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PHD THESIS ABSTRACT

THE EVALUATION OF THE OCCLUSAL TRAUMA IMPACT ON THE DENTAL-PERIODONTAL STATUS IN PERIODONTAL DISEASE PATIENT

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SUMMARY

Note: The abstract of the PhD thesis presents the results of personal researches, general conclusions and selective references. The editing of the abstract respected the same countering of tables and pictures used in the PhD thesis.

The PhD thesis contains 60 figures, 26 tables and 483 references. The abstract includes a limited number of tables and figures, maintaining the original numbers from the PhD thesis.

KEY WORDS:

- Occlusal trauma
- Chronic periodontitis
- Periodontal parameters
- Tissue loss
- Periodontal therapy
- Occlusal therapy

PERSONAL CONTRIBUTIONS

CHAPTER IV. RESEARCH MOTIVATION AND OBJECTIVES

Beginning in the first decades of the last century, researchers focused on the etiopathogenic aspects of periodontal disease including traumatic occlusal forces as a local risk factor for the development of periodontal disease. Therefore, at first glance, the research theme is not an unprecedented one. However, in the multitude of niche studies, there are many gaps and deficits in understanding the mechanisms behind a seemingly simple relationship. Although repeated classifications of occlusal trauma have been achieved, complex periodontal therapy requires a complete and complex understanding of pathophysiology, with individualization on the patient's case. The main objective of this research was to clarify the etiopathogenic relationships between traumatic occlusive forces and periodontal disease through in vitro, clinical and paraclinical research.

In vitro studies have focused more on analysing displacements in the event of orthodontic forces; FEM studies in the occlusal trauma area are almost absent and with bias factors. Thus, it seems necessary to study the present research which proposed an elucidation of the effects that occlusal forces of different intensity and distribution exert on periodontal molars and tissues in terms of maximum displacement and tension.

The objective of the optical microscopy study was to investigate the influence of occlusive forces on root resorption on teeth with periodontal disease, by quantifying it as surface and volume, on teeth with and without occlusal contact.

There is very little information on the inflammatory load in occlusal trauma on parodontopathic field and the analysis of the possible influence of this association at the systemic level is absent in the literature. Therefore, paraclinical researches suggest an analysis of local inflammatory load in patients with occlusal trauma by assessing differences in levels of RANKL, a known bone resorption marker directly involved in osteoclast differentiation and activity in crevicular fluid (GCF) in patients with chronical superficial periodontitis, with or without chronic occlusal trauma. In addition, an assessment of systemic inflammation is proposed in patients with occlusal trauma, quantified by serum levels of C reactive protein and fibrinogen, compared to patients with physiological masticatory forces.

Occlusal correction therapy is a controversial topic with discordant results in specialized studies about the concrete benefits it brings. The research also proposes a clarification of the effects of occlusal adjustment therapy in combination with non-surgical classical periodontal therapy (scaling and root planing) in patients with periodontal disease and occlusal trauma. In this part of the thesis there are two directions of research. The first one investigates the possibility of using the bacterial profile to monitor complex therapeutic outcomes. The second direction focuses on evaluating associated therapy for periodontal status in patients with periodontitis and chronic occlusal trauma caused by parafunctions (in this particular case, bruxism).

CHAPTER V. IN VITRO RESEARCH ON THE OCCLUSAL TRAUMA EFFECTS ON THE DENTAL-PERIODONTAL TISSUES

V.1 A finite elements method study on the affected periodontal tissues behaviour under the action of traumatic occlusal forces

V.1.1 Introduction and aim of the study

The aim of the present study was to investigate through the analysis of the finite elements the axial tensions in the direction of force as well as the movements in the exercise of forces of different intensities on a model of the mandibular second molar.

V.1.2 Material and method

A three-dimensional finite element model of the second mandible was constructed with the following dimensions: coronary length 7mm, root length 13mm, crown MD diameter 10.5mm, MD crown diameter 8mm, crown diameter 10mm, crown VO diameter at cervical level 9mm. The biomechanical properties of different tissues were literature-derived measurements. Each individual tissue was modelled as a homogeneous, isotropic and linear elastic material. The 3D structure was included in Catia V5 (Dassault Systèmes, France) with 20,875 knots and 16,616 prismatic prism mesh elements with prismatic parabolic finite elements. The dimensions of the prism sides were as follows: jaw-7,935 mm with a precision of 1.27 mm; ligament: 0.892 mm with an accuracy of 0.143 mm; tooth: 1.27 mm with an accuracy of 0.203 mm.

Rigid constraint was applied with intensities of 500N, 650N, 800N and 1000N, respectively. The interfaces between the dentin and the periodontal membrane, the periodontal membrane and the alveolar bone, between enamel and dentin and between the dentin and pulp tissues were treated as perfectly glued linkages. The tasks were designed and simulated to identify site influences, the pattern and direction of mechanical loading on teeth and von Mises periodontal stress. Stress distractions von Mises (Zelic et al., 2015) were mapped (Fig. V.1, V.2).

V.1.3 Results

In the case of simulation of an optimal clinical situation (non-angulated molar, alveolar bone unaffected by destruction), the force applied uniformly and evenly to the occlusal surface generated the following values of axial tension (Table V.1, Fig.V.3-12) :

- The axial tension in the direction of force ranged from 33.2 to 66.3 mPa, the average level being 49.00 ± 14.27 mPa.
- The axial tension in the direction of force increases significantly with the increase of occlusal force (r = +0.999, p = 0.001).
- The axial tension in the direction of force increases significantly with increasing maximum displacement (r = +0.999, p = 0.001).

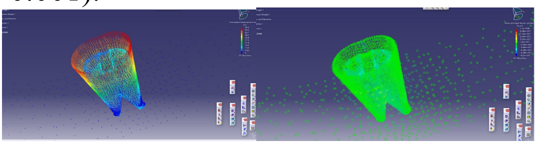

Fig V.5 Whole bone displacement and tension, non-angled tooth, with symmetrical forces of 500N

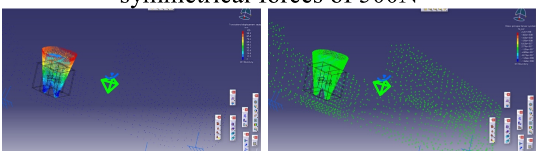

Fig V.11 Whole bone displacement and tension, non-angled tooth, with symmetrical forces of 1000N

The simulation of occlusal trauma in the context of an unaffected alveolar bone and a non-inclined mandible second molar by applying a distal asymmetric force (simulating premature contact) generated the following results (Table IV.2, Figure IV.13-22):

- Axial tension in the direction of force ranged from 110 to 219 mPa, the average level being 161.50 ± 46.62 mPa.
- The axial tension in the direction of force increases significantly with the increase of occlusal force (r = +0.999, p = 0.001).
- The axial tension in the direction of force increases significantly with increasing maximum displacement (r = +0.999, p = 0.001).

The application of a symmetrical and uniform occlusal force in the context of a affected periodontium (simulation of a 5.5mm bone) and a non-inclined mandible second molar generated the following data (Table V.3, Figure V.23, V.24):

- Axial tension in the direction of force ranged from 139 to 276 mPa, the average level being 204.0 ± 58.52 mPa.
- The axial tension in the direction of force increases significantly with the increase of occlusal force (r = +0.999, p = 0.001).
- The axial tension in the direction of force increases significantly with increasing maximum displacement (r = +0.999, p = 0.001).

The simulation of the 20-degree mesial inclination of the mandibular second molar in the context of a healthy support periodontium with the application of a distal unilateral force revealed the following data (Table V.4, Figures V.25-34):

- Axial tension in the direction of force ranged from 36.1 to 72.1 mPa, the average level being 50.70 ± 17.42mPa.

- The axial tension in the direction of force increases significantly with the increase of the occlusal force (r = +0,990, p = 0,01).

- Axial tension in the direction of force increases significantly with increasing maximum displacement (r = +0.961, p = 0.039).

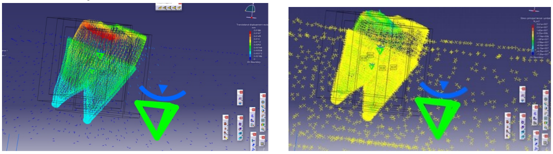

Fig V.27 Movement and whole bone tension, angular 20^0, with asymmetric forces of 500N

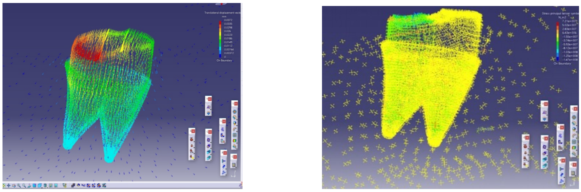

Fig V.33 Movement and whole bone tension, angular 20^0, with asymmetric forces of 1000N

The simulation of the 20° mesial inclination clinical situation with the mandibular second molar in the context of a 5.5 mm lysis support periodontium and with the application of unilateral, asymmetrical, distal forces led to the following data (Table V.5, Fig. V.35, V.36):

- The axial tension in the direction of force ranged from 311 to 622 mPa, the average level being 458.75 ± 132.94 mPa.

- The axial tension in the direction of force increases significantly with the increase of the occlusal force (r = +0,995, p = 0,006).

- The axial tension in the direction of force increases significantly with increasing maximum displacement (r = +0,996, p = 0,006).

The mean maximum displacement level recorded statistically significant statistical differences compared to bone type (p = 0.001) (Table V.6, Figure V.137):

- the lowest median level was recorded in bone not affected by periodontal disease, median-inclined 20 ° (0.027 ± 0.008 mm), showing variations in the range 0.019 - 0.037 mm;

- the highest median level was recorded in the non-diseased bone of periodontal disease, non-angulated molar, the force applied symmetrically and evenly to the distal surface (9,885 ± 2,854 mm), registering variations in the range of 6.71 - 13.40 mm.

The average level of axial tension in the direction of force recorded statistically significant statistical differences compared to bone type (p = 0.001) (Table V.7, Fig. V.38):

- the lowest median level was recorded in the non-diseased bone of the periodontal disease, unangled molar, the force applied symmetrically and uniformly to the occlusal surface (49 ± 14,27 mPa), registering variations in the range 33,2 - 66,6 mPa;

- the highest median level was recorded in the bone affected by periodontal disease by a 5.5 mm bone lysis; the force applied asymmetrically to occlusal (distal), 20 ° inter-angular (458.75 ± 132.94 mPa), with variations in the range 311 - 622 mPa.

V.1.4 Discussions

The role of occlusion on periodontal health is a challenge, and the results of research studies are contradictory and inconclusive. Several studies have attempted to evaluate the stress produced by the occlusal forces inside the tooth and supporting structures. Finite Element Analysis is a numerical form of computerized analysis that uses mechanical engineering that allows the identification and quantification of stress in structures constructed using elements and nodes.

Two-dimensional modelling is relatively simple and allows analysis on a relatively normal computer, but sometimes it tends to produce less accurate results. Three-dimensional modelling produces more accurate results, but can only work effectively on the fastest computers (Desai Shrikar & Shinde Harshada, 2012). The study carried out in this research involved the realization of a three-dimensional model with the above-mentioned advantages.

Some studies of FEM analysis of stress focused on primary and secondary occlusion trauma (TFO) include: A two-dimensional model of the central maxillary incisor evaluated the main stresses in the periodontal ligament at different base levels (Reinhardt et al., 1984). Geramy and Faghini (Geramy, 2000) used a three-dimensional FEM model of the natural central incisor to calculate the maximum and minimum stresses in the PDL of the central jaw incision with different bone heights. A study by Reddy and Vandana (2005) was the first distribution of stress in PDL tissues (PDL, root and alveolar bone) using a 3D model of finite elements (FEM). A study by Vandana et al. studied the role of stress on teeth and abrasions (Vandana et al., 2016). In the present study, as expected, the axial tension exhibited the lowest values in the clinically ideal situation of a properly implanted molar in an intact bone structure with evenly distributed forces. Conversely, the highest values for axial tension were noted in the cases of affected alveolar bone, in particular following the exertion of a nonphysiological, asymmetric force and a defect tooth implantation - 20° angular displacement. From our knowledge, this is the first study that analyses the distribution of tensions in cases of poor implantation of the tooth analysed.

In accordance with the laws of physics, the maximum displacements made at different loading force loads and at different angles of the tooth recorded the smallest values for an angular, eccentric force application, as well as the highest values for a correctly implanted tooth, with a distribution of forces across the occlusal surface.

Zhao et al. (2016) constructed a first lower molar FE model, including tooth, periodontal ligament, partially cortical membrane, and trabecular bone, and applied a 420 N vertical force on the occlusal surface of the tooth model. The results showed that the alveolar areas on the vestibular and oral ridges and the root apex regions showed higher tension when the tooth was loaded. In literature, the main efforts were directed to represent the stress of the alveolar bone (Anssari Moin et al., 2016).

Furthermore, data from the FEM model developed by Zhang et al. (2015) led to the conclusion that the size of the loading area as well as the place and direction of loading had effects on the distribution of dental stress. This is important given that when a tooth expands its different positions to have contact with the opposite tooth, different dental and periodontal tensions would occur. Then occlusal contact should pay close attention to a healthy biomechanical dental purpose. Hence, the usefulness of modifying the molar inclination adopted in this study is derived.

V.4.5 Conclusions

In the present study we have demonstrated the exercise of a maximum tension in the case of the action of an occlusal force at a premature asymmetric point, especially since there is also a dental malposition on a tooth that is already affected by periodontal disease. Physiological forces, applied uniformly, symmetrically to the occlusal surface, on a normal tooth implanted in a normal-sized alveolar bone, generated minimum stresses.

This demonstrates the role that the distribution of the masticatory forces has in simulated conditions, the traumatic occlusal forces with an asymmetric action, which can generate severe lesions on the dental supporting tissues.

V.2 A study on the relation between the root resorption on multi-rooted teeth with periodontal disease and the occlusal contacts

V.2.1 Introduction and aim of the study

The aim of the study was to investigate the influence of occlusal forces on root teeth resorption with periodontal disease. Therefore, the study aimed to quantify the root resorption on teeth with and without occlusal contact.

V.2.2 Material and methods

For this study, 66 teeth (22 premolars and 44 molar) with periodontal disease were used. Medical history was obtained prior to extraction, and patients with systemic disease were excluded from the study. Patients who have undergone periodontal treatment in the last 12 months and teeth with signs of endodontic disease have also been excluded from the study. The patients received written and oral information about the study.

The teeth were divided into the following two groups: group 1, teeth with bone loss between one and two thirds of the normal alveolar height; and group 2, teeth with bone loss greater than two-thirds of normal alveolar height. In group 1 (n = 20), 9 teeth had antagonist contact, while in group 2 (n = 46) 25 teeth had occlusal contact.

After the teeth were extracted, they were washed in phosphate buffered saline and fixed in 4% buffered formaldehyde for 48 hours, after which they were decalcified for 20 days. Each tooth was then cut into two halves in the mid-distal sense, dehydrated in alcohol and then cleaned in toluene and embedded in paraffin. Sections of thickness of 6 lm were collected on slides; five sections on the slide and 20 slides for half the teeth (40 slides on the tooth). The sections were stained with hematoxylin and eosin and Mason trichrome. An average of 200 sections (1200 lm per tooth) were analysed with an Olympus Bx40 microscope. One of three sections was photographed (400 lm per tooth) with an Olympus DP 10 camera connected to the microscope. The image was then analysed with a software program (MICROIMAGE 3.0., Hamburg, Germany).

Resorption was measured in sections where the root is observed throughout its length. In bi-radicular premolars, vestibular and oral roots were measured; in the upper molars - the mesio-vestibular, disto-vestibular, and palatinal roots, and in the lower molars the mesial and distal roots were measured. In the sections observed with the Olympus Bx40 microscope, the upper limit of the cement was marked to measure the total root length of each tooth and total root surface area. Subsequently, four independent measurements were made using the software program; the length and surface in micrometers of total root cement and the resorption of cement. The data has been grouped and then entered into a Microsoft Excel spreadsheet.

Surface and volume measurements are shown with the average values and standard deviations. T-Student was used to compare the measurements between the two different groups, and ANOVA was used to compare more than two groups. The Bonferroni methodology was also used for further comparisons. In all cases, a result was considered significant when $p < 0.05$.

V.2.3 Results

Root resorption was found in all the studied teeth. The teeth with periodontal disease in group 2 showed significantly higher values for both the surface ($p = 0.024$) and the volume resorption ($p = 0.003$), compared to periodontal disease in Group 1 (Table V.8). The percentage of resorbed surface and volume was significantly higher in teeth that showed an antagonist compared to teeth without any antagonist ($p = 0.005$ and $p = 0.002$, respectively, Table V.9).

We found the highest percentage of surface and volume resorbed to teeth with periodontal disease with antagonist and group 2. In teeth presenting an antagonist, those with group 2 periodontal disease had a higher value than group 1; this difference was significant only in the percentages of the resorbed volume ($p = 0.021$). In the case of non-antagonist teeth, those with periodontal disease in group 2 also had higher percentages and resorbed volume compared to group 1, but these differences were not significant.

Table V.8 Percentage of volume and area resorbed by the severity of periodontal disease

	n	Mean	SD	p Value
Percentage of surface resorption				
Group 1	20	0.623	0.211	p=0.024
Group 2	46	1,215	0.945	
Percentage of volume resorption				
Group 1	20	0.054	0.073	p=0.003
Group 2	46	0.478	0.314	

When the four groups were compared together, there was a significant difference in the percentages of tooth-resorbed surface with an antagonist and presenting periodontal disease in group 2, unlike those teeth without antagonist in both group 2 ($p = 0.022$) and group 1 ($p = 0.023$).

Table V.9 Percentage of volume and area resorbed depending on the presence / absence of the antagonist

	n	Mean	SD	p Value
Percentage of surface resorption				
Teeth with antagonist	34	1.261	0.943	p=0.005
Teeth without antagonist	32	0.534	0.521	
Percentage of volume resorption				
Teeth with antagonist	34	0.196	0.411	p=0.002
Teeth without antagonist	32	0.044	0.031	

The percentages of resorbed volume showed a significant difference between the teeth with an antagonist and periodontal disease in group 2 compared to the other teeth; (p = 0.021) compared with the non-periodontal disease group 1 (p = 0.007) and finally with the antagonist-free teeth and group 2 periodontal disease (p = 0.001, Tables V.10 and V.11).

V.2.4 Discussions

The identification of root resorption in clinical practice requires information about previous medical history, tooth involved, previous endodontic treatment, and associated diseases. Perforating lesions are more difficult to manage than non-perforating lesions and may even require extraction due to unfavourable prognosis. Early diagnosis is the key to better prognosis.

In our study, we noticed that root resorption was greater in both extension (surface) and depth (volume) when there was an antagonist tooth in both groups of periodontal disease. Furthermore, the higher resorption depth was significant when both factors (severity of disease and antagonist presence) were combined. Although there are no studies to analyse the influence of occlusal contact on root canal resorption on teeth with periodontal disease, there are numerous studies of the effects of the masticatory forces on the teeth.

In our study, we found that all teeth, especially those in contact with an antagonist, were subjected to excessive movements due to insertion loss. This means that even with a normal mastication pattern, there is a greater displacement of the tooth in the alveolar socket, with a greater impact on the periodontal ligament. Our results, in line with previous studies (Rodriguez Pato, 2004), showed that, without taking into account the presence of antagonists, there was higher root resorption in teeth with periodontal disease of group 2 versus group 1.

When we compared teeth without antagonists, we found that resorption increased when there was occlusal contact. At the teeth without an antagonist there was no significant difference between the two groups of periodontal disease, while in the teeth with an antagonist the volume of the resorbed cement was higher, especially in the teeth belonging to the group 2. The highest resorption with a value significantly different, was in group 2 teeth with antagonist. Our results show that in teeth with periodontal disease, occlusal contact is an aggravating factor in root resorption.

This finding is consistent with other studies showing that excessive occlusive forces may be a risk factor for periodontal destruction, with periodontal destruction being associated with increased mastication pressure (Takeuchi & Yamamoto, 2008). Antagonist forces that are not excessive for a healthy periodontium are detrimental to a periodontium affected by the disease.

The teeth with and without antagonists were extracted from patients with periodontal disease and analysed to assess the influence of occlusal contact on the presence and severity of root resorption. Contact with an antagonist increases the resorption of the teeth root with periodontal disease.

V.2.5 Conclusions

The results of this study suggest that the forces exerted on teeth with loss of attachment generate an aggravation of periodontal disease. This study contributes to its confirmation that during the treatment of periodontal disease it is necessary to avoid or minimize the occlusive forces of the antagonists.

CHAPTER VI. DETERMINATION OF THE LOCAL AND SYSTEMIC INFLAMMATORY STATUS BY FIBRINOGEN, CRP AND RANKL QUANTIFICATION IN PATIENTS WITH PERIODONTITIS AND OCCLUSAL TRAUMA

VI.1 Introduction and aim of the study

The aim of this study was to evaluate the differences in RANKL levels in crevicular fluid (GCF), as well as plasma C reactive protein and fibrinogen in patients with chronic periodontitis, with or without associated occlusal trauma.

VI.2 Material and method

The study was conducted on a group of 40 patients, investigated at the Clinic of Periodontology of the Faculty of Dental Medicine of "Grigore T. Popa" UMPh Iasi. The patients underwent a rigorous clinical examination, with periodontal parameters being determined.

For paraclinical analysis, a total of 72 crevicular fluid samples (GCF) were collected from disease sites. Subjects received instructions not to eat, drink or brush their teeth for 1 hour before GCF sampling.

Before the crevicular fluid samples were collected, the teeth were insulated with cotton rolls. The supragingival plate was also carefully removed and the sites were gently dried with the air spray. A sterile paper cone was inserted into each selected periodontal site, left for 30 seconds, and then immediately inserted into sterile Eppendorf tubes which were stored at -20°C. In the case of visible contamination with blood, the paper cone has been removed and a new site has been selected. For the determination of RANKL, the paper cones were thawed, cut at 1 cm in length and thawed with 50 µl 1X [13 mM Na2HPO4, 7 mM NaHPO4, 100 mM NaCl (pH 7.0)] buffer solution at 4°C. Further, the paper cones were centrifuged at 13000 xg for 10 min at 4°C (Sufaru et al., 2016).

RANKL concentrations were determined using the ELISA assay (MyBioSource, San Diego, CA, USA). Measurements were performed according to manufacturer's instructions and standards and the samples were measured in duplicate. The detectable minimum concentrations were 0.4 µg / ml for RANKL. Samples with concentrations below the detection limit were marked with 0.

For the determination of fibrinogen and C reactive protein (CRP), 5 millilitres of blood was collected from the antecubital fossa through venous puncture using 20 calibre needles with a 5 mL syringe. The blood was transferred to test tubes containing non-ethylenediamine tetraacetic acids and allowed to coagulate at room temperature and after one hour the serum and plasma were removed from the blood by centrifugation at 3000 rpm for five minutes. The serum and plasma were extracted, which were immediately transferred to Eppendorf vials and stored at -20°C until the test.

High serum CRP serum levels were measured using the ELISA technique.

For statistical analysis, the SPSS 20.0 (IBM) program and $p < 0.05$ was considered to indicate a statistically significant difference. Continuous variables with a normal distribution are expressed as mean ± standard deviations of the mean and were analysed using parametric tests (the T test for pairs or independent samples). Since RANKL levels were not normally distributed, the data are expressed as median (minimum and maximum) and analysed using non-parametric tests (Mann Whitney U test for unrelated samples or Wilcoxon test for related samples). Fisher and McNemar tests were used to compare frequencies between affiliated or independent samples.

VI.3 Results

We examined 40 patients with chronic periodontitis, divided into two groups: the study group - patients with occlusal trauma (n = 20) and the control group - patients without occlusal trauma (n = 20).

Regarding demographic data (Table VI.1), there were no significant differences between study groups of age values (occlusal trauma group: 47.20 ± 1.50 years, control group: 45.75 ± 1.25 years, p = 0.124).

We noticed a significantly higher percentage for male gender in the study group (70%) than female sex, compared to the control group in which male participants accounted for 40% of the subjects (Figure VI.3). We did not notice significant differences in the participants' background (urban vs. rural) (Figure VI.4).

The data revealed more severe values for the probing depth (p = 0.006), clinical attachment loss (p = 0.004) and bleeding index (p = 0.003) for the group with occlusal trauma to the control group (Table VI.1).

We noticed significantly higher differences in RANKL levels in crevicular fluid and C reactive protein and fibrinogen in serum for the study group (occlusive trauma patients) compared to healthy systemic patients (p <0.05) (Table VI.2).

Table VI.1 Periodontal Parameters by Study Groups*

Parameter	Study group (occlusal trauma)	Control group	*P* Value
Probing depth	5,97 ± 0,26	4,87 ± 0,34	0,006
Clinical attachment loss	3,21 ± 0,12	2,19 ± 0,26	0,004
Bacterial plaque index	32,24 ± 2,67	34,26 ± 2,14	0,169
Bleeding Index	3,21 ± 1,14	1,79 ± 0,23	0,003
***Data are presented as mean value ± standard deviation**			

Table VI.2 Values of inflammatory markers by study groups

	Study group (occlusal trauma)	Control group	*P* Value
RANKL (pg/site)	0,79 (0,00-146,75)	0,15 (0,00-75,20)	0,008
CRP (ng/ml)	3125,32 (107,24-3789,96)	1463,26 (68,53-1862,37)	0,004
Fibrinogen (µg/ml)	803,75 (101,30-897,88)	512,24 (145,02-603,95)	0,006
p<0.05 = statistical signification. Results are expressed as median (minimum-maximum)			

VI.4 Discussions

The occurrence and evolution of periodontitis is related to multiple factors. The disease is of polymicrobial etiology, because different types of bacteria are the initiators of the inflammatory process. Non-specific immunity is the host's first line of defence. It operates through TLRs, which recognize the conserved molecular patterns on pathogenic bacteria. A network of secreted cytokines leads to the activation of lymphocytes, but the progression of periodontal lesions is caused by the deregulation of released molecules (Martu et al., 2017b). The specific cellular activity of these secreted factors is implicated in bone regulation, and their imbalance leads to modified periodontal bone remodelling. Osteoclastic activity is intensified, with poor bone turnover, leading to decreased alveolar bone level.

In our study, we have demonstrated that secondary occlusal trauma in a periodontopathic field is characterized by significantly higher RANKL levels in patients with chronic occlusal trauma. This partially clarifies the molecular mechanisms underlying more severe tissue destruction in patients with occlusal trauma.

Expression of RANKL in periodontal tissues is a very complicated process involving many factors. RANKL is identified in lymphocytes, stromal cells and many other cell types in periodontal tissues, which play an important role in direct or indirect regulation roles. Cytokines, such as IL-1beta and TNF-α, can regulate RANKL expression in periodontal cells and stimulate osteoclast formation. Therefore, the discovery of the pivotal step in the RANKL expression may lead to a new perspective on periodontal pathogenesis and the development of a new target for periodontal therapy; for example, we can prevent periodontal bone resorption by inhibiting RANKL expression by moderating lymphocyte function or by modifying the level of some cytokines.

This study was conducted to evaluate serum CRP levels, plasma fibrinogen in systemic healthy individuals to determine whether elevated levels of periodontal parameters may predispose elevated systemic inflammatory markers such as serum CRP and plasma fibrinogen to elevated levels.

In the current study, mean levels of CRP were found to be higher in patients with occlusal trauma than in non-traumatic patients. Rai et al. (2010) and Gani et al. (2009), found elevated levels of CRP in patients with periodontitis. One possible reason for increasing serum CRP may be its role in the response of the host to lesions, infections, ischemic necrosis or malignancy if it helps to destroy infections or harmful agents to remove damaged tissue and repair affected tissue or organs.

In the present study, it was found that the mean fibrinogen level was higher in patients with occlusal trauma than subjects without occlusal trauma. Sahingur et al. (2003) found high levels of fibrinogen in patients with periodontitis compared to the control group. There is a strong association of fibrinogen with blood viscosity and thrombus formation, and circulating levels of fibrinogen have been known to have a strong relationship with coronary artery disease (Iyer & Desai, 2010).

The findings of the present study support the fact that levels of serum CRP and plasma fibrinogen were increased in people with occlusal trauma compared to individuals with normal occlusal forces and high levels of these inflammatory markers may increase the severity of periodontal destruction but may also predispose to systemic complications.

From the results of the above study, it can be assumed that levels of serum CRP and plasma fibrinogen may provide information on the presence and intensity of the inflammatory process and may be useful in predicting the biological mechanism underpinning the association between periodontitis and cardiovascular disease. Elevated levels of CRP and fibrinogen can be used as a predictive risk factor for future cardiovascular and coronary events. Further larger-size studies are needed to allow the incorporation of the periodontal treatment phase and the correlation of the periodontal microbiota with the levels of serum CRP and plasma fibrinogen to validate the results of the current study.

VI.5 Conclusions

In the context of the presence of chronic periodontitis, even in a superficial form, occlusal trauma is accompanied by much higher levels of RANKL in crevicular fluid, with more severe and faster tissue destruction. In addition, the systemic inflammatory burden is significantly higher in subjects with occlusal trauma, which is reflected by higher levels of C reactive protein and fibrinogen in the serum of patients with non-physiological occlusive forces.

CHAPTER VII. DETERMINATION OF THE NON-SURGICAL PERIODONTAL THERAPY IN ASSOCIATION WITH OCCLUSAL THERAPY ON THE PERIODONTAL STATUS

VII.1 Study of occlusal adjustment therapy effects on the bacterial profile in the occlusal trauma context

VII.1.1 Introduction and aim of the study

To investigate the possibility of using the bacterial profile to monitor treatment outcomes, the aim of this study was to use this technique to establish any benefit from treating patients with periodontitis by combined occlusal adjustment and oral hygiene procedures compared to oral hygiene procedures alone.

A ratio of spherical bacteria of 70% (cocci) to 30% other forms of bacteria (rods, fusiform, filamentous and spiral) was considered to indicate periodontal health, while the prevalence of the latter was considered an indication periodontal disease (Meynardi et al., 2016).

VII.1.2 Material and methods

Sixty-eight cases of periodontitis, confirmed by clinical examination (redness, oedema, deep pockets, and bleeding) were assigned to one of the two groups based on the treatment to be performed: group 1, comprising 32 subjects, to be either treated by oral hygiene procedures (scaling and root planing) and Group 2, comprising 36 subjects, scheduled for treatment by occlusal adjustment (selective grinding) and oral hygiene procedures. The informed consent was obtained from all patients.

Bacterial plaque samples were harvested using a sterile curette from periodontal pockets with acute inflammation, taking care to obtain a degree of homogeneity in the number of samples (3 per patient), the site of sampling (incisive, premolar and molar), and the degree of presence of inflammation (probing depth, bleeding, mobility).

Subgingival plaque samples were suspended in 2 ml of sterile aqueous solution containing 0.9% NaCl (w / v) and examined fresh by phase contrast microscopy (Leica DMR microscope, Leica GmbH, Wetzlar, Germany) at magnification 400x to analyze bacterial morphology and calculate the percentage of cocci in the top 200 counts.

Patients in both groups were then subjected to standard oral hygiene procedures (manual and ultrasonic scaling, root planing). The occlusion examination was then performed only in patients in group 2, patients in a standard position.

Contact points and interferences were revealed on 40mm thick paper (Bausch-Articulating Paper, Inc., Nashua, USA), blue for static and red for dynamic occlusion.

The static occlusion was evaluated with the patient in the usual position of maximum contact. At this point, dynamic occlusion was measured as a maximum excursion in all directions (forward, backward and lateral). The premature contact points were then removed by selective grinding.

The bacterial monitoring protocol described above was repeated in both patient groups at one month intervals over a six-month period to highlight any variation in the bacterial profile in terms of percent trend in the cocci population relative to other types bacteria (spiral, spindle, filamentous).

The statistical analysis of the results was done through the Student t Test.

VII.1.3 Results

The results are presented in Table VII.1, which shows that at the first evaluation, one month after treatment, bacterial flora of group 2 patients treated by occlusal adjustment and dental hygiene procedures showed a significantly higher cocci content than Group 1, treated only by oral hygiene. This difference reached a very high level of significance ($p < 0.001$) three months after treatment and remained at this level until the end of the monitoring period (Table VII.1, VII.2).

Changing the cocci content over time in the two groups is reflected by a trend towards pre-treatment values during the monitoring period of patients in Treatment Group 1 (Figure VII.1).

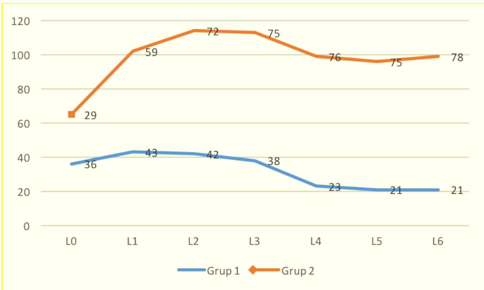

Fig. VII.1 Percentage evolution of post-therapeutic cocci concentration in the two study groups

VII.1.4 Discussions

The association between bacterial plaque and occlusal trauma induces a localized periodontal disease and the development of periodontal pockets, which are a favourable environment for anaerobic and optional bacteria. Consequently, the main prevention of periodontitis could be the control of etiological predisposing factors, as bacteria, considered essential primary etiologic factors of periodontal disease, will always be present in any individual to promote inflammation.

Animal and human studies have suggested a certain association between occlusal discrepancies / occlusal trauma and changes in periodontal support structures (Reinhardt et al., 2015; Vandana et al., 2015).

The uncertain prognosis in some clinical situations is mainly due to the fact that it relies too much on a limited approach to treating bacterial plaque response through endless maintenance periods, root planing, and frequent pharmacological treatments that generally fail to lead to definitive stabilization.

It is of the utmost importance that classical clinical signs and bacterial dynamics of the disease, represented by the re-establishment of a rich profile in pathogenic forms, such as filamentous, spindle-shaped stems, tended to be restored in periodontitis cases treated only by dental hygiene procedures, indicating that removal of the single bacterial plaque is not sufficient to eliminate the actual cause of gingival and periodontal inflammation.

In contrast, the health status of the periodontal sites treated by normalizing the biomechanical function has been shown to be stable with respect to the bacterial profile remaining saprophyte with bacterial species with a clear prevalence of spherical forms.

Stabilization of a predominantly saprophytic bacterial profile in periodontal sites treated by occlusal adjustment indicates that this approach leads to the establishment of an ecosystem characterized by a trophic state. Indeed, clinical evidence suggests returning normal microcirculation, with a stable reduction in oedema, lack of bleeding, and even reduction in dental mobility. These results are consistent with data that suggest that a trophic site in occlusal balance does not develop an aggressive bacterial profile, while an occlusive trauma site tends to restore a typical profile to a periodontist patient despite strict hygiene monitoring (Meynardi & Biancotti, 2009) and confirms that periodontal disease should not be interpreted as a strictly infectious disease but as a syndrome of multifactorial origin without omitting its psychogenic appearance.

Indeed, ignoring the biomechanical dysfunction component in the etiopathogenesis of periodontal lesions, a pathology that is essentially dystrophic / atrophic and a therapeutic approach that focuses only on the resulting infection, would be incomplete, misleading and unproductive, a serious management mistake.

Instead, it is essential to distinguish the diagnostic profile of the chronic dystrophic / atrophic periodontal disease, the damage to the tissue resulting from the biomechanical dysfunction, that of the periodontitis, the consequence of the bacterial infection. This change in thinking also involves a change in the diagnostic and therapeutic approach, which must be primarily functional in nature, the latter aiming at restoring the occlusal balance and therefore biomechanical.

Prevention strategies should also be reassessed, since focus on hygiene alone does not eliminate the cause of periodontal disease, providing only a "quick" temporary solution.

In this context, however, bacterial plaque content has a fundamental role. Indeed, the morphological (and intrinsically metabolic) quality of the bacterial profile indicates the trophic or dystrophic conditions of the periodontal niches, as well as the microbiological status of the oral ecosystem as a whole, but also some morphological types of anaerobic bacteria (spindle-shaped, filamentous and spiral) develops under dystrophic conditions, to the detriment of predominantly aerobic cocks. Thus, the bacterial profile, in terms of the percentage of present bacterial forms, is an indicator of periodontal health (Meynardi et al., 2013).

The periodontal index proposed herein, i.e. the percentage composition of spherical bacteria in periodontal floral, measured in situ under phase-contrast microscopy, has proved to be valid as a diagnostic and, in particular, prognostic, which allows the early evaluation of any tendency to periodontitis, or peri-implanted before the onset of later signs (inflammation, bleeding, mobility). This test is extremely sensitive and of greater importance than ordinary indicators (probing depth, bleeding, mobility and bacterial plaque index) but simple and quick to accomplish. Moreover, the equipment required for its assessment, ie a phase-contrast microscope, is readily available and easy to use without the need for special training or special materials, only physiologically.

Thus, the monitoring of conventional periodontal parameters has to be supplemented with the achievement of the bacterial profile, combined with the assessment of the biometrics of the dental apparatus and, in particular, of the occlusal relationship. This approach may allow for better therapeutic planning and better management of patients with periodontal disease.

VII.1.5 Conclusions

Periodontal disease is more than an infectious disease, biomechanical factors demonstrating an important role in etiopathogenesis. The occlusal adjustment by selective grinding to normalize the distribution of occlusal loading, which leads to the restoration of microcirculation in periodontal tissues and to the provision of a hostile environment for opportunistic bacteria that cause classical symptoms of the disease may be a useful adjuvant in the therapy of periodontal disease.

In addition, due to its ability to detect the presence of unhealthy microorganisms populations that could lead to periodontal disease, the achievement of the bacterial profile should be considered as an indicator of periodontal health, not only for diagnostic purposes, but also for monitoring success treatment strategies and supporting the disclosure of the complex mechanisms behind this disease.

VII.2 Study on the periodontal and occlusal therapy effects on the periodontal status in the context of occlusal trauma generated by bruxism

VII.2.1 Introduction and aim of the study

The study proposed an assessment of periodontal destruction in patients with chronic periodontitis, with and without bruxism, and to evaluate the effects of occlusion therapy in combination with non-surgical periodontal therapy.

VII.2.2 Materials and Methods

The study group included a total of 40 patients with different forms of chronic periodontitis at the Clinic of Periodontology of the Faculty of Dental Medicine of "Grigore T. Popa " UMPh, Iasi.

In order to evaluate the clinical condition of the patients participating in the study, who were treated with prosthetic therapies, a detailed anamnesis combined with a specific clinical examination as well as general and specific complementary examinations was performed. All results were recorded in their own observation sheet.

We have considered all the factors that may interfere with the physiological functionality of the dental-maxillary system.

The study group comprised 40 patients divided into two groups: study group with periodontal disease and bruxism (n = 30) and the control group consisting of patients with periodontal disease but without bruxism (n = 10).

The scaling was done manually and ultrasonically; Gracey (Hu-Friedy) curettes were used for root planing. Occlusal trauma correction therapy included the determination of the local cause for bruxism, factor adjustment (selective grinding, elimination of occlusal interference and bruxism) (Fig VII.2, VII.3).

Each patient was trained in appropriate oral hygiene.

We analysed the following periodontal parameters: probing depth, clinical attachment level, PBI and PI index at baseline (pre-therapeutic) and 3 months after the completion of therapy.

The sites were grouped according to probing depth in group 1 - superficial (0-3mm), group 2 - moderate (4-6mm) and group 3 - deep (≥7mm).

The data obtained were statistically recorded and analysed. For the statistical analysis of the data we used the Mann-Whitney test (with significance level $p < .05$). The association of periodontal disease with occlusal trauma (sites with occlusal trauma) was determined using the Spearman test (with significance level $p < .05$).

VII.2.3 Results

The study group comprised 40 patients divided into two groups: study group with periodontal disease and bruxism (n = 30) and the control group consisting of patients with periodontal disease but without bruxism (n = 10). The mean age in the control group was 48.1 ± 9.5 years and in the study group: 58.8 ± 10.4 years. We noticed a higher share for urban and rural patients for both groups. Demographics are shown in Table VII.3. No significant differences were observed between the two groups on plaque index and subgingival plaque values (Fig. VII.4, VII.5).

Table VII.4 Baseline and 3 months post-therapeutical clinical parameters for the two study groups

	Baseline			**3 months post-therapeutical**		
	Study group	**Control group**	***P* Value**	**Study group**	**Control group**	***P* Value**
Absent teeth (per patient)	5,2±1,9	3,1±2,0	.004*	5,6±0,2	3,5±1,2	.005*
Number of mobile teeth (per subject)	5,8±3,4	2,6±2,2	.001*	3,4±1,3*	2,4±1,3	.009*
Number of teeth with furcation involvement (per subject)	3,6±1,5	2,0±1,2	.012*	3,6±1,3	2,0±1,1	.012*
Bleeding on Probing Index	3,23±0,32	3,12±0,45	.546	1,43±0,44*	1,62±0,34*	.154
Probing depth	6,7±1,1	4,0±0,7	.003*	4,3±1,3*	3,2±1,2*	.007*
Attachment loss (mm)	5,67±2,4	3,02±0,4	.002*	4,12±1,1*	2,76±0,5*	.002*
Gingival recession (mm)	3,3±1,7	1,5±0,7	.001*	3,3±1,4	1,5±0,8	.001*
Values are expressed as ca Mean value ± SD **SD: Standard Deviation; *Statistical significant, *P*<.05**						

We noticed statistically significant differences between the study group (with bruxism) and the control group (without bruxism) regarding the number of absent teeth, the number of teeth with mobility and the number of furcation lesions (P <.05), with significantly elevated values for the occlusal trauma group (Table VII.4).

The same severity differences were also observed for periodontal parameters – probing depth, loss of periodontal attachment, and size of gingival recession. We did not notice any differences in active inflammation, quantified by the bleeding index. Most patients with bruxism and mild periodontitis did not show sites with occlusal trauma, while most patients with severe bruxism and chronic periodontitis had more than three occlusal trauma sites per patient. The difference between groups was statistically significant (P <.05). We also noted a statistically significant difference between the control group and the superficial periodontitis subgroup of the bruxism group (P = .013) (Table VII.5).

Following the introduction of therapy, we noticed significant improvements for both groups in terms of periodontal destruction indices - loss of attachment, probing depth, and bleeding index. Plaque indexes showed decreases from baseline without group differences. Notably, we noticed an improvement in the higher dental mobility index for the study group compared to the control group.

Table VII.5 Quantitative evaluation of occlusal trauma in patients with bruxism, by groups of severity of periodontal disease

Severity of periodontal disease	Number of sites with occlusal trauma per patient			Total
	0	≤3	≥3	
Superficial	5	2	0	7
Moderate	2	4	2	8
Severe	1	3	11	15
Total	8	9	13	
Statistical values: chi-square 91,43, *P*<.001				

VII.2.4 Discussions

This research has proposed to evaluate the degree of periodontal disease in subjects with and without bruxism, with generalized chronic periodontitis, of varying degrees of severity. We also proposed the evaluation of the correlation between the number of occlusal trauma sites and the severity of periodontitis in patients with bruxism.

The results of our study are in line with literature data, noting that in the group with chronic periodontitis and bruxism the loss of attachment was more significant and the presence of recessions, mobility teeth and edentations were higher than the group without bruxism.

A number of studies have shown that teeth subjected to excessive occlusive forces exhibited higher probing depths and a more reserved prognosis for teeth subjected to normal occlusal forces. In addition, the teeth with occlusion treatment showed a slowing of periodontal disease (Liu et al., 2013). It has been concluded that exaggerated occlusal loading is a risk factor that contributes to faster periodontal destruction, occlusal treatment slowing down periodontal destruction.

Nunn and Harrel (2001) and Harrel and Nunn (2001) examined the relationship between occlusal and periodontal discrepancies in two studies. Their sample included approximately 90 subjects who had at least two complete periodontal examinations (≥ 1 year between them), including occlusal analysis. Probing depth (PPD), tooth mobility, and furcation lesions (pluridicular teeth) were recorded. In addition, some occlusal contact relationships have been studied, such as:

(1) centric discrepancies and centric occlusion,

(2) premature occlusal contacts in the protruding (lateral and frontal) movements of the mandible in non-working sides.

A treatment plan, including both periodontal and occlusal measures, was subsequently designed for each patient.

Approximately one-third of subjects refused treatment, about 20 subjects accepted only a non-surgical treatment (SRP) approach, while about 50% of patients accepted and received comprehensive treatment including surgical removal of pockets, such as and occlusal adjustment (if necessary). Some teeth in the SRP group received occlusal treatment while other teeth with occlusal discrepancies were left untreated. It was observed that teeth with occlusal discrepancies had significantly deeper PPD values and higher mobility scores than teeth without traumatic occlusion, and also that occlusion-adjusted teeth responded better (PPD reduction) to non-surgical periodontal therapy than teeth with untreated occlusion discrepancies.

There is no consensus in the literature on the aetiology, treatment, and consequences of long-term bruxism for patients. However, some features could be highlighted so far, related to bruxism. The use of the oral device (the mouthguard system) seems to be of interest in controlling bruxism and its consequences (Manfredini et al., 2015).

VII.2.5 Conclusions

This study has shown that bruxism generates significant clinical changes on a periodontal impaired patient. High values in patients with periodontal disease and bruxism of loss of periodontal attachment, recessions, absent teeth, dental mobility and furcation lesions are translated by major loss of periodontal tissue.

Periodontal therapy, coupled with correction of occlusion and bruxism, generated statistically significant improvements in periodontal parameters. Thus, the therapy of occlusal trauma in patients with bruxism becomes an absolute necessity in periodontal therapy.

CHAPTER VIII. GENERAL CONCLUSIONS

Following studies in the research on the effects of traumatic occlusive forces on dental-periodontal structures as a local factor favouring periodontal disease, the following can be concluded:

1. Dental malposition, in combination with traumatic occlusal forces, especially in the case of premature contact, can lead to severe lesions on dental supporting tissues, especially in the context of the presence of bone destruction from periodontal disease, as evidenced by high tension maximal to ideal clinical situations where the tooth is correctly implanted in the alveolar bone and the forces are normally distributed.

2. Excessive forces on teeth with loss of attachment generate a worsening of periodontal disease, with destructions including at the level of cement tissue in volume and area. Thus, it is confirmed that during the treatment of periodontal disease it is necessary to avoid or minimize the occlusive forces of the antagonists.

3. Occlusal trauma generates an exacerbated local and systemic inflammatory context; in the presence of chronic periodontitis, even in a superficial form, the occlusal trauma is accompanied by much higher levels of RANKL in crevicular fluid, with the possibility of generating more rapid and severe bone destruction. Furthermore, it appears to be associated with a high systemic inflammatory burden as determined by the serum C reactive protein and fibrinogen levels in the absence of diagnosed systemic maladies, which may predispose to the occurrence of general inflammatory diseases.

4. Selective occlusal adjustment therapy can normalize the distribution of occlusal loads, leading to the restoration of microcirculation in periodontal tissues and the provision of a

hostile environment to opportunistic bacteria that cause classical symptoms of the disease; thus, this type of therapy can be a useful adjuvant in the management of periodontal diseases.

5. The development of the bacterial profile should be considered as an indicator of periodontal health, not only for diagnostic purposes, but also for the monitoring of the therapeutic success in the periodontal maintenance therapy.

6. Bruxism can generate significant clinical changes in patients with periodontal disease. High values in patients with periodontal disease and bruxism of loss of periodontal attachment, recessions, absent teeth, dental mobility and furcation lesions are translated by major loss of periodontal tissue.

7. Periodontal therapy, coupled with correction of occlusion and bruxism, generated statistically significant improvements in periodontal parameters. Thus, we have demonstrated once again that occlusal trauma therapy becomes an absolute necessity in periodontal therapy.

CHAPTER IX THE ORIGINALITY OF THE STUDY. PERSPECTIVES OFFERED BY THE THESIS

We have established a second mandibular molar model to explore the effects of excessive prolonged occlusion forces on dental stress. The von Mises stress distribution regions and values have been used to describe the load transfer mechanism. Although this model was established using only the data of a molar that had certain particularities, the regularity derived from the analysis of this model would be useful to understand some stable regularities with regard to occlusion biomechanics. In the FEM study we carried out a quantification of the movements and stresses generated in the application of occlusal forces. Determination of stress values is a necessity to decipher the role of occlusion on periodontal tissues. The future direction on this gross topic requires understanding of biological adaptation to design a method to evaluate the most complex problem of structural and functional interaction.

We noticed that root resorption was greater in both extension (surface) and depth (volume) when there was an antagonist tooth in both groups of periodontal disease. Furthermore, the higher resorption depth was significant when both factors (severity of disease and antagonist presence) were combined. Although there are no studies to analyse the influence of occlusal contact on root canal resorption on teeth with periodontal disease, there are numerous studies of the effects of the masticatory forces on the teeth. In our study, we found that all teeth, especially those in contact with an antagonist, were subjected to excessive movements due to insertion loss. This means that even with a normal mastication pattern, there is a greater displacement of the tooth in the alveolus, with a greater impact on the periodontal ligament. Antagonist forces that are not excessive for a healthy periodontium are detrimental to a periodontium affected by the disease.

Inflammatory load in a patient with periodontal disease and traumatic occlusion is of crucial importance, as it can lead to the generation of severe lesions in a much shorter time. One of the more inflammatory markers of bone resorption is the ligand of nuclear receptor activator Nk (RANKL). With the discovery of completely new activities of RANKL-RANK signalling, it is of great interest that the therapeutic inhibition of RANKL-RANK signalling could affect these new functions, especially given the neuroprotective role RANKL-RANK seems to play in the CNS under ischemic conditions. Therefore, it is not unreasonable to assume that further detailed trials of the RANK-RANKL-OPG multifunctional trials will lead to new yet unresolved functions and possible new therapeutic targets for diseases previously not associated with RANKL-RANK signalling.

The discovery of a higher systemic inflammatory load in patients with occlusal trauma, quantified by CRP and fibrinogen, raises new problems in the complete and complex approach of these patients, especially in the absence of systemic diseases. Thus, new research directions are opened, with further investigations of these patients to assess the risk of developing systemic illnesses.

The uncertain prognosis in some clinical situations is mainly due to the fact that it relies too much on a limited approach to treating bacterial plaque response through endless maintenance periods, root scaling, and frequent pharmacological treatments that generally fail to lead to definitive stabilization.

It is of the utmost importance that classical clinical signs and bacterial dynamics of the disease, represented by the re-establishment of a rich profile in pathogenic forms, such as filamentous, spindle-shaped stems, tended to be restored in periodontitis cases treated only by dental hygiene procedures, indicating that removal of the single bacterial plaque is not sufficient to eliminate the actual cause of gingival and periodontal inflammation.

In contrast, the health status of the periodontal sites treated by normalizing the biomechanical function has been shown to be stable with respect to the bacterial profile remaining saprophyte with bacterial species with a clear prevalence of spherical forms.

Indeed, ignoring the biomechanical dysfunction component in the etiopathogenesis of periodontal lesions, a pathology that is essentially dystrophic / atrophic and a therapeutic approach that focuses only on the resulting infection, would be incomplete, misleading and unproductive, a serious management mistake.

Instead, it is essential to distinguish the diagnostic profile of the chronic dystrophic / atrophic periodontal disease, the damage to the tissue resulting from the biomechanical dysfunction, that of the periodontitis, the consequence of the bacterial infection. This change in thinking also involves a change in the diagnostic and therapeutic approach, which must be primarily functional in nature, the latter aiming at restoring the occlusal balance and therefore biomechanical.

Prevention strategies should also be reassessed, since focus on hygiene alone does not eliminate the cause of periodontal disease, providing only a "quick" temporary solution.

Thus, the monitoring of conventional periodontal parameters has to be supplemented with the achievement of the bacterial profile, combined with the assessment of the biometrics of the dental apparatus and, in particular, of the occlusal relationship. This approach may allow for better therapeutic planning and better management of patients with periodontal disease.

Treatment of periodontal disease, removal of plaque and calculus and removal of periodontal pockets will restore a healthy periodontium, but with a low height. The question is whether a healthy periodontium with a low height has a similar capacity to that of normal periodontium to adapt to traumatic occlusive forces (secondary occlusal trauma). Charging with sites with occlusal trauma was significantly higher in patients with severe bruxism and periodontitis; so we could establish a direct correlation between the severity of chronic periodontitis and the number of sites with occlusal trauma. The lack of definitive treatment for bruxism has led to palliative approaches to the management of bruxism and its negative consequences on dentition. Furthermore, the dental complications found in patients with bruxism pose a series of clinical challenges to restore the functional and oral aesthetic conditions of these patients.

Indeed, one of the critical points related to oral rehabilitation of patients with bruxism is long-term success. Therefore, longitudinal clinical evaluation studies are very important in this context.

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