612	**4**
51.383	250.156	400.005	500.013	**5**	CH1	CS1	10.342	**5**
400.061	100.230	51.415	150.820	**6**	PI	CSL1	11.158	**6**
300.117	7.253	150.623	250.612	**7**	GG	CS3	12.166	**7**
101.713	400.478	550.650	650.709	**8**	Cluster 5	AP	12.789	**8**
400.083	100.173	51.071	150.638	**9**	Cluster 2	DP2	24.814	**9**
300.127	7.703	150.663	250.626	**10**	Cluster 8	CS2	30.102	**10**
150.299	150.263	300.394	400.443	**11**	Cluster 9	Cluster 7	30.373	**11**
502.086	801.359	951.497	1051.529	**12**	Cluster 11	DP1	41.385	**12**
3870.504	4154.961	4299.698	4396.072	**13**	RT1	CH4	42.253	**13**
1675.914	1883.194	1999.322	2078.511	**14**	Cluster 13	Cluster 3	49.270	**14**
360.176	60.623	90.029	190.040	**15**	Cluster 6	CSL3	50.012	**15**
420.264	120.646	30.373	130.009	**16**	Cluster 12	Cluster 10	50.271	**16**
250.198	50.566	200.024	300.049	**17**	Cluster 14	Cluster 4	50.318	**17**
540.069	240.077	90.121	12.789	**18**	CH3	CC6	51.000	**18**
250.067	50.318	200.220	300.280	**19**	Cluster 17	GV	51.751	**19**
100.360	200.285	350.397	450.454	**20**	Cluster 18	Cluster 15	52.920	**20**
315.326	98.142	182.643	272.061	**21**	CC3	CSL2	56.064	**21**

491.685	756.592	899.231	995.238	**22**	Cluster 19	Cluster 16	60.623	**22**
528.556	741.786	870.692	959.594	**23**	Cluster 20	RT2	71.403	**23**
1228.089	1462.858	1591.470	1678.679	**24**	Cluster 23	Cluster 22	100.492	**24**
264.173	99.672	220.280	314.814	**25**	Cluster 24	Cluster 21	101.713	**25**
305.084	56.151	162.370	258.387	**26**	Cluster 25	RA	150.542	**26**
125.243	214.013	359.585	458.093	**27**	AM1	CH5	180.989	**27**
300.058	600.056	750.141	850.194	**28**	Cluster 26	CC7	204.114	**28**
	300.098	450.148	550.193	**29**	Cluster 28	Cluster 27	260.912	**29**
300.098		150.216	250.285	**30**	AM2	PP	483.105	**30**
450.148	150.216		100.085	**31**	Cluster 30	Cluster 29	721.410	**31**
550.193	250.285	100.085		**32**	Cluster 31	ID	2575.336	**32**
				R	DF	P		
			Cophenetic Correlation	**0.966**	526	0.000		

Cluster 1 is obtained by naming in the same class the "closest" CC5 and CC2 treatments, which have a distance between them of 2.94. The next cluster is obtained by joining CC4 and CC1, which have a distance of 4.91. It can be seen that out of the 7 treatments for complicated cavities, these are joined by step 4, respectively 2. The others are: (1) CC6 which joins CH3 at iteration 18; (2) CC3 which joins CSL2 at iteration 21; (3) CC7 which joins with a cluster obtained at iteration 26 of which RA, CC3, CSL2 are part at iteration 27. The most isolated treatment is the ID dental implant which is joined only in the last iteration with another cluster. Regarding the treatments of simple cavities, it can be seen that 8 elements were studied. CS1 joins with CH1 in iteration 5, CSL1 joins with PI in iteration 6, CS3 joins with GG in iteration 7, CS2 joins with a cluster that includes AP, CH1 and CS1 in iteration 10. CSL3 merges with a cluster that also includes CSL1 and PI at step 14. CSL2 is a simple cavity treatment that is quite close to the treatment of a complicated cavity, the proof being the fact that it joins with CC3 at iteration 21. In total, the iterative process comprises 32 steps and is shown in Figure 1.

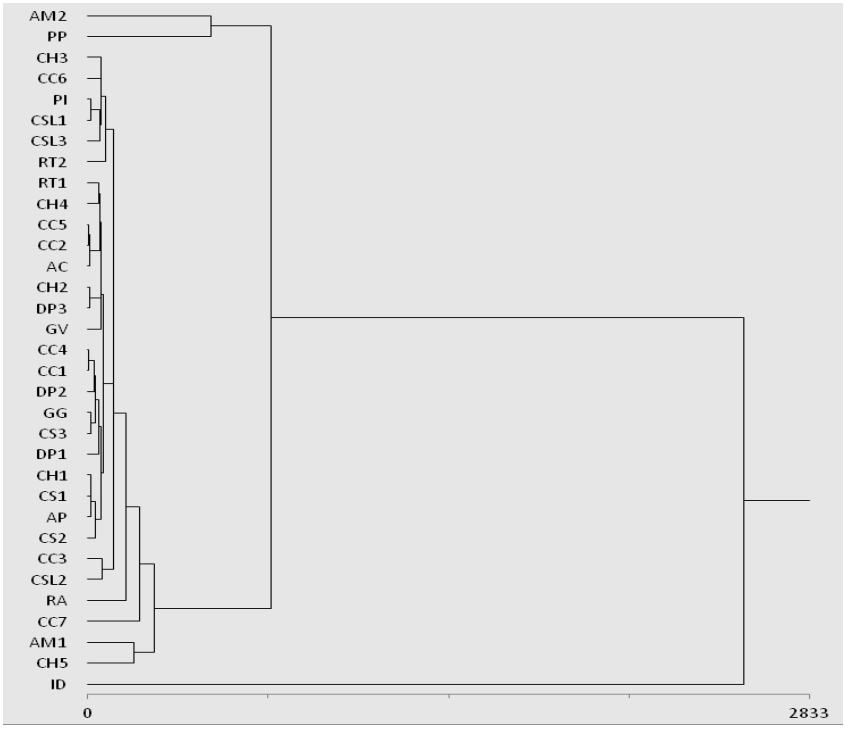

Figure 1. Dentogram obtained by clustering software

Regarding periodontology, 18 treatments were analysed. The most individualized treatment is AM2 which only unites with PP at step 30 of 32. AC is quite similar to the CC2 and CC5 treatments of complicated cavities, because at interaction 3 it joins with the cluster formed by these 2. DP3 and CH2 are the closest treatments in periodontology, being united in cluster 4 in the first iterations. The whole process is based on that matrix of distances which in the first 23 steps is based on quite small distances between treatments. Thus, at iteration 23 when RT2 is grouped, its distance from cluster 23 with which it joins is 71.40. At iteration 30, when AM2 and PP join, the distance is 483.10. At the last iteration, when approached by the most individualized treatment clustering process, the distance is significantly longer, namely 2575.37. Figure 1 comprises

the dentogram obtained by the clustering software which presents in a graphical form the model in which the 33 treatments studied combine.

6. Conclusions

We find that in Romania there is a specific local concern at the level of society: *poor dental hygiene*. In the absence of prevention, Romanians end up needing complicated interventions early (insertion of implants, complete restorations), very expensive even compared to the average income. At the same time, for doctors, treating complex cases is a challenge. This is an important vector of the development of the field and a reason why the market of dental services is growing from one year to another. Unfortunately, Romanian patients come to the dentist when they suffer from severe pain, when the treatment plan is very expensive because it involves, in some cases, the total restoration of teeth.

These are expensive treatments, which involve difficult procedures from dentists, as well as complicated laboratory work, insertion of dental implants, etc. Statistics on oral hygiene in Romans are very relevant and we observe their accuracy every day, treating patients in difficult situations. For this reason, in Romanian clinics, there is a need to invest a lot in prevention programs for vulnerable communities and in education regarding oral health at a very young age. In this regard, collaborations need to be developed with kindergartens, schools and non-governmental organizations, which operate in rural communities with a high share of people with very low incomes. The hierarchical clustering method used in the present analysis is an algorithm that groups similar objects into groups called clusters. At a certain iteration, the formed clusters form a partition of the set of elements considered, in this case, the 33 treatments in the dental office analysed. Hierarchical clustering begins by treating all 33 observations with a separate cluster. Then the iterative process performs 2 steps in each step: (1) Identifies the most similar (close) clusters; (2) Merges the clusters identified in the previous step. This iterative process continues until only one cluster is reached.

The obtained results are summarized in the dentogram that indicates the hierarchical relationship between the clusters. In the example studied, the distance used to calculate the distance between the clusters was the Euclidean distance. The results obtained and analysed in the previous paragraph indicate treatments generally from the same category of works that were joined in the same cluster, as well as some surprising results which can be observed. The software I used can use other distances besides Euclidean distance. The choice of distance metrics is based on theoretical considerations that characterize the field of study. When such considerations do not exist, Euclidean distance is preferable, as this is the best measure of distances in the physical world. Therefore, hierarchical clustering is a direct method for understanding the analysed phenomenon and for simplifying it to the desired degree. In this case, there are 33 degrees of simplification of the analysis, which characterizes each of the stages of the iterative process.

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