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**DEVELOPMENT OF A PROGRAM OF MIXED RADIOLUCENT-RADIOPAQUE  
LESIONS IMAGING VIA RADIOGRAPHIC CASES FOR ACTIVE LEARNING IN  
ORAL MEDICINE**

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## 1. Objectives proposed in the project presentation

The **objectives** we set in the presentation of our innovation project were as follows:

1. Prepare a file of mixed radiolucent-radiopaque radiographic images of jawbone pathologies, all ordered by location.
2. Establish explanatory bases of each pathological process.
3. Point out a diagnostic guide for each image to properly establish a correct differential diagnoses.
4. Improve the acquisition of practical skills by using selected clinical images versus the conventional system of clinical practice.
5. Facilitate learning through personal research (from the student side) of links using keywords.

## 2. Reached objectives

We will comment on each of the objectives achieved on each of the sections:

1. Prepare a file of mixed radiolucent-radiopaque radiographic images of jawbone pathologies, all ordered by location.

We have prepared a file with 43 mixed radiographic images. Such lesions are included in the following sections to facilitate learning:

- “Mixed radiolucent-radiopaque periapical lesions”: we have included 15 mixed images located in the tooth apex area.
- “Mixed radiolucent-radiopaque pericoronal lesions”: we have included 8 mixed images located above the tooth crown.
- “Mixed radiolucent-radiopaque lesions not necessarily contacting teeth”: we have included 20 mixed images of the more common lesions not always related to the tooth structure.

2. To establish the major explanatory bases of each pathological process in relation to other pathologies of the same location.

We have made 4 flowcharts or outlines. The first flowcharts corresponding to the pathologies within the periapical lesions, another flowchart for the pericoronal lesions, and 2 flowcharts for the other section. The latter, we have divided the lesions in two groups to facilitate the comprehension process into related to surgical, traumatic, radiotherapy, systemic diseases, and medication history, and the into not necessarily previous conditions. In these flowcharts we resumed the most significant clinical characteristics of each and every one of the pathologies. We have focused primarily in those clinical and radiographic features that can help us differentiate a pathology from another.

3. Highlight the diagnostic process in each image, to properly establish the differential diagnosis.

In each of the flowcharts, we followed a guide to aid in the diagnostic process. In each of the 4 diagrams, we used a different process because it was impossible to group the lesions and make different sections as they were very different from each other. In some, we have begun by highlighting the most common pathologies and their clinical and radiographic features, vitality of related teeth (vital or non-vital); then we have highlighted the most common age of onset, symptomatology, appearance of the lesion (cloud-like, cotton-wool), if there is swelling present or not... The aim of this process has been to rule out pathologies from the same initial group, to be able to stay with the diagnostic pathology or a small group of pathologies.

4. Improve the acquisition of skills by using selected clinical radiographic images versus conventional clinical practice.

This objective has not been fully achieved because we will test it next academic year 2017/2018 in the subject of Oral Pathology for third year dental students. Yes, we tested the effectiveness of our project with a small group of students belonging to the Oral Medicine specialist degree. This academic year 2016/2017 in the postgraduate degree, we have 11 students, and each of them received lessons regarding the usual kinds of pathologies of the jawbone of which 25% belonged to mixed (radiolucent-radiopaque) lesions of the jaws. Also, 6 students randomly selected also received this form of learning (flowcharts, cases, images and clinical diagnosis). Of the 20 questions in the final exam pertaining to mixed lesions, the 6 students who received the material, answered correctly 90-100% of the questions, but the other group only answered 45-60% of them correct.

Anyway we believe that this study guide should be implemented in the next academic year, as we specified above, for its effectiveness among third year dental students.

5. To facilitate student learning through personal search using keywords  
We believe that by giving the student a knowledge base through flowcharts, and provide clinical cases, the student will develop the curiosity needed to seek new cases on the Internet or try to watch for images that we have not been able to locate due to low frequency. Anyway, this section also has to be checked after implementing it among third year dental students next academic year. In addition, as the work has been done in English, we will initiate our students with literature searches, as most medical and dental literature is in English; thus helping them with the necessary material necessary to make appropriate searches in English.

### **3. Methodology used in this project**

First, we selected the most representative clinical images, and 90% of the images were provided by Dr. Ortega Piga, an eminence in oral and maxillofacial radiology in our country.

Later we discuss what images would be included in the project. Out of 60 images, we ruled out 17. These images were discarded by low quality (4 images), tests too complex for the student (6 images), great diagnostic difficulty (value of 9 and 10 on a scale of 1-10) (7 images).

The images that were not in digital format, were scanned and improved with Photoshop. After having all the images in digital format, we highlighted in yellow to aid students in locating lesions on the radiographs.

Later we made flowcharts or outlines to help diagnose injuries by group of lesions such as with the Power Point program. "Mixed radiolucent-radiopaque periapical lesions", "mixed radiolucent-radiopaque pericoronal lesions", and "mixed radiolucent-radiopaque lesions not necessarily contacting teeth", The latter divided the lesions into two groups to facilitate the comprehension process in related to surgical, traumatic, radiotherapy, systemic diseases, and medication history, and the into not necessarily previous conditions. It was all explained with a Microsoft Powerpoint presentation.

We collected medical records for each of the radiographic cases, we summarized the most significant data, and also classified them by the 3 different sections named above. These medical records were numbered to match the number with the radiographic clinical case. This was done with Microsoft Word.

We collected radiographic cases with bookmarks, and put them in the corresponding section. The number in the Power Point document corresponded to the number of medical history of the previous document.

We also made a document with the diagnosis of the lesions, so that the student after thinking hard and trying to diagnose each case, he/she could check if he/she had been successful or if the correct result was within the possible final diagnoses.

All documents were made as PDF files. This pack, flowchart or outlines, medical records, and diagnostic radiographic cases, were available to all members of the group in order to correct possible errors. Subsequently it has been placed in the hands of the 6 students from the Oral Medicine specialist degree to estimate its utility as a preliminary step.

#### **4. Human resources**

The professors that have worked on this innovation project are:

- Rosa M<sup>a</sup> López-Pintor Muñoz, associate professor from the Department of Stomatology III, and professor in the postgraduate “Specialist in Oral Medicine” at Complutense University of Madrid.
- Gonzalo Hernández Vallejo, professor and Head of the Department of Stomatology III, and Director in the postgraduate “Specialist in Oral Medicine” at Complutense University of Madrid.
- Ricardo Ortega Aranegui, associate professor from the Department of Stomatology III at Complutense University of Madrid.
- Víctor Manuel Paredes Rodríguez, honorary collaborating professor from the Department of Stomatology III at Complutense University of Madrid.
- Lorenzo de Arriba de la Fuente, associate professor from the Department of Stomatology III at Complutense University of Madrid
- Elisabeth Casañas Gil, external collaborator in clinical practice from the Department of Stomatology III, and professor in the postgraduate “Specialist in Oral Medicine” at Complutense University of Madrid.
- Lucía Ramirez Martínez-Acitores, professor in the postgraduate “Specialist in Oral Medicine”.
- Julia Serrano Valle, PhD student and professor in the postgraduate “Specialist in Oral Medicine”.

## 5. Activity development

Since they communicated the acceptance of this project until the beginning of January of 2017, we made a selection of images. It was difficult to get images of all the pathologies, especially those less frequent. This phase, therefore, has taken us the longest. As discussed above 90% of the images were provided by Dr. Ortega Piga, the remaining 10% were contributed by Dr. Hernández and Dr. López-Pintor.

In the months of January and February, Dr. López-Pintor developed flowcharts in English that she then classified according to the relationship of the lesion to the tooth. She made 3 groups of mixed lesions of the jaws such as “mixed radiolucent-radiopaque periapical lesions”, “mixed radiolucent-radiopaque pericoronal lesions”, and “mixed radiolucent-radiopaque lesions not necessarily contacting teeth”. The latter we subdivided the lesions into two groups: those lesions related to surgical, traumatic, radiotherapy, systemic diseases, and lesions related to medication history, and into not necessarily previous conditions.

We only made diagrams for 4 groups that included mixed radiological lesions of the maxilla and mandible, and the most important characteristics of each lesion in order to facilitate the diagnostic process. Such diagrams were done using Microsoft Power Point, which sometimes included drawings to aid diagnosis, especially at the starting point.

During the first fifteen days of March, Dr. Gonzalo Hernández and Dr. Lorenzo de Arriba scanned (as some images were very old), edited (as the images were not well calibrated according to brightness and contrast) and improved images with Photoshop.

Also, they created Power-Point presentations, by groups (see the above 3 groups), and made notes and highlighted in yellow to help students locate lesions on radiographs. Nonetheless, it is difficult for them locate lesions or there may be several of them, and we just want the students to center their attention in diagnosing one of them. Also they numbered each of the cases within their subgroup

During the last fifteen days of March, Dr. Victor Paredes, Dr. Lucia Ramirez and Dr. Julia Serrano López-Pintor located the medical records of each of the cases, the most significant data were summarized and also classified by the different sections named above.

There were medical records (6 cases) that could not be located because they were very old or were cases referred for radiological diagnosis to Dr. Ortega Piga. In such cases, we made a medical history based on the diagnosis of the lesion, according to the general characteristics of the pathology.

These medical histories were numbered to match the corresponding radiographic clinical case. This was done with Microsoft Word.

The first week of April, Dr. López-Pintor made the diagnostic documents for each of the images, so that the student after thinking thru and try to diagnose each case could check if the result had been the right one or if the correct answer was within the possible final diagnoses. This works as a final evaluation test to assess the effectiveness of this learning strategy.

During the second and third week of April, Ms. Elisabeth Casañas Gil, a bilingual (english-spanish) dentist, corrected the English of all documents. Later, Dr. López-Pintor transformed all documents to PDF files, 4 flowcharts, 3 PowerPoint documents that included radiographic cases placed in groups according to their location, 3 documents of medical records classified according to their location, and 4 documents with the diagnosis of each of the lesions.

During the last week of April, this pack, made of diagrams or charts, medical records, and diagnostic radiographic cases, was available to all members of the group in order to correct possible errors.

Towards the end of April, Dr. López-Pintor provided this folder to 6 students from the Oral Medicine Specialist degree, to assess its effectiveness in learning. The results are promising, as discussed above.