**Editorial board**

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**BALKAN STOMATOLOGICAL SOCIETY**

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<tr>
<td>Past President:</td>
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<tr>
<td>President Elect:</td>
<td>M. Ganibegović</td>
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<td>Vice President:</td>
<td>M. Stanojević</td>
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<td>Secretary General:</td>
<td>A. Filchev</td>
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<td>Treasurer:</td>
<td>J. Popovski</td>
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<tr>
<td>Editor-in-Chief:</td>
<td>A. Markopoulos</td>
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<td>M. Durićković</td>
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<td>N. Ćurak</td>
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<td>G. Pantelas</td>
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History of the Balkan Stomatological Society (BaSS)

SUMMARY

Some of the main activities of the Balkan Stomatological Society (BaSS) over a rich 19-year history are presented. These activities have been aimed at improving oral health care provided by the dentists throughout the Balkans, and to establish ties of friendship and collaboration between researchers and clinicians in this region, creating a foundation for mutual understanding and peace. To accomplish these goals, the BaSS annually organizes congresses and publishes a scientific journal, beside many other activities, such as public oral health promotion, bringing into accordance study programmes and curricula, supporting student exchange programmes, etc.

Keywords: Balkan Stomatological Society; Balkan Journal of Dental Medicine

The idea of writing a short history of the Balkan Stomatological Society (BaSS) sprung up at the BaSS Council several years ago. However, no one was ready to undertake such a complex task, although several promises were made. Finally, I decided to try to do that, regardless the fact that I am not a historian; moreover, I am quite inexperienced in the business of writing chronicles or history in general. But, I have been in the BaSS from the very beginning and founding of the Organization, and tightly connected with the BaSS Council activities.

Birth of the Idea to Establish a Society

The Balkan Stomatological Society is a scientific society which aims at improving the standards of dental medicine, and thus improving the health care provided by the dentists to the people of the Balkans. Even more, the aim of founding our Society was to establish ties of friendship and collaboration between scientists and practitioners in this region, creating a base for mutual understanding and peace. This society is a non-governmental and a non-political body, and I believe that it is mainly because of this fact that it is so widely accepted and so much supported by most of the members of our profession in all the Balkan countries. In fact, people of the Balkans, in the span of the centuries, have lived together in this region; therefore, we have developed many common cultural attitudes that bring us together and make understanding each other quite an easy task. Members of this Society believe that there are no problems which can not be solved in a peaceful way.

General international communication is, and has been improving dramatically during the last years. We need to utilize all of the communication opportunities available to consolidate quality improvement, within a peaceful environment, for the benefit of the people we serve as health providers.

We must share knowledge and skills with all our colleagues. One of the most precious cornerstones of our stomatological profession is that knowledge is freely shared among us all. It is to be shared openly through publications, lectures and meetings of all types at the pre- and post-graduate levels. That is why our minds and hearts should be open to share all our knowledge in the interest of better care for patients throughout the Balkans. This would strengthen the entire profession, and confirm the idea by which the BaSS society was guided throughout these years.
Founding of the Organization

The Balkan Stomatological Society (BaSS) was founded at the 1st Balkan Dental Congress in Thessaloniki, Greece, in 1996. The main idea of establishing such an association in the Balkans was to bring specialists from different fields of dental medicine closer together and enable the exchange of personal experiences and observations among professionals throughout the Balkans. Already in the first few years of the Society showed the validity of that idea, providing all the members with many wonderful moments at the congresses in all member countries, and creating prerequisites for further individual contacts. Only a year after the foundation, the BaSS started editing a journal, the Balkan Journal of Stomatology (BJS), which additionally contributed to the main idea of the Society and enabled international publishing of scientific papers of Balkan authors.

But, as in most endeavours, beside success and achievement, there are also losses - the BaSS lost some of its most respected and loved members. At the end of the previous century, we heard the sad news about the death of Prof. Dimitri Iacovidis, the former Secretary General of the BaSS. All who knew him remember his outstanding enthusiasm and efforts in developing our Society, as well as his kindness and sincerity, which helped build and strengthen relations among colleagues throughout the Balkans. And only two weeks later, we lost the honoured professor Joakim Eleftheriadis from the same department of the Dental School of the Aristotelie University in Thessaloniki. Exceptional professional qualities and outstanding knowledge of both were highly respected by all colleagues throughout the Balkans, and worldwide. We all miss them tremendously. In 2005 we also lost Prof. Olga Blagojevic, a distinguished member of the BaSS Council, on July 10th, after a fatal car accident on the road from Sarajevo to Foca. She was especially close to the idea of BaSS among Bosnian colleagues. Although her country had not joined the association from the very beginning, she regularly attended its meetings and actively took part in the Council activities from 2001, and she was the first to introduce many of her younger colleagues to the BaSS and other associations and institutions as part of a continuing education process and further improvement. In 2009, during his presidency to the BaSS, we lost Prof. Marko Vulovic, a distinguished member of our Society and one of its founders. His great contribution to the Society was widely acknowledged, especially for establishing the Preventive Dentistry Group of the BaSS shortly after founding the BaSS and for his leadership of the Society at the very end of his life.

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<thead>
<tr>
<th>Year</th>
<th>BaSS Congress</th>
<th>Place of the Congress</th>
<th>President of the Congress</th>
<th>President of the BaSS</th>
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<tr>
<td>1996</td>
<td>1st</td>
<td>Thessaloniki, Greece</td>
<td>Prof. D. Karakasis</td>
<td>-</td>
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<tr>
<td>1997</td>
<td>2nd</td>
<td>Belgrade, Yugoslavia</td>
<td>Prof. D. Beloica</td>
<td>Prof. D. Karakasis</td>
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<td>1998</td>
<td>3rd</td>
<td>Sofia, Bulgaria</td>
<td>Prof. N. Atanasov</td>
<td>Prof. D. Karakasis</td>
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<tr>
<td>1999</td>
<td>4th</td>
<td>Istanbul, Turkey</td>
<td>Prof. N. Yazicioglu</td>
<td>Prof. D. Karakasis</td>
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<tr>
<td>2000</td>
<td>5th</td>
<td>Thessaloniki, Greece</td>
<td>Prof. D. Iakovidis</td>
<td>Prof. D. Beloica</td>
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<td>2001</td>
<td>6th</td>
<td>Bucharest, Romania</td>
<td>Prof. A. Iliescu</td>
<td>Prof. D. Beloica</td>
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<td>2002</td>
<td>7th</td>
<td>Kusadasi, Turkey</td>
<td>Prof. N. Arpak</td>
<td>Prof. N. Yazicioglu</td>
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<td>2003</td>
<td>8th</td>
<td>Tirana, Albania</td>
<td>Prof. P. Kongo</td>
<td>Prof. N. Yazicioglu</td>
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<td>2004</td>
<td>9th</td>
<td>Ohrid, FY ROM</td>
<td>Prof. M. Carcev</td>
<td>Prof. N. Atanasov</td>
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<td>2005</td>
<td>10th</td>
<td>Belgrade, Yugoslavia</td>
<td>Prof. M. Vulovic</td>
<td>Prof. N. Atanasov</td>
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<td>2006</td>
<td>11th</td>
<td>Sarajevo, Bosnia and Herzegovina</td>
<td>Prof. H. Sulejmanagic</td>
<td>Prof. A. Iliescu</td>
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<td>2007</td>
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<td>Prof. H. Bostanci</td>
<td>Prof. A. Iliescu</td>
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<td>2008</td>
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<td>Dr. I. Irodotou</td>
<td>Prof. M. Vulovic</td>
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<td>2009</td>
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<td>Ass. Prof. N. Sharkov</td>
<td>Prof. M. Vulovic</td>
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<td>2010</td>
<td>15th</td>
<td>Thessaloniki, Greece</td>
<td>Prof. T. Lambrianidis</td>
<td>Prof. P. Koidis</td>
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<td>2011</td>
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<td>Bucharest, Romania</td>
<td>Prof. N.C. Forna</td>
<td>Prof. P. Koidis</td>
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<td>2012</td>
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<td>Prof. H. Bostanci</td>
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<td>2013</td>
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<td>Skopje, FY ROM</td>
<td>Prof. A Minovska</td>
<td>Prof. H. Bostanci</td>
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<tr>
<td>2014</td>
<td>19th</td>
<td>Belgrade, Serbia</td>
<td>Prof. D. Stamenkovic</td>
<td>Ass. Prof. N. Sharkov</td>
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</table>
Nine distinguished professors led the Organisation as presidents of the BaSS (see Tab. 1). The first president, and founder of the Organisation, was Prof. Dimitrios Karakasis (president till 1999). It is essential to say that Prof. Karakasis's merits for the Society were indeed precious, not only for the implementation and success of the idea of bringing the dental professionals at the Balkans together, but also for the status and design of the Society. It is also important that he supported the idea of founding the scientific Journal of the Society from the very beginning, constantly contributing to its scientific level, as well as to its reputation outside the Balkans. At the end of his mandate as president, he was acknowledged for his great contribution to the Society, which continued in various aspects in the years that followed.

**Congresses of the BaSS**

Balkan Stomatological Society was founded at the 1st Balkan Dental Congress in Thessaloniki in 1996. The Yugoslav Stomatological Association and the City of Belgrade were the hosts of the 2nd Congress of the Balkan Stomatological Society (already known as BaSS), from the 2nd to 5th of April 1997. The Congress was held in the „Sava Center”, the biggest congress centre in Belgrade. More than 700 participants from almost all Balkan countries attended the Congress. As expected, the dentists from the host country were the most numerous. Beside the participants from Balkan countries, dentists from other European countries, as well as from Asia, presented their papers at the Congress. The participation of our colleagues from Germany, Japan, Austria, Sweden and Great Britain was noticed, and many dentists from former Yugoslavia, living and working in different European countries, also attended. The Scientific Committee succeeded in producing a very interesting Programme with various lectures and symposia presented simultaneously. The Scientific Forum with invited speakers raised exceptional interest. The lectures of the Scientific Forum were divided into five main themes: (1) The Improvement of Oral Health; (2) Contemporary Aesthetic Dentistry; (3) Basic Sciences in Dentistry; (4) Contemporary Treatment Methods; and (5) Surgical Procedures in Dentistry. Many Oral Presentations, Video Sessions, Poster Presentations and Table Clinics were also presented.

The official language of the Congress (as well as of the Balkan Stomatological Society) was English, but most of the presentations were simultaneously interpreted into Serbian. Two General Assemblies of the Balkan Stomatological Society took place during the Congress. The Statute of the Society was approved and the new Council was nominated. Professor D. Karakasis (Greece) was elected President of the BaSS and Professor D. Beloica (former Yugoslavia) was also elected as future president (President Elect). It was decided that the next, the 3rd Congress of the Society would be organized in Sofia (Bulgaria), from April 2-5, 1998, and the following in Turkey in 1999. For the first time, at the 2nd Congress of the BaSS each Congress participant was given (with the congress material) a copy of the 1st number of the Balkan Journal of Stomatology (BJS), an official publication of the Balkan Stomatological Society. The general atmosphere at the Congress was very pleasant and friendly and many new contacts were established, which helped strengthen future cooperation and understanding in the Balkan countries, as well as to improve the oral health of the population.

The first two congresses of the BaSS showed a remarkably high standard of public dental health care and dental science on average in the Balkan region. However, the participation of dentists, other than the faculties’ academic staff, in the Society’s activities was proportionally low, especially of those from the private dental practice. Private dentists from Balkan countries certainly have a lot to discuss on common problems and should exchange experiences, which is why there is a general belief that they will take a more prominent role in the Society’s activities in the future.

One of the most attractive Turkish cities, Istanbul, probably the only city in the World located on 2 continents, was the host of the 4th Congress of the BaSS. The congress was held from 22 to 25 March, 1999 and took place in the European part of Istanbul, at the attractive Congress and Exhibition Center „Lütifi Kirdar“, which has excellent conference halls and auxiliary technical facilities. Unfortunately, global politics left an even greater impact on the Congress participants the day before the end of the Congress, when bombing of former Yugoslavia by NATO started. That unbelievable event influenced an outstanding meeting and shocked not only the Yugoslav participants, but others as well, who expressed their sincere wishes to help and offered support in every way. Serbian colleagues will always remember the kindness and sympathy shown by our hosts and other friends from the Balkans.

At the congress in Istanbul, many existing problems in dental medicine were elucidated, and participants of the Congress could find various subjects of interest regarding contemporary dentistry. There were over
30 lectures delivered by eminent experts from all over the World, including the Balkan region. Two round tables dealing with the problem of caries prevention in children were held, presided by Prof. Vulovic from Belgrade. Presentations at the congress reflected a high standard of dental health service and dental medicine research of the Balkans. A great number of posters was also presented (over 400), and that too was an occasion for direct contacts among colleagues from all over the Balkans. One of the main aims of the Congress was exactly that: to enable contacts among experts and provide an occasion for them to meet and exchange professional experience. No doubt this Congress has helped promote further professional cooperation in the region.

After a successful two years mandate held by Prof. Dimitri Karakasis, who was also the founder of the BaSS, in compliance with regulations of the BaSS Bylaws, Prof. Dragan Beloica from Belgrade was elected the new President of the Society. At the same time, Prof. A.N. Yazicioglu from the Ankara University was elected Vice President.

The 6th annual Congress of the BaSS was held in Bucharest, Romania, from May 3rd to 6th. The Congress was attended by over 800 participants from all Balkan countries. In addition to a number of selected lectures of prominent speakers, almost 300 oral presentations and almost 400 posters were presented. During the Congress, a Deans’ meeting of several dental faculties from the Balkans was also held. The discussions on various themes were extensive and, among others, the question on unifying of programmes and curricula was raised. The problem of evaluation of the work of faculties was discussed, too. It was concluded that the student exchange programme should be intensified. Also, at the meeting of dental associations, various professional problems were discussed.

The delegates from FYROM, Dr. N. Carcev and Dr M. Gigovski, informed the Council about the next Congress planned to be held in Ohrid in May, 2002. It was decided that the Congress in 2003 would take place in Tiran (Albania), and the Congress in 2004 in Cyprus. Bosnia and Herzegovina with 2 councillors, 1 from each of the existing entities, became a regular member of the BaSS after unanimous voting.

After these early congresses, altogether 19 congresses were held in several cities of the Balkans - Kusadasi (Turkey), Tiran, Ohrid (FYROM), Sarajevo, Limassol (Cyprus), Varna (Bulgaria) etc (see Table 1). All these congresses were opportunities for mutual exchange of experiences regarding contemporary dentistry in the aim of, not only of raising standards of dental health service and dental medicine research, but also to strengthen already created friendship among professionals.

**Publishing the Journal**

It is a strange fact that dentists and scientists in several fields of dental medicine in the Balkan countries, generally speaking, are better acquainted with the achievements in dental science in the rest of the world than in the Balkan region. One of the possible reasons for this is the fact that several languages are spoken in the Balkans. This is why it has been agreed at the Council of the BaSS that English should become the official language of the Balkan dentists, as it is universally accepted for communication among medical professionals. One of the primary goals of the BaSS was to bring specialists from different fields of dental medicine closer together and enable the exchange of personal experience and observations. An official journal of the BaSS, i.e. a professional journal representing all dentists of the Balkan countries, would additionally contribute to that goal and improve the possibility of interchanging opinions and ideas among professionals throughout the Balkans. In my first editorial, published in the very first issue of the BJS, I stressed the strange fact that dentists and scientists in several fields of stomatology in the Balkan countries, generally speaking, are better acquainted with what is going on in the science of dental medicine in the rest of the world than in the Balkan region.

The Editor-in-Chief had always tried to define the content of each issue of the Journal by selecting papers from different Balkan countries with the intention of covering as many dental specialities as possible. This inevitably created a certain imbalance regarding the quality of published papers, but the basic aim of the Journal was, primarily, better communication among Balkan dental professionals, exchange and improvement of knowledge on the whole. By actively contributing their papers, dental professionals from the Balkans consistently supported BaSS’ idea and practice to publish a journal for dentists of all Balkan countries.

The first two volumes of the BJS comprised only two issues per year. However, at the beginning, there were so many contributions to the Journal that the BaSS Council decided, in 1999, to increase the number of issues of the Journal per year from 2 to 3, which is a contemporary policy. For scientific journal, several conditions governed this policy, which were carefully examined, especially of financial nature and not only...
During its history, two supplements of the journal were published. The first, published in 1999, was dedicated to the celebration of the 50th anniversary of Belgrade’s Faculty of Dental Medicine (at that time: Faculty of Stomatology). On that occasion, among many events and activities, special attention was paid to the interesting scientific programme, which consisted of outstanding lectures delivered by guest speakers - well-known experts in different fields of dental medicine from all over the World. These lectures were published in the first supplement of the Journal. The significance of publishing these lectures is twofold. First of all, without a doubt, these lectures were worthy to be published and become attainable to a wider group of professionals. But even more, this supplement also contributed to the idea of presenting the Balkan faculties (on this occasion - University of Belgrade). Unfortunately, the BaSS and the Journal thereafter did not continue to present other faculties on similar occasions or events. The second supplement was published in 2005, during the 10th Congress of the BaSS in Belgrade, representing an abstract book of the papers presented during the Congress.

There are probably 3 basic problems that attract attention of many editors of scientific journals: the scientific value of the papers, which is reflected on the average quality of the journal, the coverage of professional interest of the targeted population, i.e. a professional diversity of papers and, finally, the overall dispersion of the journal among potential readers, i.e. the distribution of the journal and its access by readers.

Concerning the scientific quality of the papers accepted for publication, this is primarily a matter of the competent peer review process. As to the official Journal of the BaSS, the situation is somewhat specific: there are several editorial teams, one in each Balkan country, who receive papers and organize peer reviewing, selecting peer reviewers in accordance to their own judgement among local outstanding experts. That is why the Editor-in-Chief does not have the first of the mentioned problems, as he is not involved in the selection and acceptance of papers, which is the duty of the National Editorial Boards (NEBs).

Due to the fact that the Editor-in-Chief receives from the NEBs a lot of papers from different fields of dental medicine, which is a privilege of journals dealing with a relatively wide professional scope, it hasn’t been so difficult to combine papers of various topics for each issue of the Journal, and to cover a wide range of interest; in other words, to prepare a journal as interesting as possible to the whole targeted population (dental professionals in the Balkans).

As such, the first 2 of the 3 cited possible problems did not occur within the scope of duties as Editor-in-Chief of the BJS. But the third, regarding the distribution of the Journal, caused concern not only to the Editor, but also to the BaSS Council. On several occasions it was brought to the BaSS Council’s attention that some authors were unaware that their papers had already been published (as it happened that they had not received the relevant issue of the Journal).

In search of an answer to this problem, one should remember that the BJS, from the very beginning, has been distributed only among members of the BaSS, which is understandable if one takes into account that the BJS is published by the BaSS. But the problem that we confronted in that sense is the fact that the BaSS membership “fluctuates” every year, which creates difficulties not only in the distribution of the Journal, but also when planning the number of each issue to be printed. Solving of this problem was on the agenda of several BaSS Council meetings, unfortunately without a final conclusion. Contemporary views on accessibility to scientific research, however, notably do not permit any borders or limitations such as the Balkans. Therefore, apart from aiming to achieve a higher scientific level, the Journal should be recognized beyond the Balkan borders, i.e. worldwide. Realization of that would begin with its open access publishing and indexing in as many as possible secondary publications. This could be achieved by the end of this year, and would certainly be of interest to all the professionals in the Balkan region and of great help to future editors.

It seems, in general, that the Journal has fulfilled the main concept and aims of its founding - to publish results of scientific efforts and present interesting clinical cases from all parts of the Balkans, to help the exchange of practical experience and communication, to present latest achievements in dental science of the Balkan region, as well as to raise the scientific level of the dental profession among Balkan countries.

Looking back, but also ahead, it is obvious that there is still room for improvement in the process of editing the Journal. Concerning its content, I am happy to say that our initial fears that there will be no interest
among authors throughout the Balkans to publish papers in English in this Journal has been absolutely dispelled. The number of submitted papers, especially from some countries like Turkey or Greece, considerably exceeded the possibility of publishing them all at the same time, so that a waiting list for their publication had to be made. This situation, obviously, enabled the Editor to make good selections among many papers and create interesting issues of the Journal, composed of various kinds of papers and covering different fields of dental medicine.

Although personally satisfied with the way in which the BJS has been published till now, I believe that we have, after so many years, approached the point where further improvement is needed to enhance the recognition of the Journal among dental professionals worldwide, as well as to obtain for publication papers of a higher scientific level. Recognition of a scientific journal is best provided by appropriate indexing, and citation indexing is an important consideration for the editorial and publication processes of a journal, as well as for the journal’s readers and authors. The concept is simple - the value of published information is determined by those who use it, so the quality of a published paper can be assessed by measuring the impact it makes in the community at large.

I realized that this was somewhat I had not anticipated enough at the very beginning because of the main concept of the BJS which, in the aim of presenting dental achievements of professionals throughout the Balkans and various levels of research, inevitably created a certain imbalance in the quality of published papers. However, the basic question that needs to be answered is: how to maintain the fundamental idea and, at the same time, to raise the scientific level of the Journal, enabling its citation indexing and worldwide recognition? Probably, the best solution would be to provide a more rigorous peer reviewing process.

Since 1997, in 18 years of the BJS history, exactly 665 papers were published, representing the state of art and achievements of dental medicine in almost all regions of the Balkans - 30 papers from Albania, 6 from Bosnia and Herzegovina, 15 from Bulgaria, 70 from FY ROM, 196 from Greece, 13 from Romania, 70 from Serbia, 262 from Turkey, and 9 from other countries. The last 6 issues of the Journal (beginning with the 2nd issue of the 11th volume) were fully presented on the BaSS website. However, only a few of those were published after presentation at the BaSS Congresses regardless the enormous number that were submitted on those occasions. If we take into account that each BaSS congress had at least 200 (oral or poster) presentations (which is understated because many of had over 300 to 400), it means that a low percent of previously presented papers is published, probably less than 2.5%.

The above-mentioned data stress a need to comment the obviously expressed phenomenon of under-publishing in this region among dental professionals. It appears that only 2% (approximately) of presentations reported at BaSS congresses were published in scientific journals, and this is far from the generally accepted insufficient percentage of 50%! This phenomenon is absolutely inexplicable and unacceptable and that this policy must be changed in future, at least by publishing in the Balkan Journal of Dental Medicine (BJDM).

Scientific journals are usually classified as international and local - the first group being directed to the wide international audience and usually published in English, and the second group directed toward domestic audience, publishing papers of local researchers and in local language. Certainly, journals of the first group are much more widely accessible and, although it is more difficult for authors to publish in these journals, it is also more desirable, too. The BJS (BJDM) stands somewhere between these 2 groups of journals - it is not strictly local, but it is not, in a global sense, international. I believe that we have now, after almost 20 years, approached the point where we need to go regarding recognition of the Journal among dental professionals worldwide and aim at reaching a better quality, and higher scientific level of published material.

Other Activities

The strongest impact of the BaSS presence is that cooperation between dental scientists has intensified, especially between academic staff of the Balkan schools of dental medicine. This cooperation was initiated at the very beginning of the Society’s foundation, and already at the 2nd Congress of the BaSS a meeting of Deans was called, where all the Deans agreed to hold future meetings at each BaSS congress. After initial acquaintance, some issues concerning educational programmes and curriculums were discussed in search of further possibilities of developing cooperation between faculties.

The idea of establishing the Preventive Dentistry Group of the BaSS was brought up by Prof. Marko Vulović from Belgrade at the 2nd Congress of the BaSS. The establishment of this Group was recognized with full support by the BaSS Council, at the Council meeting in Thessaloniki in 1997. The first meeting of the
Preventive Group of BaSS in Belgrade was organized by Prof. Vulović and his associates. Beside the Serbian participants, representatives from Greece, Bulgaria, FYR Macedonia and Romania were also present at the meeting, while representatives from Turkey and Albania, who supported the meeting, were unable to participate. At the meeting, all the participants agreed to promote the establishment of the Preventive Section as a part of the BaSS during the following BaSS Congress. The main goal of the Preventive Section was the improvement of oral health in Balkan countries by fulfilling several tasks: to establish the priorities of the primary prevention of oral diseases; to create the policy of the BaSS in the field of prevention; to motivate members of BaSS to support this policy; to seek support from the ministries of health of Balkan countries for this policy; to improve oral health among the population in the Balkans by motivation through common preventive programmes and activities; to make joint projects on the basis of research, realisation and monitoring of the basic goals of oral health; to improve educational curriculums in the Balkans based on current trends in preventive dentistry. Members of the Initiative Committee of the Preventive Section of the BaSS were appointed as follows: M. Vulović, M. Carević, K. Louloudiadis, N. Sharkov, A. Podariu, M. Mirceva and the representatives from Turkey, Albania and Cyprus.

During the meeting, participants also agreed on the basic organising structure of the Section with several proposals, as follows: members of the Preventive Section must be members of the BaSS; the executive board will be constituted on the basis of one representative from each Balkan country; the president and the president elect will be appointed by the executive board for the period of two years.

Gathering of basic data on the present oral health status in Balkan countries (agreed to be sent by the end of February 1998 to M. Vulović and M. Carević) was the first joint activity made by the group. The presentation of the obtained data would be regarded as support to the idea of establishing the Preventive Section at the 3rd BaSS Congress in Sofia. The Preventive Group ended its meeting in Belgrade with hopes that the proposed foundation of the Preventive Section, with the given goals, will improve oral health throughout the Balkan countries.

At the following meetings of representatives of dental faculties of the Balkans (Deans and Vice Deans), held in Ankara from the 8th to 11th November, 1997 the Balkan Inter-Faculties Committee was constituted, with the main task to prepare a draft of Agreement between dental faculties of the Balkans in the aim of closer mutual cooperation. Members of the Committee (Prof. N. Atanassov, Prof. N. Sayan, Prof. V. Burlui and Prof. D. Stamenkovic) made a commitment to prepare this draft for the next meeting of the Society (in Sofia), expecting that the anticipated cooperation will include a programme of students exchange during holiday time, joint research projects, comparison and coordination of educational programmes etc. The Deans’ meeting in Sofia was expected to encourage these activities and enable better inter-faculties cooperation in the future.

The first 2 congresses of the BaSS had shown a remarkably high standard of public dental health care and dental science on average in the Balkan region. However, the participation of dentists, other than the faculties’ academic staff, in the Society’s activities was proportionally low, especially of those from the private dental practice, although private dentists from Balkan countries should have a lot to discuss on common problems, and exchange experiences from different regions of the Balkans. In the years that followed, their participation in BaSS activities grew, and there is a general belief that they would take a more prominent role in the Society’s activities in the future.

Looking back, one can conclude that the basic goal of the BaSS has been fulfilled only partially. At several BaSS congresses we had the opportunity to learn about scientific achievements in dental medicine of all the BaSS member countries; we could exchange experience and viewpoints on professional matters and clinical cases. Finally, we made a lot of acquaintances and friends. But, have we really got to know anything about the organization of national dental health care services or dental educational systems in the Balkan countries? Although some facts concerning these matters have occasionally been mentioned at some meetings, they were not widely presented.

One of the most interesting initiatives of the Society, which raised a lot of attention, was the endeavour to acquaint representatives of member countries with the different dental study programmes in the Balkan countries, and to solve the question of how to create closer, more compatible dental education processes throughout the Balkans. Moreover, one of the proclaimed aims of the Society, stated in the Constitution of the BaSS, was “to attempt to establish uniform training requirements for the science and to coordinate student exchange” (Article 3).

In the meantime, countries of the European Community, somehow at the same time or, to be honest, slightly earlier, commenced the process of standardisation of European Higher Education Area,
which started in the 90s, now known as “Bologna process” and defined through “Bologna declaration” resulting in several documents created thereafter. It was aimed at essential reforming of universities, which would result in the removal of barriers and development of such a framework of teaching and learning that would enhance mobility, cooperation and awareness of belonging to one common social and cultural space while respecting national diversities. Through all these documents, some basic principles or action lines have stood out: facilitating the readability and comparability of qualifications in order to achieve their international transparency and academic and professional recognition; establishing a system of credits such as ECTS (the European Credit Transfer System), which facilitates student mobility and international curriculum development and represents a key element in the Bologna Process; promoting European cooperation in quality assurance with a view to developing comparable criteria and methodologies; promoting the European dimensions in higher education, especially with regards to curricular development, inter-institutional cooperation, and integrated programmes of study and research.

However, although significant progress in diploma recognition is underway, still considerable efforts are required to ensure a systematic use of the Bologna transparency tools - ECTS and the Diploma Supplement. The European Higher Education Area needs curricula that allow mobility by use of ECTS (60 per year), core curricula that satisfy the established standards and harmonization within Europe. But, harmonization of the educational process in dentistry is still far from being reached, especially in terms of its possible cycling. And especially in the Balkans where we have countries that are in the European Union, countries in the process of becoming EU members, as well as those still waiting to be accepted, with rather diverse university interests and different dental education curricula. We all know the saying: “All roads lead to Rome”; perhaps not all, but surely more than one road leads to Bologna. However, the road to Bologna is a long and winding one, full with crossroads and, probably, with dead-ends. How far have we gone with dental education in the Balkans, and which road to choose? Deans and representatives from several dental faculties have discussed the possible harmonization and standardisation of dental education, for the first time in Ankara in the late 90s, and at several BaSS congresses thereafter. I believe this issue needs to be discussed further, at future BaSS reunions, now in the light of new tendencies in Europe.

This brief review is only a personal view of the situation, and I would like to stress that I am not an expert in these matters. However, I hope that future meetings dedicated to these topics, will elucidate the situation in each respective country more precisely and in more detail. All information that will help us get to know each other better will be welcome.

One of the main goals of the BaSS - better mutual understanding and communication among dental practitioners and scientists of Balkan countries - has already been achieved through exchange of experience and knowledge at the Balkan congresses and several national congresses held in the Balkans. However, there are many more activities that could be carried out under the auspices of the BaSS, and others will arise in the future. Contacts between dental faculties throughout the Balkans are scarce and should improve. There are probably many reasons for this, but the following are evident.

First of all, as mandates of some Deans (members of the BaSS Council) are rather short, the newly elected Deans are not always well acquainted with the Society’s activities. Another problem is that some Faculty officials, due to the fact that they can’t all be members of the Council, seem rather uninterested in the development of the BaSS. This could be overcome by better communication and an increased exchange of information - primarily from BaSS Councillors to other colleagues and faculty staff, but also vice versa, to be open to suggestions and interest of those not present at meetings.

Therefore, having made the first steps in the previous century, we should step further in the 21st century by ensuring better communication, exchange of information, results and know-how. One of the BaSS objectives could be creation of a network of universities and professional associations in the area of dental medicine on a regional level, which could later be integrated into corresponding world networks; although one shouldn’t forget that the BaSS is an association of individuals and not of institutions or societies, but these are composed of individuals, are they not?

In Conclusion

As can be seen from this short, but successful history of the BaSS, we have accomplished many of the
planned activities from a regional point of view. With a strong foundation already laid, I believe it is now time for closer scientific cooperation and production of joint projects, such as exchange of students, teaching staff etc. Concerning the official Journal of the BaSS, the Balkan Journal of Dental Medicine, the first planned activity is to enable open access publishing, which would considerably contribute to its better visibility among researchers and clinicians and, consequently, wider citation of the published papers.

Finally, I must stress that this paper is only an attempt to present a part of the BaSS history and records of events I personally attended. Inevitably, that something important might have been omitted! I hope that, in the future, some new facts on the history of the BaSS will be reported by more than one member of the BaSS, as many of the founders are still active in the Society.

References

Several editorials, may own and guest editorials, published previously in the BJS, were used to prepare this report.

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SUMMARY

In literature, anatomical variations of the inferior alveolar nerve branches (infratemporal, extraosseous and intraosseous) are reported and their importance in clinical practice is discussed too. The spatial vessels’ position in relationship with the nerve in the mandibular canal was explored, which is of clinical significance in impacted third molar and implant surgery. It is believed that the neurovascular content of the main mandibular canal follows any variations of the mandibular canal i.e. bifid mandibular, retromolar and accessory mental canals. Retrospective studies and case reports reported the presence of multiple foramina on the medial surface of the ramus, near the main mandibular foramen. In some cases, one supplementary mandibular foramen was found to be connected with the lower third molar, which is called “temporal crest canal”. Others found an accessory mandibular foramen that led into a second mandibular canal which joined the main mandibular canal (double) anteriorly. The bony canals contained a terminal branch of the anterior trunk of the mandibular nerve or a branch of inferior alveolar nerve before it entered the mandibular foramen.

The aim of the study was to describe and classify anatomical structures of the mandibular canal and posterior foramina of the mandible through an extensive review of the corresponding studies via the PubMed, Scopus and Google Scholar databases.

Keywords: Mandibular Canal; Inferior Alveolar Nerve, Artery, Vein; Mandibular Foramen

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Neurovascular Content of the Mandibular Canal and Its Clinical Relevance: A Literature Review of the Related Anatomical and Radiological Studies

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LITERATURE REVIEW (LR)

Introduction

Mandibular canal crosses the mandibular body and part of the ramus. Knowledge of the anatomic structures enclosing the mandibular canal, the relationships with each other and with adjacent structures is important for both the general dentist as well as for the oral surgeon and implantologist. Moreover, anatomical variations of the inferior alveolar nerve branches are reported in bibliography and their importance in clinical practice too. For the purposes of the article, only the branches of the mandibular nerve providing innervation to mandibular teeth and periodontal tissues will be described with emphasis to the inferior alveolar nerve.

The aim of the study was to describe and classify anatomical structures of the mandibular canal and posterior foramina of the mandible through an extensive review of the corresponding studies via the PubMed, Scopus and Google Scholar databases. Databases reviewed included the PubMed (MEDLINE), Scopus and Google Scholar.

The long buccal nerve derives from the anterior stem of the mandibular nerve. It usually passes between the two heads of the lateral pterygoid muscle, then follows the inferior part of the temporal muscle and emerges under the anterior border of the masticator muscle, continuing in an anterolateral direction. A level of the occlusal plane of the mandibular third molar, it crosses in front of the anterior border of the ramus and enters the cheek through the buccinator muscle. The long buccal nerve provides sensory...
innervation to the mucosa and skin of the cheek\textsuperscript{1,2}. In some cases, it gives anastomotic branches to the facial nerve\textsuperscript{1}. Also, sensory fibres pass into the retromolar triangle, providing innervation to the buccal gingiva of the lower third molars and the buccal mucosa of that region\textsuperscript{1,2}.

**Mylohyoid nerve** originates from the inferior alveolar nerve before the latter enters the mandibular foramen. It runs downward and forward in the mylohyoid groove, between the medial pterygoid muscle and the internal surface of the ramus\textsuperscript{1}. Then, it crosses between the submandibular gland and the lower surface of the mylohyoid muscle. The mylohyoid nerve bifurcates from the inferior alveolar nerve at a distance of 14.7 mm from the mandibular foramen\textsuperscript{2}. Mylohyoid nerve is a mixed nerve being responsible for the motor innervation of the mylohyoid muscle and the anterior belly of digastric muscle, and for the sensory innervation of the skin on the inferior and anterior surfaces of the mental protuberance and submental region\textsuperscript{2}.

DeSantis et al\textsuperscript{3} stated that in 43% of the examined cadaver dry mandibles osseous lingual foramina were identified in the anterior lingual surface of the mandible, which were associated with nerve branches of the mylohyoid nerve that are inserted the mandible, whereas in another study\textsuperscript{4} the branches of mylohyoid nerve were found to innervate the pulp and gingiva of lower incisors in 50% of the cadaver dry mandibles. There is evidence that the mylohyoid nerve may be involved in supplying pulpal innervation to mandibular molars in some persons, usually the mesial root of the 1\textsuperscript{st} molar\textsuperscript{3}, and to the anterior teeth\textsuperscript{3-6}.

The mandibular nerve is one of the 3 divisions of the fifth cranial nerve, trigeminal nerve, and passes through the oval foramen to the infratemporal fossa, wherein it subsequently branches in several nerves\textsuperscript{1}. One of them is the *inferior alveolar nerve* (IAN) which is situated posteriorly and laterally the lingual nerve between the pterygoid muscles. IAN enters the mandible through mandibular foramen with homonyms blood and lymphatic vessels\textsuperscript{2}. The *inferior alveolar neurovascular bundle*, usually, travels through the mandibular canal, inferiorly to the lower posterior teeth, and continues until the premolar region dividing into its 2 terminal branches:

a) **mental neurovascular bundle** - it is the branch leaving the mandible through the mental foramen, giving 3 terminal ends that innervate skin and mucous membrane of the lower lip and skin of the chin region\textsuperscript{2-7}. In several cases, before the mandibular neurovascular bundle exits the jaw, it creates an endosteal curved loop proximal to the mental foramen, called **anterior loop**, and then returns distally to finally leave the mandible through the mental canal as mental neurovascular bundle (Fig. 1).

b) **lower incisor neurovascular bundle** - it is the terminal branch of the endosteal course of the inferior alveolar bundle, which travels in the incisive canal inferiorly to the mandibular anterior teeth and terminates in the midline of the jaw where it is anastomosed with the corresponding bundle of the opposite side\textsuperscript{5,7-10} (Fig. 2). The incisive nerve remains within the incisive bony canal and forms a nerve plexus that innervates the pulpal tissues of the mandibular first premolar, canine and incisors via the dental branches\textsuperscript{5}.
The IAN innervates the lower jaw, teeth, periodontal tissues and buccal soft tissues of the premolars and anterior teeth, the skin of the chin and the mucosa of the lower lip. The position of the mandibular foramen varies depending on the race and ethnicity. It is located on a bony insolation, the lingula, at the middle of the ramus' medial surface, at about 19.7 mm from the anterior border of the ramus. The distance from the injection point for the inferior alveolar block anesthesia to the foramen is about 21 mm equal to the length of the short needle or to ⅔ of the large one.

By determining as a hypothetical vertical distance the line joining the condyle with the inferior border of the ramus and as a horizontal distance the line joining the posterior edge of the ramus until the most concave point of the anterior border of the ramus, the mandibular foramen is usually situated in the ventral and inferior ⅔ of the ramus without difference according to the side, sex or age. However, studies report conflicting results about the exact location of the foramen. One study reported that, in adults, the foramen was inferior, at the same level and superior to the occlusal level at a percentage of 75%, 22.5% and 2.5%, respectively, while another stated percentages 29.4%, 47.1% and 23.5%, respectively. Hence, if the insertion of the needle occurs at the same level as the occlusion plane the foramen is likely to be at a highest location point at 2.5-23.5% and the anesthesia will fail. Thus, it is recommended to insert the needle at the deepest part of the pterygomandibular raphe at 6-10 mm above the occlusal plane of the mandibular molar teeth.

Authors of contemporary dental anesthesia books emphasize on an alternative method of administering the IAN block anesthesia. The traditional way of determining the injection point for the needle of syringe is by using the index finger intraorally at the most concave point of the ramus' anterior border. Hence, the clinicians insert the ⅔ of the needle at the pterygomandibular raphe, at a height of 1 cm above the occlusal plane of the mandibular molars and with a direction coming from the opposite mandibular premolars. Alternatively, the clinicians may place the thumb intraorally on the coronoid notch and the index finger extraorally on the posterior border of the ramus and estimate the distance between these points, which is in other words the width of the ramus. The alternative technique offers the sense of horizontal length of the ramus in comparison with the traditional way which cannot. There is a need of a randomized clinical trial to prove the advantage of this method in comparison with the conventional one of inferior alveolar block anesthesia in achieving better anesthesia results.

In the literature, several case reports stated the presence of multiple foramina on the medial surface of the ramus, near the main mandibular foramen, while an anatomical study indicated that double mandibular foramina were found in a percentage of 8.9% of the examined jaws. Murlimanju et al observed accessory mandibular foramina in 11 out of 67 adult human dry mandibles (double mandibular foramina in 9 cases and triple in 2 cases). Freire et al found that 27.9% and 43.2% of the 222 examined dry mandibles presented at least one accessory mandibular foramen located on the medial surface in position below and above, respectively, of the main mandibular foramen. Samanta and Kharb stated a presence of accessory mandibular foramina in 16.7% of 60 human adult dry mandibles. In 10% mandibles, a single accessory foramen was present, and in 6.7% double foramina were present. Haveman and Tebo found that foramina of 0.4 mm in diameter, or greater, occurred bilaterally superiorly or inferiorly to the main mandibular foramen in more than 90% of 150 examined dry adult human mandibles. The bony canals that started from these foramina contained branches of the IAN or mandibular nerve, which gave these branches at a highest point of the usual mandibular foramen.

In two case reports, metallic wires were inserted within the osseous canals of the supplementary mandibular foramina. The results showed that 1 supplementary mandibular foramen, situated 17 mm superiorly to the main mandibular foramen, was connected with the crypt of the lower third molar in each side of the jaw. In our opinion, the anatomical variation of the above studies was a subtype of temporal crest canal, which was connected with the third molar of the mandible. Temporal crest canal is a bony canal that starts from a supplementary mandibular foramen located anteriorly to the main foramen at the temporal crest and finally opens at the retromolar fossa. It is believed that it contains a terminal branch of the anterior trunk of the mandibular nerve (long buccal nerve variant) or a branch of the IAN before it enters the mandibular foramen.

The presence of multiple foramina and para-mandibular canals was explained by the conduct of Serres development, a formation which was described by the French anatomist Antoine Etienne Reynaud Augustin Serres in 1817. It was initially called “conduct of the first teething”, believed to contain a branch of the inferior alveolar artery and vein dedicated to irrigation of temporary teeth. This entity was just distally to the main mandibular foramen and highly prevalent in infantile jaws and in newborn it reached 100%. However, the anatomical study of Suazo et al on 324 jaws of 68 sub-adults aged 0-2 years and 256 adults aged 18-100 years showed a prevalence of “conduct of Serres” in 100% in sub-adults group and 42.6% in the adults group. The study showed that the term “Serres’ conduct” is observed in almost all the ages.
With these data, the character of this anatomical variation as Serres’ conduct is questionable due to the fact that it is actually a bony canal that has its opening distally to the main mandibular foramen, at a supplementary foramen. Furthermore, the term “conduct” refers to a structure of soft walls, but with the analyzed formation being a structure of hard walls this then should be called “canal”36. With these considerations, besides the parallel orientation of the mandibular canal, the name of the foramen and conduct of Serres should be replaced with “accessory mandibular foramen” and “para-mandibular canal”, respectively, while this canal is not joined with the main mandibular canal during its anteriorly intraosseous course (without confluence with the main mandibular canal).

Moreover, a large accessory mandibular foramen was present in 1 mandible out of 335 mandibles (0.3%) observed in a cadaveric study37. The accessory foramen led into a canal that passed forward and lateral to the mandibular canal and joined the lateral at the level of the wisdom tooth. This kind of canal is called in bibliography a “double mandibular canal”, which originates from 2 separate mandibular foramina38-52.

The inferior alveolar artery (IAA) originates from the internal maxillary artery, branch of the external carotid. Before its insertion at the mandibular foramen, it branches the mylohyoid artery53,54. Throughout its path in the mandibular canal it accompanies the IAN and the inferior alveolar vein (IAV) and courses with them in a parallel direction1,55. Its diameter is of 0.7-2 mm and provides dental, gingival and alveolar bony branches38,55. At the level of the jaw between premolars the artery cleaves in the lingual nerve or the long buccal nerve30 and an innervation branch to the lateral pterygoid muscle50.

The IAN, before entering the mandibular canal, may give multiple extraosseous branches. In some cases this variation is associated with the presence of accessory mandibular foramina and insertion of these neural branches in the osseous canals. Then, the branches: a) may communicate through a bony canal (temporal crest canal) with the retromolar triangle and end at an exit foramen called “retromolar foramen” distal to the third molar31-33, b) may communicate with the third molar20,28,31, c) may travel within the supplementary canal through the ramus or body of the mandible until exiting the mandible through a supplementary buccal mental foramen39 or a lingual foramen41 or d) may join the main mandibular nerve31,38,39.

Even if the IAN enters the mandible by a single mandibular foramen, it can have intraosseous branches, during its course into the mandibular canal, which are not always surrounded by bony tissue, such as to be radiographically imaged40. Several authors have described the intraosseous course of IAN and its branches variations in different ways. A literature review of the related publications was conducted via PubMed (MEDLINE), Scopus and Google Scholar from January 1970 until July 2013 (Tab. 1)8,28,31,55,61-63.

Carter and Keen31 examined 8 dissected human mandibles and described 3 types of inferior alveolar arrangement: Type I (n=6) was a single nerve lying close to the root apices, Type II (n=1) ran lower down in the mandible and gave off long oblique branches to the teeth, Type III (n=1) gave off 2 posterior branches that ran in separate canals (bifid canal). A large inferior branch passed to the mental foramen and incisor teeth, whereas a more superior alveolar branch supplied the molar and premolar teeth. The findings were also confirmed radiographically on 80 dried mandibles.

Discussion

The IAN and its variations were described by several researchers as below:

Throughout its infratemporal course, the IAN may give communication fibres to the mylohyoid nerve, the lingual nerve or the long buccal nerve30 and an innervation branch to the lateral pterygoid muscle50.

The IAN...
Table 1. Classifications of intrabony branching patterns of the inferior alveolar nerve (IAN). Anatomical (dissection), histological and MRI studies describing variations of the IAN, published from January 1970 until July 2013, were only included. Radiological studies were excluded.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year of study</th>
<th>Method of study</th>
<th>No of specimens studied (cadaveric mandibles)</th>
<th>Types of inferior alveolar nerve and variations</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carter &amp; Keen</td>
<td>1971</td>
<td>Dissection, radiographic examination</td>
<td>8 80</td>
<td>Type I: The IAN is a large structure lying in a bony canal (single canal). Subsequently, the nerve terminated in a mental arborization, with offshoots to the plexus adjacent to the incisors, before it enters the mental foramen. The incisor plexus, while connected to the branches mentioned, was not the source of the dental branches.</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type II: The IAN is situated substantially lower down in the mandible (lower canal) some distance from the roots of the molars. The dental branches are given off more posteriorly and are more oblique in position than in type I. The further course of the nerve is described as above.</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type III: The IAN is separated posteriorly into two large branches, which together could be regarded as equivalent to an alveolar branch (bifid nerve) while the main continuation of the nerve occupied a more inferior position and continued, as in other types, towards the mental foramen and the supply of the anterior teeth.</td>
<td>12.5</td>
</tr>
<tr>
<td>Ikeda et al</td>
<td>1996</td>
<td>MRI examination, histology</td>
<td>6</td>
<td>The IAN inside the mandibular canal is composed of three branches: retromolar branch: it is separated from the main stem of IAN at the level of the mandibular foramen and it travels at company with IAN for a 2-5 mm course; in continue it turns up right at a level just behind the wisdom tooth. molar branch: is responsible for the innervations of posterior teeth and starts from IAN or the retromolar region, follows a parallel course with the ridge and inferiorly to the teeth and when it reaches its final destination it turns up. incisive branch: it is branched from the stem of IAN near the mental foramen region and travels anteriorly. The IAN exits the mandible from the mental foramen as mental nerve.</td>
<td>100</td>
</tr>
<tr>
<td>Wadu et al</td>
<td>1997</td>
<td>Dissection, radiographic examination</td>
<td>29</td>
<td>The nerve trunk is divided into a molar plexus in the molar area. The main nerve is then secondly divided into the incisive and mental branches in the molar area well before reaching the mental foramen. There were communications between the mental and incisive nerves proximal (incisal plexus) to and at the mental foramen.</td>
<td>100</td>
</tr>
<tr>
<td>Polland et al</td>
<td>2001</td>
<td>Dissection, panoramic examination, histology</td>
<td>7</td>
<td>The inferior alveolar nerve near the mandibular foramen was a large trunk, consisting of three to four nerve bundles with connective tissue sheaths. It became more loosely arranged toward the mental foramen. Medial to the latter, the nerves were frequently in the form of small bundles in the marrow. Any incisive canal, when present, ran through a labyrinth of intertrabecular spaces.</td>
<td>100</td>
</tr>
<tr>
<td>Kieser et al</td>
<td>2004</td>
<td>Dissection</td>
<td>39</td>
<td>Type I: Single trunk that coursed anteriorly toward the mental foramen without obvious branches (unbranched).</td>
<td>38.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type II: A single trunk and a series of individual simple branches directed at the superior border of the mandible.</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type III: A small (fine) molar plexus of branches from the proximal half of the IAN.</td>
<td>28.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Type IV: There are two nerve plexuses, one associated with the proximal half and one the distal half of the IAN, proximal and distal nerve plexus respectively.</td>
<td>25.6</td>
</tr>
</tbody>
</table>
Type I  
A common neural stem with a series of nerve branches directed towards the alveolar ridge in a vertical plane joining the ridge with the canal.  

Type II  
A common neural stem with a small nerve plexus in the molar region.  

The spatial fascicular arrangement of the IAN took various forms. The somatotopic arrangement of the IAN was categorized according to the nerve fascicles innervating each tooth.  

In all of 15 cases of nerve fascicle separation, the nerve fascicles innervated the mandibular second and third molars.  

In case of presenting the retromolar branch, this branch also arose from the superior buccal nerve fascicles of the IAN.  

The nerve fascicles innervating the first molar were classified into two categories:  
1. those running in the superior buccal portion of IAN and  
2. those running in the superior portion of the IAN.  

A nerve branch innervating the second premolar was observed for two categories of nerve fascicles running in:  
1. the superior portion of the IAN and  
2. the superior buccal portion of the IAN.  

The nerve fascicles innervating the first premolar were classified into four types, with the nerve fascicles running in:  
1. the superior lingual portion,  
2. the superior buccal portion,  
3. inferior lingual portion, and  
4. the superior portion of the IAN.  

The courses of the nerve fascicles innervating the mandibular anterior teeth (central, lateral incisors, and canine) could be divided into six categories, with nerve fascicles running in:  
1. the superior lingual portion of the IAN within the posterior MC and the lingual portion within the anterior MC;  
2. the superior and inferior lingual portions of the IAN within the posterior MC, and then in the lingual portion within the anterior MC after merging;  
3. the superior lingual portion of the IAN throughout the MC;  
4. the inferior lingual portion of the IAN throughout the MC,  
5. the inferior portion of the IAN, receiving the nerve fascicles from the inferior lingual and inferior buccal portions within the posterior MC, and then in the inferior lingual portion of the IAN within the anterior MC; and  
6. the lingual and buccal portions of the IAN within the posterior MC, and then in the lingual portion of the IAN within the anterior MC.  

The MN travelled mainly within the IAN and contained nerve fascicles running in the buccal portion throughout the MC.  

Ikeda et al identified with MRI and histology that in edentulous patients the IAN (higher signal intensity than the surrounding connective tissue) inside the mandibular canal is composed of 3 branches: a) retromolar branch, which is separated from the main stem of the IAN at the level of the mandibular foramen and travels at company with IAN for a 2-5 mm course; it continuous and turns up right at a level just behind the wisdom tooth; b) the second (molar) branch, which was responsible for innervation of posterior teeth and starts from the IAN at the retromolar region, follows a parallel course with the ridge and inferiorly to the teeth and when
it reaches its final destination it turns up; c) the third branch, which is called incisive nerve is branched from the stem of the IAN near the mental foramen region and travels anteriorly. The IAN exits the mandible from the mental foramen as mental nerve. The mandibular canal contains IAN, the inferior alveolar vessels (low level signal), loose connective tissue and sometimes the retromolar and molar branches. Histologically, the IAN is composed by 2-8 nerve bundles.

Kieser et al. reported that the IAN was located in the superior part of the body of the mandible in 31% of the cases, all of which showed a small posterior molar plexus of branches. In 69% of cases the IAN was halfway or closer to the inferior border of the mandible. Of the latter cases, 1% demonstrated a small posterior molar neural plexus, 37% showed posterior and anterior plexuses and 22% showed no branches or a single trunk with a small number of single branches directed superiorly to the alveolar ridge. However, in another study, Kieser et al. reported that in edentulous patients the arrangement of the IAN was found to be: a) a common neural stem with a series of nerve branches directed towards the alveolar ridge in a vertical plane joining the ridge with the canal (52-59%); or b) a common neural stem with a small nerve plexus in the molar region (21-26%). This may explain the alveolar ridge alterations after tooth loss and why these patients report pain or discomfort in the molar region during mastication with a dentition.

According to Hur et al., the most common pattern of nerve fascicle innervation to the mandibular teeth could be grossly classified into 3 types: 1) the superior buccal portion of the IAN innervating the molars; 2) the superior portion innervating the premolars; and 3) the superior lingual or the superior lingual and inferior lingual portions in the posterior MC and the lingual portions in the anterior MC, innervating the incisors and canine. The buccal ¾ portion of the IAN innervated the lower lip, skin of the chin, and the vestibular gingiva.

Radiographically, the mandibular canal appears as a dark, linear shadow with thin, radiopaque superior (or roof) and inferior (or bottom) borders, cast by the cortical bone that bounds the canal (Fig. 1). The total length of the canal is in average 62.5 mm, while in men it is usually longer by 2.5 mm. The canal’s diameter is always wider near the mandibular foramen and is approximately 4 mm, while its average diameter is found to be 2-3.4 mm. The canal was found to be oval-shaped near the mandibular foramen and round-shaped near the molars. Indicatively, Miller et al. reported that the shape of the mandibular canal was oval-shaped with vertical and horizontal dimension of 2.9 and 2.5 mm respectively in examined cases of impacted wisdom teeth. The smallest canal diameter of 1.2 mm concerned a case where the canal was course between the roots of the impacted tooth. It is believed that the neurovascular content of the main mandibular canal follows the variations of the mandibular canal, i.e. bifid mandibular canal, retromolar mandibular canal and accessory mental canal.

Chavez et al. reported that during embryonic development there may be 3 canals innervating 3 groups of mandibular teeth. The canal to the incisors appeared first followed by the canal to the primary molars and subsequently canal to the permanent molars. These canals are directed from the lingual surface of mandibular ramus towards different tooth groups. During rapid prenatal growth and remodeling in the ramus region, there is a spread of intra-membranous ossification that commences where the IAN divides into mental and incisive branches around 7 weeks prenatal. The extension of ossification posteriorly along the lateral border of Meckel’s cartilage produces a gutter around the IAN that eventually forms the single mandibular nerve canal. Hence, a possible explanation of the presence of bifid or even three-fid mandibular canal is the incomplete embryological fusion of these nerve canals. Branching of the IAN or communications with other nerves would be reflected in various types of mandibular canal and/or neural morphology.

Conclusion

To summarize, reviewing the literature, it can be concluded that there are variations of the mandibular canal and the IAN that are not well reported in anatomic textbooks or are not classified in detail. The course and the content of the mandibular canal, its variations and foramina are of clinical importance in oral surgery, implantology and dental anaesthesia. The IAN is accompanied by the homonymous vessels inside the mandibular bony canal. The knowledge of topographic relationship between the IAN and the homonymous vessels are of crucial importance for any clinician. Preoperative radiographic evaluation of a mandibular canal variation or the location and course of a retromolar or accessory mental canal is necessary in order to avoid any complications during oral surgery procedures, i.e. bleeding or paraesthesia.

References


SUMMARY
Purpose: The aim of this paper is to document the oral hygiene and nutrition habits of young people (aged 18 to 25) in Greece.

Material and Methods: In a random sample of 100 people in Greece aged 18 to 25, a questionnaire including 23 questions (4 demographical and 19 other) was given. The frequency, the usual reason for visiting the dentist, the frequency of brushing, the type of toothbrush and the criteria for choosing toothbrush and toothpaste were searched. The nutrition habits were recorded as frequency in receiving sugar or no sugar meals during the day. The statistical analysis included frequencies and the use of chi-square test for interrelation with the demographical questions.

Results: 72% of the sample visits the dentist at least once a year, while the reason for visiting was prevention in 69%. 85% brushes at least twice a day, and the same percentage uses medium hardness toothbrush. The choice of the toothpaste is based on flavour and fragrance in 25%. The frequency of receiving sugar meals was recorded as 45% once daily and 43% in 2 or 3 times daily (p<0.05 between smokers and non smokers). 78% of the young people receives less than 5 meals and snacks per day. There was no statistically significant difference between different available monthly budgets in the sample for the oral hygiene and nutrition habits.

Conclusion: More than 1/3 of young people in Greece aged 18 to 25 visits the dentist at least once yearly for prevention and uses medium hardness toothbrush. The frequency of sugar consumption was significantly higher in smokers when compared to non smokers. Statistically significant differences were not observed between males and females except for the frequency in brushing (p<0.05). A review of the literature was performed for issues related to this project.

Keywords: Oral Hygiene; Nutrition Habits; Young People; Greece

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ORIGINAL PAPER (OP)

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Oral Hygiene and Nutrition Habits of Young People in Greece Aged 18 to 25 and Review of the Literature*

Introduction

Oral hygiene is a significant factor for oral health and life quality for a society's citizens. 2 of the most common and important diseases in the population worldwide are caries and periodontal disease, where the prevalence is high in societies of low socio-economic level. The habits in oral hygiene and nutrition play an important role in oral and physical health. Frequent dental visits, accompanied by personal oral hygiene with the use of brushing, dental floss and oral mouth rinse, lead to a diminishment in the prevalence of caries and periodontal problems. The correct and up to date information of the population from the dentists constitutes a significant factor. Prevention is considered necessary in modern societies and accompanies its evolution. The regular preventive check up from the early years of a person's life can lead to an in time diagnosis of the diseases mentioned above. Poor oral health is influencing quality of life by causing dental

* The paper was oral presented at the Greek Dental Association, Athens, Nov. 2013
pain and loss of the ability to feed and communicate as well\textsuperscript{10}. Also, differences in oral hygiene seem to exist due to factors related to geography and civilization\textsuperscript{11-13}.

A significantly high number of studies have been performed in order to record the oral hygiene and nutrition habits in certain groups of the population like children, elders or pregnant women\textsuperscript{14-17}. The documentation of these data will help in taking measures that aim at the improvement of oral health in high risk groups of the population. The current study aims to fill the gap in the literature concerning the oral and nutrition habits of young people, and especially those aged between 18 and 25, which is not enough studied up to today. This study's purpose is to search habits related to oral health in a population facing a vast economical and social crisis, the population of Greece nowadays.

### Questionnaire

1. GENDER
   - [ ] MALE
   - [ ] FEMALE

2. LEVEL OF EDUCATION
   - [ ] HIGH SCHOOL GRADUATE (3 CLASSES)
   - [ ] HIGH SCHOOL GRADUATE (6 CLASSES)
   - [ ] ADVANCED EDUCATIONAL INSTITUTE STUDENT
   - [ ] TECHNOLOGICAL EDUCATIONAL INSTITUTE STUDENT
   - [ ] ADVANCED EDUCATIONAL INSTITUTE GRADUATE
   - [ ] TECHNOLOGICAL EDUCATIONAL INSTITUTE GRADUATE

3. AVAILABLE MONTHLY BUDGET
   - [ ] 0-250 Euros
   - [ ] 250-500 Euros
   - [ ] >500 Euros

4. ARE YOU SMOKERS?
   - [ ] YES
   - [ ] NO

5. HOW OFTEN DO YOU VISIT THE DENTIST?
   - [ ] 1 TIME/ 6 MONTHS
   - [ ] 1 TIME/ 12 MONTHS
   - [ ] 1 TIME/ MORE THAN 12 MONTHS
   - [ ] IN CASE OF PAIN

6. USUAL REASON FOR VISITING THE DENTIST
   - [ ] PAIN
   - [ ] PREVENTION
   - [ ] DENTIST'S RECOMMENDATION
   - [ ] AESTHETICAL REASON

7. HOW OFTEN DO YOU BRUSH YOUR TEETH?
   - [ ] 1 TIME/ DAY
   - [ ] 2 TIMES/ DAY
   - [ ] 3 TIMES/ DAY
   - [ ] MORE THAN 3 TIMES/ DAY
   - [ ] A FEW TIMES A WEEK
   - [ ] RARELY
   - [ ] NEVER

8. HAS YOUR DENTIST SHOWN YOU BRUSHING?
   - [ ] YES
   - [ ] NO

9. HAS A DENTIST VISITED YOUR SCHOOL TO INFORM YOU ABOUT ORAL HYGIENE (Need of brushing, type of brushing, etc.)
   - [ ] YES
   - [ ] NO

Figure 1. Questionnaire (first page)
Material and Methods

In a random sample of 100 young people living in Greece, aged 18 to 25, a questionnaire of 23 questions was electronically provided (Fig. 1). It included 4 demographical questions and 19 questions about oral hygiene and nutrition. The participation was voluntary, self-administrated, the participants were recruited consecutively and the completion of the questionnaire was performed anonymously. The questionnaires were strictly provided electronically, with no restriction to the gender, educational level, origin, and their smoking habits. The exclusion criteria included: (1) Age more than 25 years old; (2) Age less than 18 years old; (3) Students or graduates of dental schools.

This age group selected has not been studied enough like other age groups, such as children, elders etc, have.

The demographical questions were: (1) The gender (male or female); (2) The level of education (high school graduates, advanced educational institute’s graduates, technological educational institute’s graduates, advanced educational institute’s students and technological educational institute’s students); 3. The available monthly budget (less than 250 €, 250 to 500 €, more than 500 €); and (4) Smoking (yes or no).

The frequency of dental visits and the usual reason for visiting, the frequency of brushing, the use of dental floss and mouth rinse were a few of the questions aiming to record the oral hygiene habits of the sample. The criteria for choosing toothpaste and toothbrush, as well as the use of electrical toothbrush, were also searched in the questionnaire.

The frequency of receiving sugar meals during a day as well as the frequency of meals and snacks were also questions included to determine the nutrition habits of the sample. The frequency of sugar consumption was defined in the questionnaire as: “Number of sugar meals in a day including sweets, refreshments, coffee with sugar, etc”.

A nother element that was studied was a personal opinion for the prevention measures that these young people were using, their personal opinion for their oral health evaluation and their willingness to seek dental hygiene methods themselves (for example in the web and in valid sites like the Greek Dental Federation).

The data collected was analyzed statistically. For the interrelation with 4 demographical questions, the chi-square test, Statistical Package for Social Sciences (SPSS) version 22 was used and statistical significance was set to 0.05. Statistical significant differences in the sample’s responses are searched for: (1) gender; (2) level of education; (3) available monthly budget; and (4) smoking.

Results

From a total of 100 participants that constituted the sample of the current project, 38 (38%) were male while 62 (62%) were female (Tab. 1). As far as the educational level is concerned: 53 (53%) were students of advanced educational institutes, 22 (22%) were graduates of advanced educational institutes, 6 (6%) were graduates of technological educational institutes and 1 (1%) was a high school graduate. The sample was considered insufficient and inappropriate for the extraction of inferences for the educational level and the oral hygiene and nutrition habits by the authors (Tab. 1). 50% of the sample had an available monthly budget of 250 to 500 €, 27% less than 250 €, while 23% had more than 500 €; 36% were smokers, whereas 64% were non smokers (Tab. 1).

Table 1. The Sample’s Responses on Demographical Questions

<table>
<thead>
<tr>
<th>DEMOGRAPHICAL QUESTION</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENDER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38</td>
<td>38%</td>
</tr>
<tr>
<td>Female</td>
<td>62</td>
<td>62%</td>
</tr>
<tr>
<td>EDUCATIONAL LEVEL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School Graduate (3 classes)</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>High School Graduate (6 classes)</td>
<td>7</td>
<td>7%</td>
</tr>
<tr>
<td>Advanced Educational Institute Student</td>
<td>53</td>
<td>53%</td>
</tr>
<tr>
<td>Technological Educational Institute Student</td>
<td>11</td>
<td>11%</td>
</tr>
<tr>
<td>Advanced Educational Institute Graduate</td>
<td>22</td>
<td>22%</td>
</tr>
<tr>
<td>Technological Educational Institute Graduate</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>AVAILABLE MONTHLY BUDGET</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-250 €</td>
<td>27</td>
<td>27%</td>
</tr>
<tr>
<td>250-500 €</td>
<td>50</td>
<td>50%</td>
</tr>
<tr>
<td>&gt;500 €</td>
<td>23</td>
<td>23%</td>
</tr>
<tr>
<td>SMOKING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>36</td>
<td>36%</td>
</tr>
<tr>
<td>No</td>
<td>64</td>
<td>64%</td>
</tr>
</tbody>
</table>
72% of the sample visits the dentist at least once a year, and in detail, 44% visits once a year and 28% once every 6 months. The main reason for the visit is prevention in 69% of the sample. 93% brush their teeth at least once daily - 11% once a day, 53% 2 times a day, 29% 3 times a day (Tab. 2). Statistically significant differences were noted between males and females regarding the frequency of brushing (p<0.05). Females seem to have a higher frequency in brushing where 48.3% of them brush 3 or more times a day compared to 5.3% of the males (Tab. 3). Medium hardness toothbrush is used in 85% of the sample, while dental floss is used by only 32% (and 20% of the sample only a few times in a week); dental mouth rinse is used by 44%, and 48% states that has used electrical toothbrush mainly due to advertisement and convenience in use (Tab. 4). A dentist has performed a demonstration of oral hygiene methods for 77% of the sample and in 47% of the cases a dentist has visited the school in the past to inform students about oral hygiene habits.

Table 2. Oral Hygiene Habits of the Sample

<table>
<thead>
<tr>
<th>Oral Hygiene Habits</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dental Visit Frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time/ 6 months</td>
<td>1 time/12 months</td>
<td>28%</td>
</tr>
<tr>
<td>1 time/ more than 12 months</td>
<td></td>
<td>44%</td>
</tr>
<tr>
<td>in case of pain</td>
<td></td>
<td>13%</td>
</tr>
<tr>
<td>never</td>
<td></td>
<td>2%</td>
</tr>
<tr>
<td>Reason of visit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pain</td>
<td>prevention</td>
<td>18%</td>
</tr>
<tr>
<td>dentist’s recommendation</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>aesthetical reason</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>no visit</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Brushing frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time/ day</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>2 times/ day</td>
<td>53%</td>
<td></td>
</tr>
<tr>
<td>3 times/ day</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>more than 3 times a day</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>a few times a week</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>rarely</td>
<td>1%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Gender and Brushing Frequency

<table>
<thead>
<tr>
<th>Brushing Frequency</th>
<th>Male</th>
<th>Female</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 time/ day</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>2 times/ day</td>
<td>26</td>
<td>27</td>
<td>53</td>
</tr>
<tr>
<td>3 times/ day</td>
<td>2</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>More than 3 times a day</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>A few times a week</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Rarely</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>38</td>
<td>62</td>
<td>100</td>
</tr>
<tr>
<td>p- value</td>
<td>&lt;0.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The criteria for choosing toothbrush and toothpaste varied. 29% of the participants stated that they choose their toothbrush randomly, while 26% chooses according to the dentist’s recommendation. Other reasons include the brand (15%), the aesthetics - colour/design (10%) and the cost (9%). When choosing toothpaste, the taste and flavour seem to play an important role, followed by the dentist’s recommendation, the random choice, the brand and the advertisement (Tab. 5).

Almost half of the sample performs dental debridement at least once a year (17% once every 6 months and 30% once a year). 16% of the sample visits the dentist for debridement once every 12 to 24 months, whereas 10% in more than 24 months. 28% has received 2 to 3 times debridement in a life time, 27% more than 5, 16% 4 to 5, and the same percentage has never received debridement in a life time. At the same time, 64% of the participants admit that their gums bleed during brushing.

Table 4. Oral Hygiene Products’ Used in the Sample

<table>
<thead>
<tr>
<th>The product</th>
<th>Soft</th>
<th>Medium</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toothbrush Hardness Yes (48%)</td>
<td>Easy in use</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (32%)</td>
<td>2 times/day</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 time/day</td>
<td>7%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 time/2 day</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A few times a week</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>68%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Dental Mouthrinse Yes (44%)</td>
<td>2 times/day</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 time/day</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 time/2 days</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A few days a week</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>56%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Criteria for choosing toothbrush and toothpaste in the sample

<table>
<thead>
<tr>
<th>Toothbrush Choice</th>
<th>Cost</th>
<th>9%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brand</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>Aesthetic (colour, design)</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Advertisement</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Dentist’s recommendation</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>Random Choice</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>Other reason</td>
<td>10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toothpaste Choice</th>
<th>Cost</th>
<th>6%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Brand</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>Flavour-Fragrance</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Advertisement</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Dentist’s recommendation</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>Random Choice</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>Other reason</td>
<td>11%</td>
</tr>
</tbody>
</table>
As far as nutrition habits are concerned, 88% consume 1 to 3 sugar meals per day. Only 5% consume more than 5, and 4% none sugar meal per day (Tab. 6). For the number of meals and snacks during a day, 79% answer that they receive less than 5, 19% 5 to 7, and 2% more than 7. Also, statistically significant difference was found in the frequency of sugar meals received between smokers and non smokers ($p<0.05$). In detail, 11.1% of the smokers in the sample consume sugar meals 4 or more times a day in contrast to 6.25% of non-smokers for the same frequency (Tab. 7).

For personal perception of their oral hygiene, 71% of the participants evaluated it as satisfactory, while at the same time 61% of the sample stated that they believe they are not using all necessary oral hygiene methods for their oral health reassurance. 80% were willing to seek oral hygiene methods either with access in valid sites in the web or by visiting their dentist.

### Table 6. Nutrition Habits in the Sample

<table>
<thead>
<tr>
<th>Nutrition Habits</th>
<th>None</th>
<th>4%</th>
<th>1 time</th>
<th>45%</th>
<th>2-3 times</th>
<th>43%</th>
<th>4-5 times</th>
<th>3%</th>
<th>&gt;5 times</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar meals consumption frequency in a day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of meals and snacks in a day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As far as nutrition habits are concerned, 88% consumes 1 to 3 sugar meals per day. Only 5% consume more than 5, and 4% none sugar meal per day (Tab. 6). For the number of meals and snacks during a day, 79% answer that they receive less than 5, 19% 5 to 7, and 2% more than 7. Also, statistically significant difference was found in the frequency of sugar meals received between smokers and non smokers ($p<0.05$). In detail, 11.1% of the smokers in the sample consume sugar meals 4 or more times a day in contrast to 6.25% of non-smokers for the same frequency (Tab. 7).

### Discussion

Augmentation of the macrobiotics load in the oral cavity leads with different mechanisms in 2 completely different pathologic situations: caries, as far as the hard dental tissues are concerned, and the gingivitis and periodontitis, as far as the soft tissues of the oral cavity are concerned. The need for preserving the load in low levels is related with absence of the previously mentioned diseases and also with the diminishment of the risk for development of other conditions that have been related today with the dental diseases.

### Periodontitis and Systemic Diseases

As far as periodontal disease is concerned, there is today intense evidence that it is related with cardiovascular diseases [24-26]. This relationship renders necessary the control of every infection, as well as the periodontitis, especially in patients suffering from diabetes for the improvement of their overall health. As a result, the need for implementing impeccable dental hygiene also emerges.

### Table 7. Frequency of sugar meals and smoking

<table>
<thead>
<tr>
<th>Frequency in sugar meals consumption</th>
<th>Smokers</th>
<th>Non smokers</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>3 (8.3%)</td>
<td>1 (1.6%)</td>
<td>4</td>
</tr>
<tr>
<td>1 time/ day</td>
<td>13 (36.1%)</td>
<td>32 (50%)</td>
<td>45</td>
</tr>
<tr>
<td>2-3 times/ day</td>
<td>16 (44.4%)</td>
<td>27 (42.2%)</td>
<td>43</td>
</tr>
<tr>
<td>4-5 times/ day</td>
<td>3 (8.3%)</td>
<td>0 (0.0%)</td>
<td>3</td>
</tr>
<tr>
<td>&gt;5 times/ day</td>
<td>1 (2.8%)</td>
<td>4 (6.3%)</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>36 (100%)</td>
<td>64 (100%)</td>
<td>100</td>
</tr>
</tbody>
</table>

p-value <0.05

In addition, there is strong evidence that relate periodontitis with interactive relations to diabetes mellitus [24-26]. This relationship renders necessary the control of every infection, as well as the periodontitis, especially in patients suffering from diabetes for the improvement of their overall health. As a result, the need for implementing impeccable dental hygiene also emerges.

Also, in bibliography there has been evidence that relates bad oral health with chronic obstructive pulmonary diseases [27-30]. This correlation up to today does not include acute pulmonary infections.

Finally, there is the correlation between periodontal disease and the preterm birth, which is still under investigation, but has some strong indications and that has been supported in a number of studies in the USA [31-33]. These studies suggest an influence of the presence and evolution of periodontitis in the frequency of preterm birth.
The above suggest that there is evidence nowadays that connects the presence of periodontitis with certain systemic diseases. Also, the need for implementing dental hygiene as well as preventing dental infections that can relate to the overall health emerges.

**Caries and Theory of the Focal Infection**

As far as the influence of caries in general health is concerned, from ancient times in Greece, Hippocrates described the therapy of arthritis with the use of a tooth extraction34. Later, the theory of the focal infection emerged after the establishment of the microbiological criteria of Robert Koch (1870-1880)35,36. In 1900, British physician William Hunter suggested that the oral sepsis is the cause of systemic diseases35,37. In dentistry, Weston Price in 1923 reported that teeth host bacteria that produce toxins after endodontic treatment34. As a result, dentistry entered an era where dead or endodontically treated teeth were extracted34,38. In 1919, C. Edmund Kells spoke out in public the first criticism against this theory39. The end of it came in 1952 from the Journal of the American Dental Association40. The revival of the theory came in the in 1952 from the Journal of the American Dental Association40. In 1900, British physician William Hunter suggested that the oral sepsis is the cause of systemic diseases35,37. In dentistry, Weston Price in 1923 reported that teeth host bacteria that produce toxins after endodontic treatment34. As a result, dentistry entered an era where dead or endodontically treated teeth were extracted34,38. In 1919, C. Edmund Kells spoke out in public the first criticism against this theory39. The end of it came in 1952 from the Journal of the American Dental Association40. The revival of the theory came in the 90s with epidemiological studies that relate dental infections with systemic diseases bringing the concept of periodontal medicine in the forefront41. In a recent paper of the Journal of Indian Society of Periodontology (2012), it is stated that the oral cavity can act as a source of pathogenic microorganisms that can act in distant body parts, especially in immunocompromised hosts42. From 1920 until today, research has been driven to pleomorphic bacteria (especially L forms and Mycoplasma) where there is strong evidence for their etiological role in cryptic etiology diseases and especially autoimmune diseases43,44.

The acknowledgement of these relations between oral and systemic diseases also emerges from the growing interest for creating scales and indexes of oral health. These tools apart from recording the oral health levels in individuals and populations can also be used for relating these levels with systemic diseases45.

**Molecular Basis of the Oral Cavity Diseases**

Today, more than ever before, the role of the genetic background and its possible participation in the oral cavity diseases is investigated. Although the microbiological etiology of these diseases carries huge scientific documentation, already from 1960, modern multifactorial models relate only 20% of the extent of periodontal destruction with the presence and the microbial load. The final clinical image is finally formed from both environmental and genetically defined factors46,47.

As far as periodontitis and its appearance or evolution is concerned, quite a few studies point genetic relations, mostly destructive, with mechanisms that control the organism's defense. For example, the aggressive periodontitis has been related to the type of CD32 receptors of polymorphonucleares in conjunction with the elevated production of IgG248,49. At the same time, the interrelation of the parallel presence in both genes of the allele 2 of Interleukin 1 (IL 1) and the severe periodontal destruction is widely accepted50. This relationship has been documented enough and is also used as a diagnostic tool.

For the appearance of caries, there is evidence that supports the presence of a relation with genetic background. The beginning of these investigations came with the genetic studies in twins. The concordance rate, the percentage of infection of 2 twins from the same multifactorial disease, is one of the indexes used. When this degree appears to be greater in monozygotic than dizygotic, there is important evidence that there is genetic contribution51. In 1930 Goldberg in such a study demonstrated that there is evidence of participation of the genetic factor in caries but concluded that such participation only contributes in the process52. Also, other studies supported the contribution of the genetic background in the development of caries. Memorable is the Minnesota study of twins reared apart, where twins that were reared apart participated. The participants were older than 40 years old and were exposed to different environments from shortly after their birth to the time of the study. This study showed evidence of the genetic factor participation in caries' experience again, this time setting aside the environmental factors that differed in the twins53,54.

Although the above studies proved the involvement of genetic background in the appearance of caries, they did not succeed in connecting caries with specific genes.

Another direction of studies is the existence of syndromes that relate to morphological alterations of enamel and render it more susceptible to caries. For example, one of the syndromes that cause alterations to hard dental tissues and increased caries susceptibility is epidermolysis bullosa (EB). In 1993 Wright reached the conclusion that 2 types of this syndrome are related to the increased incidence of dental caries since they alter the hard tissues and render it more susceptible to caries55.

A last direction of studies refers to the possible relationship between salivary function and the existence of xerostomia with the caries incidence56.

It has become obvious from the above that the existence of a genetic influence in the appearance and evolution of oral cavity diseases, caries and periodontitis, is under investigation. The huge progress of genetics in nowadays allows the genetic control of the patients aiming in providing a personalized plan of therapy or prevention to each patient. If these scenarios are affirmed in the future, the significance of oral hygiene and its methods will become degraded, whereas other methods aiming to the specific factor responsible for the disease will arise.
Related Studies for Oral Hygiene and Nutrition Habits

Similar studies to the present one have been conducted in many countries worldwide and in different population groups (students, children, elders, adults etc). The results of these studies resemble in most of their outcomes. The frequency for brushing is recorded as 70% twice a day\cite{57,58,59}. Women seem to present a greater frequency in brushing as well as better oral health\cite{57,58,60,61} but also display a higher frequency of dental visits\cite{59}. The satisfactory oral hygiene habits relate to the female gender, the higher level of education, the non smokers and the patients who visit the dentist for preventive reasons\cite{58}.

The percentage in the samples that uses dental floss daily is minor\cite{57,58,59}. An important finding in bibliography is that a vast majority of children have been informed from school\cite{59,62}. The family also plays an important role, and this influence has been found in acquiring oral hygiene habits and in the frequency of brushing\cite{60,61}.

The Europeans' dental visiting frequency is averaged 2 times per year. 4 out of 10 European citizens visit once yearly, while 34% 2 times per year, 10% 3 and 13% 4 or more. For Greece, 2.7 visits per year are recorded\cite{64}. For the reason of dental visits, 50% of the Europeans is motivated for a check-up or debridement, 33% for a routine treatment and 17% for an emergency situation. Prevention is the main reason of the visit for United Kingdom (72%), Denmark (69%), Italy (67%) and Sweden (60%). In Greece, 42% visit their dentist for prevention according to the European Committee and at the same time the percentages rise for women and young adults\cite{64}.

Similar studies have been performed regarding nutrition habits of some population groups. In an epidemiological study of König et al\cite{65}, no statistically significant difference due to gender were observed related to nutrition habits. The frequency and quantity of receiving sugar meals is related to caries susceptibility\cite{66}. Ismil et al\cite{67} reported that people aged 9 to 29 present greater risk for caries as the frequency of sugar meals received increases. The consumption of 450gr of refreshment between meals per day presents 1.86 greater possibility of high DMFT value\cite{67}. Also Burt et al\cite{68} came to the same conclusion about sugar consumption. In a study from Hinds et al\cite{69} in 1500 preschool children, 22% of low consumption of sugar meals presented caries compared to 40% of high consumption of sugar meals. Similar results about sugar meals were found in a study with children 4 years old where the dmft value was double for sugar consumption in more than 4 meals per day\cite{70} as well as in a study of Holbrook et al\cite{71}.

Europeans receive an average of food or drink 5 times per day. 30% reports at least 6 intakes, while 47% receives up to 4. In Greece, 3.9 meals are received in average. 15% of Europeans receives sweets often in their nutrition, while for Greeks the percentage rises to 20%. Refreshments present a high resonance in Europe, where 19% is consumed often - 21% in Greece. Young adults aged 15 to 24 and working Europeans present higher frequency in consumption\cite{64}.

Prevention and Crisis

The question that arises is in what degree is prevention affected by the socio-economic crisis that has arisen in Greece but in the rest of Europe too in the past few years. Studies in Greece show that there is a correlation between the provided health services and the crisis. The economical depression in Greece creates injustices in the accessibility of health service\cite{72}.

13% in average of the state's budget in the European Union member states end in Health\cite{73}. In 2010 the budget for health remained stable in many countries, whereas in others it diminished\cite{73}. According to the records of the European Observatory for health and security issues and the Global Organization for Health, there is an augmentation, especially in Greece and Spain, in the difficulties to access primary health care\cite{73}. In Estonia, Ireland, and Slovenia the nations' provided dental care are in decline while in Iceland the exemptions from dental charges in low-income people are expanding\cite{73}. In Iceland, there seems to be no negative effect of the economic crisis in the dental habits of the population\cite{74}.

The economical crisis overall has led many governments in reduction of the state expenses for health\cite{73}. The prevention due to the economical but also social crisis has been sidelined and neglected both from societies and governments.

Conclusion

The information regarding oral hygiene and nutrition habits in a population group can help in resolving the problems that may be observed.

Half of the sample hasn’t received at school visit by a dentist in order for him to inform them about methods of improving their oral health and to promote the value of prevention in modern dentistry;

More than one third of these participants visits their dentist at least once a year, for preventive reasons and has obtained the habit of brushing their teeth 2 to 3 times per day;

Statistically significant difference observed between females and males concerning their frequency in brushing has appeared before in the literature\cite{13,57,58,60}.

The higher frequency in consuming sugar meals from smokers against non-smokers is also important. Other papers report similar results: satisfactory level of oral health shows a higher prevalence in women, in non-smokers and people of a higher educational level\cite{13,75,76};
The use of complimentary methods for oral hygiene is considered poor and at the same time 1 out of 5 participants stated that they have never received dental debridement up to today.

As far as nutrition habits are concerned, the adoption of a balanced nutrition that will provide all the necessary elements for the organism is highly important. In the current study, the consumption of sugar meals is considered satisfactory, since such meals are received once to 3 times a day.

In an educational system of the 21st century and in a member state of the European Union, the lack of preventive dentistry appears to constitute a problem. It is important that the reassurance of oral health becomes a routine, since it can lead to a decline of the prevalence for periodontal disease and caries when combined with correct and balanced nutrition.

Worth noting is the finding of absence of statistically significant difference in habits due to the different available monthly budgets in young people in Greece. The lack of adequate statistically significantly results could be partially explained by the size of the sample, indicating that further studies, including bigger samples, should be conducted to bring results that could be implemented in everyday practice of dentistry.

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SUMMARY

Root fractures are relatively uncommon among other dental traumas and mostly affect the anterior dentition. This case report presents the endodontic and prosthodontic management of a maxillary central incisor with a combined fracture in the middle third of the root and the crown, as well as the 7-year follow up of the case. The healing potential of a horizontal root fracture in the middle third of the root is highlighted when appropriate treatment is applied. MTA used for obturation of the coronal fragment, induced hard tissue formation apically and promoted healing in the area, while the 2mm MTA left as apical barrier at the second stage of re-treatment and obturation with gutta-percha prevented its extrusion. The multidisciplinary approach in the management of such cases ensures a long term survival.

Keywords: Horizontal Root Fracture; MTA; Tooth Crown Fracture; Apical Barrier

Introduction

Root fractures can be defined as fractures involving the dentine, the cementum as well as the pulp. They are relatively uncommon among dental traumas, comprising 0.5-7% and 2-4% of the injuries affecting the permanent and primary dentition respectively. They are more common in teeth with complete root development. Root fractures usually appear in central (68%) and lateral (27%) maxillary incisors, whereas they rarely affect (5%) mandibular incisors. The International Association of Dental Traumatology (IADT) has recommended a specific protocol to follow in cases of horizontal root fractures. In particular, repositioning and immobilization of the coronal fragment through fixation to neighbouring teeth, as well as endodontic treatment, where appropriate, should be performed in these cases.

The pulp of approximately 5-25% of teeth with horizontal root fractures will become necrotic and endodontic treatment will be required. Endodontic treatment of teeth with fracture in the cervical part of the root has been shown to be of poor prognosis, especially in patients with poor oral hygiene. Removal of the coronal fragment and orthodontic or surgical extrusion of the apical fragment should be considered in these cases.

Conservative endodontic treatment of teeth with fracture in the middle or apical part of the root may concern the coronal fragment alone or both fragments. The choice depends on radiographic findings, such as peri-radicular changes, the width of the pulp lumen, the separation or not of the fragments, and pulp vitality in the apical fragment. The coronal fragment may be filled with gutta-percha immediately after chemo-mechanical preparation if the anatomy of the root canal permits obturation without the risk of material extrusion. On the other hand, in cases of wide root canals, a hard tissue barrier formation is required prior to final obturation of the coronal fragment. Calcium hydroxide has been widely recommended for this purpose.

MTA has also been proposed and used for single visit apexification, presenting successful outcomes and at the same time presenting the highest fracture resistance after one year when compared to untreated teeth and teeth treated with calcium hydroxide. The aim of this case report is to present the endodontic and prosthodontic management of a maxillary central incisor with fracture in the middle third of the root.
Case Report

A 13-year old male patient with non-contributory medical history presented for evaluation and treatment of his maxillary central incisors suffering traumatic injury due to an accident in the previous day. Clinical and radiographic maxillofacial examination revealed no trauma of the soft tissues and absence of any fracture of the maxilla, mandible or other facial bone. Oblique crown fractures were evident in both maxillary incisors, at the level in-between middle and cervical third of the crown labially, propagating towards the neck of the teeth palatally. Concussion injury of the right incisor was also diagnosed. The incisors did not respond to electrical and thermal vitality tests; their mobility was within normal limits. A periapical radiograph of the affected teeth revealed complete apex formation of both teeth with no obvious sign of a root fracture (Fig. 1).

Repositioning of the coronal fragment of the left incisor was not required since the distance between the 2 fragments was minimal. A soft diet and avoidance of chewing with the anterior teeth were recommended. A recall programme was explained to the patient and the first appointment after 6 weeks was scheduled. The patient did not comply with the recall appointments. He reappeared after 3 months with an endodontic treatment of the right central incisor by his general dentist. A periapical radiograph of the affected teeth revealed the presence of a horizontal mid-root fracture at the left incisor. Due to the negative vitality test at the left incisor at that time, root canal therapy was initiated and was performed only in the coronal fragment (Fig. 2). A week later the instrumented canal up to the fracture line of the left central incisor was filled with MTA. The exposed dentin at both teeth was covered with resin composite crowns serving as interim restorations (Fig. 3).

The patient was advised to conform to the scheduled recall appointments. However, he came back 5 years later for permanent prosthetic restoration of the involved teeth. Clinical examination at that time revealed no symptoms from the affected area. Radiographic examination revealed normal peri-radicular tissues, formation of a hard tissue barrier apically in the coronal fragment of the left incisor and obliteration of the pulpal lumen in the apical fragment. Permanent prosthetic restoration of the teeth was decided at this time (Fig. 4).

Due to secondary caries in the proximal area, as well as loose of retention of the interim crown and consequently possible recontamination of the root canal, endodontic re-treatment was decided prior to the final restoration. MTA was removed with the aid of ultrasonic tips (EMS, Switzerland) and a modified #3 gates-glidden drill, leaving 2 mm of MTA as an apical barrier and root canal preparation was performed with K-files up to #100.
under copious irrigation with 2.5% NaOCl. The root canal was obturated by using the warm vertical gutta-percha compaction technique with epoxy resin based sealer - AH26 silver free Densteply (Fig. 5). Both central incisors were prepared with the use of a cylindrical diamond bar. A 1mm axial reduction was performed and a 90 degrees shoulder with a rounded internal gingivoaxial line angle was created. Due to the importance of the aesthetic element in the labial area, disilicate glass ceramic was utilized for the crown construction (Empress 2, Ivoclar, Lichtenstein).

The short root canal length of the fractured left incisor, the need for preservation of the root canal sealing integrity, the extremely narrow buccal-lingual shape of the canal of the right incisor, the willingness for homogeneity concerning the crowns of both teeth and simultaneously the necessity for root canal access in case of endodontic treatment failure prevented the preparation and fabrication of a typical post. Instead, shallow 3 mm post wells were prepared apically to the pulp chamber, removing the gutta-percha with the aid of system B heat source (SybronEndo-USA) and the ceramic crowns were modified into an extremely short “Richmond” type. For the impression, a 2-phased silicon was used (Silaplast-Silasoft S, Detax GmbH&CoKG, Ettlingen, Germany). After local anesthesia, 2 gingival retraction cords (Ultrapak, Ultradent Products Inc, Utah, USA) were positioned in both teeth (Fig. 6).
The colour was selected with the use of a Vita Shade Guide in natural light and was evaluated intraorally during “biscuit” stage; the final shade was verified upon glaze completion and prior to cementation. Further on, the crowns were cemented with a resin cement (Optec, Jeneric/Pentron Inc, Wallingford CT, USA) following manufacturer’s instructions, and a fine articulating paper (Accufilm II, Parkell, Farmingdale, USA) was utilized for the occlusal evaluation and adjustment (Fig. 7). Finally, the patient was given instructions for proper oral hygiene and appropriate recall protocol (Fig. 8).

Discussion

Root fractures usually result by a frontal impact, which creates compression zones labially and lingually or by restorative procedures. Horizontal root fractures usually take place in the middle third of the tooth root, whereas they rarely appear in the apical third. Horizontal root fractures may not be visible in the first radiograph taken immediately after the incidence (Fig. 1) but may need more time for the fragments to separate and become evident (Fig. 2). Also the sensitivity results may not reflect the pulpal status and thus monitoring of the healing is recommended.

The healing of transverse root fractures can be accomplished by the interposition between fragments of hard/calcified tissue, connective tissue, both bone and connective tissue or granulation tissue. The first one is considered to be the most favourable type of healing. Some case reports demonstrate spontaneous healing without any treatment.

According to the IADT, repositioning of the coronal fragment is supposed to be essential for the successful healing of the horizontal root fractured teeth when the fragment is dislocated. Optimal repositioning (less space between the fragments) leads to healing with disposition of hard tissue more frequently than with incomplete repositioning. The fixation period should be approximately 4 weeks to ensure sufficient hard tissue formation. In the present case, there was no need for splinting due to the absence of fragment mobility.

The evidence of pulpal necrosis in the coronal segment during follow up examinations outlines the need for root canal therapy. The decision may be taken after 3 months of follow up if the results of pulp vitality tests are still negative. Endodontic treatment is not required as long as the pulp retains its vitality. In the present case, the vitality tests were negative. This was expected as the risk of necrosis was considered higher when compared to teeth with open apices. The absence of pathologic changes periapically was indication for endodontic treatment only in the coronal fragment. This favoured healing since research has indicated less favourable healing results in cases where endodontic treatment has been performed at both fragments. This could be attributed to complications due to impaction of necrotic tissue and filling debris between the fragments during instrumentation, as well as overfilling with gutta-percha. In cases of delayed necrosis of the apical fragment, its surgical removal may be attempted.

The proportion of healing of teeth filled with gutta-percha in only the coronal fragment can reach 76%; a higher percentage of 86% has been observed when Ca(OH)2 placement has been preceded.

In the present case, MTA was selected to serve as an apical barrier. MTA presents advantages such as: biocompatibility, non-mutagenicity, encouragement of hard tissue deposition, and resistance to bacterial penetration due to its ability to adapt to adjacent dentin and form superior dentin bridges when compared to Ca(OH)2. Furthermore prolong application of Ca(OH)2 in extracted bovine teeth has weakened dentin’s resistance to fracture. This fracture resistance was improved when Ca(OH)2 was replaced with MTA after a month. Holland et al. investigated the periapical tissues’ response to MTA in dogs and resulted that MTA exhibited better biological properties and at the same time did not produce inflammatory reactions in the periapical tissues. In addition, MTA has been shown to hold several cell-surface interactions such as: cell attachment, cell proliferation, concerning gingival and periodontal ligament fibroblasts and gene expression as well, for example expression of osteoblast-associated proteins. For these reasons, MTA...
has become a new challenging material when dealing traumatic injuries of the teeth. In the presented case, MTA induced the formation of an apical hard tissue barrier and while serving as an apical barrier, prevented the material extrusion into the peri-radicular tissues.

The interesting aspect of this case report is the simultaneous creation of a crown fracture and a horizontal mid root fracture in the left incisor, which poses a lot of questions concerning the mechanism, the force characteristics leading to it, as well as the prognosis. Vertical forces are considered to cause high stress concentrations in the apical area of teeth and are related to oblique crown-root fractures and oblique root fractures. The analysis of forces in vertical and horizontal components might explain the double fracture of the current case. Furthermore, the significant vertical component of the force might be the cause of the extremely narrow space created in-between the fractured parts that finally favoured the uncomplicated survival of the tooth.

This case report highlights the healing potential of a horizontal root fracture in the middle third of the root when appropriate treatment is applied. The obturation of the coronal fragment with MTA prevented material extrusion into peri-radicular tissues and induced formation of a hard tissue barrier and consequently healing.

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Sandwich Osteotomy of the Atrophic Posterior Mandible Prior to Implant Placement: A Case Report

SUMMARY
The aim of this report was to present a patient with atrophic posterior mandible, rehabilitated with endosteal dental implants after a sandwich osteotomy of the mandible. Some aspects of the procedure are discussed as well as its outcome.

Keywords: Mandible, atrophic; Sandwich Osteotomy; Dental Implants

Introduction
An extensive loss of the alveolar ridge and teeth in the posterior mandible presents a complex case for reconstruction. Several augmentation techniques are currently utilized to create sufficient bone volume for predictable placement of endosseous implants in such cases. The numerous surgical approaches were proposed, such as placement of autogenous bone grafts, alloplastic materials, and recently, alveolar distraction osteogenesis.

After the teeth were lost, the alveolar ridge undergoes a continuous resorptive process that is severely accelerated by denture wear. This process is the most pronounced during the first 12 months after the tooth extractions. Excessive resorption of the alveolar ridge in a vertical direction may compromise possibility of implant placement and prosthetic rehabilitation. The continuing resorption of the alveolar ridge will eventually result in insufficient bone superior to the inferior alveolar nerve (IAN), making dental implant placement impossible without performing augmentation of the alveolar bone in terms of height. The augmentation procedure above the IAN provides sufficient bone for implant placement and allows for long-term successful restoration of missing teeth with implant-supported prostheses. All the methods suggested should take into consideration patient-related issues, such as postoperative pain, swelling, sensory nerve disturbances, incidence of graft failure and resorption, as well as functional long term restoration.

Reconstruction of vertically atrophic posterior mandibles with onlay bone grafts has been well documented, but the results have not been promising. Different donor sites (mental symphysis, calvaria, iliac crest) have been used as sources of autogenous bone. Vermeeren et al. demonstrated bone resorption up to 50% even when autogenous onlay grafts were used. Rigid fixation of the graft material is imperative to prevent micro-rotation, which can result in non-union or fibrous union of the graft material. Guided bone regeneration was proposed in a 1991 report by Dahlin et al. The use of expanded polytetrafluoroethylene membranes is a treatment option for posterior mandibular reconstruction that has been used with varying degrees of success, as reported by various authors. Tinti et al. commented that vertical augmentation is a highly sensitive technique, predictable only when surgical protocol is followed strictly. Vertical ridge augmentation of the atrophic maxilla and the mandible by means of a titanium mesh and autogenous bone grafts has been used successfully and has gained popularity since its introduction. However, the titanium mesh used must be fixed by titanium screws, and infection is a common complication that may cause loss of the grafted bone, resulting in failure. Visor osteotomy was first described in 1975 by Harle to increase the absolute height of the atrophic edentulous mandible. In this technique, the alveolar ridge of the mandible is osteotomized and moved on the visor principle. The 2 bony parts require fixation with wires. When the procedure is applied to vertical ridge augmentation in the posterior mandible, the mandible is split vertically and, unfortunately, the width of the ridge is reduced. The sandwich technique, which uses bone block graft positioned between osteotomized bony segments,
was developed by Schettler\textsuperscript{21} in 1974. Stoelinga et al\textsuperscript{22} combined the visor osteotomy and sandwich techniques to augment the severely atrophic edentulous mandible with success\textsuperscript{22}. The aim of this report is to present a case of a patient with atrophic alveolar ridge, treated with sandwich osteotomy and rehabilitation with dental implants.

**Case Report**

A 49-year-old female patient presented with a bilaterally atrophic mandible and requested implant rehabilitation. A thorough radiographic examination using cone-beam tomography revealed mandibular ridges that were not suitable for immediate implant placement in terms of height (6.2 mm on the left side and 7.2 mm on the right side). The patient was suggested the augmentation of the ridge using an inter-positional block of allogenic bone under general anesthesia. The patient gave her written informed consent, and a preoperative radiograph and computerized tomography (CT) scan were obtained (Figs. 1 and 2). A horizontal incision was made below the mucogingival line in the edentulous area (Fig 3). The mucoperiosteal flap was raised to expose the mental foramen, and the mental nerve was identified. Two vertical and one horizontal bone cuts were then made 2 mm above the mental foramen. The more mesial vertical cut was performed 2 mm away from the neighbouring tooth. A SG1 handpiece of NSK VarioSurg piezoelectric surgery was utilized to complete the osteotomy. The bone segment was then raised upward to leave space for the bone graft, with no disturbance of the lingual periosteum (Fig 4). An allogenic bone block was inserted between bone segments and placed in the middle of the space formerly created, without any fixation between the basal and the cranial segment (Fig. 5). The remaining spaces in both ends were filled with particular bone graft. The wound was then closed primarily with 4-0 vicryl U-shaped suture.
A postoperative X-rays were obtained (Figs. 6 and 7) to assess the new vertical height of the mandible. After 3 months, a crestal incision of the attached gingiva was made. The mucoperiosteal flap was detached and endosseous implants were inserted using the classical approach, 2 into the right side, and 3 in the left side of the mandible, measuring 4 mm in diameter and 10 mm in length (Figs. 8 and 9). The primary stability was relatively high and allowed a placement of the healing abutments. The postoperative period was uneventful and the aesthetic result was satisfying (Fig. 10). The patient was followed monthly.

**Discussion**

Moderate to severe posterior mandibular atrophy was successfully treated with inter-positional sandwich osteotomy bone grafts. This led to the successful placement of implants and fixed prosthetic implant restorations, thus allowing ever more patients to be considered for implant treatment. The placement of implants of 10 mm in height was possible. The technique, which has been recently revisited, permits dental rehabilitation in terms of raising the bone above the
nerve, reshaping the alveolar crest, and normalizing the interocclusal distance and the crown-implant ratio.

References


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SUMMARY

Objectives: The purpose of this case report is to evaluate an abscess formation due to intralesional methylprednisolone acetate application to a patient with erosive oral lichen planus.

Case Report: A 47 years old male patient with a histopathological and clinical diagnosis of erosive oral lichen planus (2x3cm) was treated with intralesional methylprednisolone acetate injection (5 injections of 0.1cc each around the lesion every 15 days). An infection developed after the third application. Magnetic resonance imaging (MRI) revealed an abscess formation, and the patient was hospitalized for further treatment.

Conclusion: Although systemic adverse effects are seldom seen in intralesional steroid application, mucosal atrophy is the main local side effect of this method. In this case, the cause of abscess formation could be an inoculation of the oral flora into submucosal tissues. Therefore, asepsis and oral disinfection are mandatory in intralesional applications.

Keywords: Intralesional steroid; Complication; Abscess Formation; Lichen Planus

Introduction

Oral lichen planus is a chronic inflammatory immunological reaction in which epithelial basal cell damage produces mucosal lesion of various types. It tends to be chronic; complete remissions are either non-existent or infrequent, particularly in patients with erosive lesions, and exacerbations are unpredictable and common.

The large number of medication that has been used in the management of the disease; however, not any agent could control the symptoms in all patients. The mainstay of the treatment of oral lichen planus remains on corticosteroids, which can be used topically, intralesionally, or systemically. Of these treatment forms, intralesional injection of steroids can improve the symptoms.

This study is to evaluate one possible complication of the intralesional corticosteroid injection to a patient with oral lichen planus.

A Case Report

A 47-year-old male patient with a painful lesion of the left buccal mucosa was referred to the Department of Oral Diagnosis and Radiology, Faculty of Dentistry. Examination revealed an ulcerous lesion (2x3cm) with surrounding erythematous area and Wickham’s striae (Fig. 1). An incisional biopsy specimen was taken from the lesion and histopathologically diagnosed as erosive oral lichen planus. The treatment plan included 10 intralesional injections of methylprednisolone acetate, each 0.1 cc and 1 cm apart, at intervals of 15 days.

An infection with an extraoral minor swelling of the left cheek developed after third application. As abscess findings were absent, it was thought to be sialoadenitis, and sipramycine (3000000 I.U.x2, rovamycine) tablets were prescribed (Fig. 2). The swelling increased, and phlegmonous appearance was detected after 2 days (Fig. 3). The patient was sent for MRI examination, and the medication was changed to amoxicillin/clavulanate potassium (klamoks BID, 2x1) and ornidasole (250 mg, 2x2) tablet combination.
Figure 1. Ulcerous lesion with surrounding erythematous area and Wickham’s striae

Figure 2. Minor swelling of the left cheek

Figure 3. Extraoral view of the patient 2 days later

Figure 4. MRI – axial (a) and coronal (b) plane T1W images

Figure 5. MRI - axial (a) and coronal (b) plane T2W images
Discussion and Conclusion

The main treatment for erosive and atrophic forms of the oral lichen planus is corticosteroid therapy\(^1,4-12\). It is reported that even complete healing can be observed after systemic corticosteroid application\(^5,11\). This kind of application is limited as the side effects of systemic corticosteroids are much more exerted than those after the other steroid treatments.

Successful results have been reported for local corticosteroid treatment of oral lichen planus\(^3,5-10\),\(^13,14\),\(^16-19\). However, it may be difficult to apply the drug to the proper sites in old patients. Optimal effect can be achieved with 5-10 applications a day\(^10,11\). Furthermore, swallowing and salivary wash-out can prevent the drug adhesion to the lesion. Thus, the absorption through the semi-permeable mucosa is decreased\(^2,6\).

Many studies have shown that intralesional therapy with steroid anti-inflammatory drugs is useful in controlling ulcerative and inflammatory oral mucosal diseases, especially oral atrophic and erosive oral lichen planus\(^5,6,11-13\). This local treatment of steroids is based on the concept that a high activity could be produced at the site of administration and, at the same time, the severity of systemic side-effects may be minimized or avoided\(^2-7\).

The most frequent side-effects in the intralesional application are tissue atrophy and candidiasis\(^5,8,9,13,14,16-19\). In this case, an abscess formation was the complication. This abscess formation may be due to the inoculation of the oral flora to the deep tissues during the injections. Antiseptic mouthwashes can help to prevent this complication and must be used during the treatment.

MRI revealed an abscess formation (Figs. 4 and 5) between muscles (6x4 cm). Patient was hospitalized, and drainage of the abscess was performed (Fig. 6).

References


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SUMMARY

Background: Angiokeratoma is an asymptomatic, hyperkeratotic, capillary disorder of the skin present as solitary or multiple, keratotic papules or plaques, which may also be related to Fabry disease. Oral involvement may be observed in cases of widespread mucocutaneous angiokeratomas, whereas solitary buccal angiokeratoma without systemic/cutaneous involvement is extremely rare.

Case Report: A 45-year-old woman was referred with a 3-month, painless, bluish lesion, located on left buccal mucosa. The medical record of the patient was free of any systemic disease or medication. After a careful clinical oral, mucosal as well as skin examination, an excisional biopsy was taken. A routine haematoxylin-eosin staining and additional immunohistochemistry were performed. Differential diagnosis included haemangioma, haematoma or lesions of melanocytic origin. Clinical examination showed a solid, lobulated bluish lesion, located on left buccal mucosa without other skin or mucosal involvement. The microscopic findings revealed dilated vascular spaces covered by normal endothelium without atypia, extending into the epithelium, indicating the diagnosis of angiokeratoma.

Conclusions: Despite its rare occurrence, solitary angiokeratoma of oral mucosa should be included in the differential diagnosis of black-bluish lesions. Further investigation for other similar lesions throughout skin or mucosa is needed to avoid complications as haemorrhage.

Keywords: Solitary Angiokeratoma; Oral Mucosa

Introduction

Angiokeratoma (AK) is a rare capillary vascular disorder, characterized clinically by asymptomatic, solitary or multiple, keratotic papules or plaques, and histologically by benign vascular ectasia of the papillary dermis. Angiokeratomas (AKs) have been described as either a generalized systemic form, presenting as multiple asymptomatic papules on the skin, associated with metabolic diseases, or a solitary cutaneous form. On the basis of their clinical appearance, AKs have been grouped traditionally into localized (purely cutaneous) or widespread types. Though all types differ clinically, they share similar histological features.

Mucosal involvement, including the oral cavity, has been reported both in systemic forms and as a component of localized ones. Oral mucosal angiokeratomas (OAKs) are most commonly seen as a component of diffused corporal angiokeratoma in Fabry syndrome. They may also be associated, uncommonly, with AKs of the scrotum and/or gastrointestinal mucosa (jejunum). However, AKs found exclusively in oral mucosa have been rarely reported as multiple or solitary, mainly located at tongue.

The aim of this report is to describe a rare case of solitary buccal AK based on clinical and immunohistochemical findings and additionally, we provide a brief review of the literature for OAKs.
Case Report

A 45-year-old woman was referred with a painless, black-bluish (non-homogeneous), solid, lobulated mass (0.5x1cm) located at left buccal mucosa (Fig. 1). According to the patient, the lesion appeared 3 months previously, and was not related to local trauma. It did not change considerably in size and colour, so far. Her medical history was free of any systemic metabolic or other disease. The initial clinical diagnosis included vascular malformations, such as haemangioma, traumatic haematoma or lesion originated by melanocytes. A careful examination of skin and other mucosal linings was performed and the oral lesion was totally excised under local anesthesia afterwards. Serial sections stained with haematoxylin-eosin revealed dilated vascular spaces covered by normal endothelium without atypia, which extended into the overlying epithelium (Fig. 2). In some of the vascular structures, small thrombi were seen. An additional immunohistochemical staining with CD34 (DakoCytomation, monoclonal mouse anti-human, clone QBEnd), by using the automated Envision/HRP immunohistochemical technique (DakoCytomation A/S, Glostrup, Denmark) was performed for better observation of the endothelium of vascular formations (Fig. 3).

The combined clinical and microscopic findings set the final diagnosis of a solitary oral angiokeratoma. In the last follow-up consultation, 1 year after surgical excision, the patient remained asymptomatic, with no evidence of recurrence.

Discussion

The current taxonomy of AKs includes the following types: (1) the generalized systemic type, or diffused corporal angiokeratoma of Fabry; (2) the bilateral form occurring in the dorsal of fingers and toes angiokeratoma of Mibelli; (3) the localized scrotal form angiokeratoma of Fordyce; (4) the usually solitary papular angiokeratoma; and (5) the multiple papular and plaque-like circumscribed angiokeratoma6.
Angiokeratomas (AOKs) have been rarely described in the oral cavity, mainly at the tongue, sometimes in the context of diffused corporal angiokeratoma (Fabry’s disease) or fucosidosis, where in mucosal involvement occur as part of a more generalized systemic disorder. The presence of swollen and vacuolated (lipid-containing) endothelial cells, in addition to typical AOK histopathology, is characteristically seen. Also, OAK is associated to AK of the scrotum, in the Fordyce type, or related to AOKs of scrotum plus jejunum.

Clinically, OAKs present as single/multiple, erythematous, shiny papules, which may be studded with keratotic tops. They are firm on palpation, non-tendered, show telangiectatic vessels on diascopy, and may bleed, occasionally. They may be misdiagnosed as hematomas, hemangiomas, lymphangiomas, focal epithelial hyperplasia, or nevi. Due to the low frequency of such a form of presentation, the clinical diagnosis is not always straightforward and the differential diagnosis must be established, not only with other vascular lesions, but also with melanocytic lesions of the oral cavity.

Although the first case of AK was reported more than a century ago, isolated OAKs appear to be a rare and relatively new subset, described for the first time in 1997 by Leung and Jordan. To date, only 10 case reports of OAK, mostly as solitary lesions, have appeared in the literature. However, it has been hypothesized that the lesion is probably more frequent than reported, due to misdiagnosis.

The tongue, with a predilection for a dorsal surface, appears to be the most common site of solitary OAK in the oral cavity. In most patients, the lesions develop in early childhood and, as in other types of AK, females are affected more frequently. Interestingly, multiple OAKs have been described exclusively in males.

Despite similar microscopic features in all types of AK with other vascular malformations, biopsy and diagnosis based on histology is necessary for the exclusion of melanoma or other melanocytic lesions. The microscopic features of hyperkeratosis, acanthosis, and papillomatosis of the epithelium that encloses partially or completely, dilated vascular spaces covered by normal-appearing endothelium and containing erythrocytes and thrombi from the papillary part of the corium are characteristic for the diagnosis of OAK. The immunohistochemical staining with CD 34 may be useful in order to distinguish the presence of vascular proliferation into the epithelium. OAKs are histologically similar to their cutaneous counterparts; the only difference described was the additional presence of parakeratosis.

Another main concern is the differential diagnosis of AK from circumscribed lymphangioma, which is a true tumor of the lymphatic capillaries.

Pathogenesis of AK is still uncertain. It is thought that the primary event is vascular ectasia within the papillary dermis just beneath the basement membrane. The epidermal pathological changes seem to be a secondary reaction. It has been speculated that the increased proliferative capacity on the surface of vascular malformations and the close proximity of the vascular spaces to the epidermis in AK could explain the reactive epidermal growth.

A recent classification has been proposed to denote solitary from multiple lesions, respectively, and this precise distinction between solitary and multiple lesions may help in management planning. The treatment of OAK is the complete surgical excision, not only for microscopic diagnosis but also to avoid bleeding. Alternatively, solitary AK may be treated by diathermy or cryotherapy, whereas multiple lesions will require laser excision. The excisional biopsy with detailed histologic examination is important to confirm the diagnosis, as demonstrated in our case.

Conclusion

Despite its rare occurrence, solitary angiokeratoma of oral mucosa should be included in the differential diagnosis of black-bluish lesions like hematomas, hemangiomas and of melanocytic lesions including melanoma or nevi. Also, multiple AKs in adulthood may be related to Fabry syndrome. Nevertheless, further investigation for other similar lesions throughout skin or mucosa is needed after the diagnosis of AK, to avoid complications such as haemorrhage.

References


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