**Summary**

**Company**
Coimbra’s Surgical Center

**Sector**
Health - Ophthalmology

**Needs**
Simplification of the storage and access to results of complementary diagnostic exams (images, video, numeric values, reports), performed on different equipment.

**Solution**
OphthalSuite - Integration Platform for Ophthalmology

**Current Situation**
Solution up and running on the client, with 100% medical and technical staff satisfied with the improvements.

**Benefits**
- Speed, ease and convenience of access to examinations;
- Increase of 170% in quality of stored information;
- Increase of 500% in quantity of stored images;
- Safety, reliability and data integrity;
- Business Intelligence for clinical and administrative decision support.

**Other Data**
- 25 diagnosis equipments
- 7 Ophthalmologists
- 200 consultations/day
- 94,242 patients
- 188,488 exams
- 1,480,153 images

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**Context**

The act of diagnosing ophthalmologic pathologies requires the analysis of the results of complementary diagnostic tests.

In general, the equipments where these tests are performed are very limited in terms of their ability to connect to a central system and in terms of interoperability between them.

This limitation results in the need for greater effort by health professionals in storing, accessing and analyzing data collected by the several existing equipment.

The integration solutions that exist in the market are restricted to only one of the brands of equipment, have limitations in quantity and quality of data collected or have a very high impact on productivity.

OphthalSuite is a reliable solution, simple to learn and use, extremely fast and flexible to adapt to physicians, technicians and internal working mechanisms of different health units.
The ophthalmologists from Coimbra’s Surgical Center intended to reduce the difficulty of accessing and analyzing the exams that were performed on their patients.

Additionally, there was interest in facilitating the execution of statistical analysis for the collection of internal quality indicators and the publication of scientific articles. This component of Business Intelligence would depend on the solution's ability to collect and organize automatically the information generated by the diagnostic equipments.

The creation of a solution would also have to take into account that the test results can have various formats - high resolution pictures, videos, tables of numerical values, etc..

At the time of the beginning of the project, the mechanisms used to access the patient’s exams consisted in the printing and filing of paper documents or remote access to screenshots of images collected by the repetition of a sequence of steps for each individual picture to place on the central system.

The main disadvantages of this approach were:

- The increased time required for implementation of each examination;
- The reduced number of images collected;
- The low quality of images collected, depleted during the export process;
- The lack of organization of numerical data in easily analyzable formats (e.g. Excel spreadsheets);

Therefore, the identified need was that of an integration platform capable of sending automatically the data collected by each device to a secure central file, where they would remain accessible to be remotely consulted.

The functioning of the entire system should be autonomous and transparent, allowing, for example, storing the correspondence between tests on the equipment and on the electronic patient record (EPR).

Surgical Center of Coimbra

www.ccci.pt

The Surgical Center of Coimbra is a private healthcare unit, based in Coimbra, being recognized by the differentiation and high quality medical services that has to offer to their users. Provides health cares in several specialties, such as: ophthalmology, neurosurgery, cardiology, pediatrics, orthopedics, medically assisted procreation techniques, development psychology, urology, endocrinology, speech therapy, among others, with special focus on the area of ophthalmology.
After analyzing the data and the workflow of the Surgical Center of Coimbra, an application software was installed and customized - OphthalSuite - which consists in an integration platform that allows to automatically collect information from different devices and redirect it to a centralized database.

OphthalSuite is compatible with several equipments and exams, such as fundus, angiography, tonometry, OCTs, electroretinography, perimetry, GDx, among others.

For some of these equipments, also allows to synchronize the databases in order to avoid repeating the registration of patients.

OphthalSuite requires a maximum of three "clicks" to define the patient (if this has an ID number in the equipment different from the ID number in the central system), store and print out an examination and the respective report, these being readily available for all physicians to consult them.

In the event of flaws in the internal network, OphthalSuite has the ability to keep up functioning with limited functionalities, resending automatically and in a transparent manner, the data that have been affected by failures, when the network connection is restored.

This application allows an organized and structured storage of information collected that becomes available to be accessed via its own OphthalSuite or other third-party solutions.

The ophthalmologists from the Surgical Center of Coimbra who are already using OphthalSuite consider that:

- Using OphthalSuite is easy or very easy;
- There was a positive impact on daily clinical practice;
- The quality and quantity of information available for the diagnosis has increased;
- The daily productivity (no. of consultations) has increased in some cases;

Source: Survey from October 2009
OphthalSuite proved its strength as a platform for interoperability regardless of manufacturer, the generation of operating systems, storage mechanisms and data transmission, since it allowed the following equipment integration:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Equipment - Model</th>
<th>Equipment Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcon</td>
<td>UltraScan</td>
<td>Ecograph</td>
</tr>
<tr>
<td>Clarity Medical Systems</td>
<td>Retcam II</td>
<td>Retinograph, Pediatric Angiograph</td>
</tr>
<tr>
<td>Haag-Streit</td>
<td>LenStar LS900</td>
<td>Biometer</td>
</tr>
<tr>
<td></td>
<td>BQ900 (José Cotta software )</td>
<td>Slit Lamp (Anterior Segment)</td>
</tr>
<tr>
<td>Heidelberg Engineering</td>
<td>HRA2</td>
<td>Angiograph, Retinograph, Auto-fluorescence</td>
</tr>
<tr>
<td></td>
<td>HRA Spectralis+OCT</td>
<td>HRA II + OCT</td>
</tr>
<tr>
<td>Metropsis</td>
<td>CCT-Cambridge Color Test</td>
<td>Sensitivity chromatic analysis</td>
</tr>
<tr>
<td></td>
<td>CSF-Contrast Sensitivity Function</td>
<td>Sensitivity contrast analysis</td>
</tr>
<tr>
<td>Oculus</td>
<td>Pentacam</td>
<td>Corneal topograph</td>
</tr>
<tr>
<td>Optos</td>
<td>Optomap Panoramic 200</td>
<td>Wide field Retinograph and angiograph</td>
</tr>
<tr>
<td>OTI</td>
<td>OCT-SLO</td>
<td>OCT</td>
</tr>
<tr>
<td></td>
<td>OCT-Spectralis</td>
<td>OCT – Spectral domain</td>
</tr>
<tr>
<td>Reichert</td>
<td>AT550</td>
<td>Tonometer</td>
</tr>
<tr>
<td>Rodenstock</td>
<td>SLO-Scanning Laser Ophthalmoscope</td>
<td>Micro-Perimeter, Visumetry</td>
</tr>
<tr>
<td>Roland Consult</td>
<td>Retiport ERG</td>
<td>Electroretinograph, PEV</td>
</tr>
<tr>
<td>Tomey</td>
<td>EM-3000</td>
<td>Specular Microscope</td>
</tr>
<tr>
<td>Topcon</td>
<td>TRC 50IX/50DX (IMAGEnet2000 and i-base)</td>
<td>Angiograph, Retinograph</td>
</tr>
<tr>
<td></td>
<td>SL-D (IMAGEnet i-base)</td>
<td>Slit Lamp (Anterior Segment)</td>
</tr>
<tr>
<td></td>
<td>KR-8100P</td>
<td>Auto-refractometer</td>
</tr>
<tr>
<td></td>
<td>TRC-NW8 (IMAGEnet i-base)</td>
<td>Non mediatric retinograph</td>
</tr>
<tr>
<td></td>
<td>CT-80 (IMAGEnet i-base)</td>
<td>Tonometer</td>
</tr>
<tr>
<td>Zeiss</td>
<td>GDx Vcc</td>
<td>RNFL Polarimeter</td>
</tr>
<tr>
<td></td>
<td>Humphrey HFA II-i (with network plugin)</td>
<td>Computerized perimeter</td>
</tr>
<tr>
<td></td>
<td>Stratus OCT</td>
<td>OCT</td>
</tr>
</tbody>
</table>
**CASE STUDY**

**OphthalSuite**

**SURGICAL CENTER OF COIMBRA**

**Benefits**

1. **Time Saving**
   - Information available increases without increasing the time of export.
   - In some cases the whole export process becomes faster.
   - In some cases, the need to enter the patients data on equipments is eliminated.
   - Reduction of time and complexity of accessing examinations by physicians.

2. **Quality increase**
   - The available information has a higher quality.
   - The synchronization of the users registration significantly reduces the likelihood of getting information associated with incorrect records.
   - Greater ease in identifying and correcting nonconformities (missing data, duplicate patients, etc.).

**Average examinations access time**

<table>
<thead>
<tr>
<th>Time (seconds)</th>
<th>Without OphthalSuite</th>
<th>With OphthalSuite</th>
</tr>
</thead>
<tbody>
<tr>
<td>180</td>
<td>24</td>
<td>2</td>
</tr>
</tbody>
</table>

**Image Quality Increase**

- OCT-SLO: 156%, HRA2 / HRA+OCT: 92%, TRC-50X: 300%, GDx: 25%

**Image Quantity Increase**

- OCT-SLO: 2300%, HRA2 / HRA+OCT: 230%, TRC-50X: 122%, GDx: *

* Examinations whose content was not saved before OphthalSuite

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Images that before the OphthalSuite were saved digitally using print screen
Examinations that before OphthalSuite were only printed
Examinations without any support before OphthalSuite

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Benefits

3. Fault Tolerance

- The automatic recovery of failures that can occur on the internal network and the ability to keep the system in operation during these precludes the need to suspend the examinations.
- Existence of backups to avoid data loss when a failure of equipment occurs.

4. Business Intelligence - Research & Management Support

- Very easy to execute statistical studies, data collection and data mining (e.g., the mean ocular tension of all patients of the Glaucoma consultation).
- Possibility of extracting various reports, such as total number of exams grouped by equipment, pathology, physician and date.

Average number of images saved/examination

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Without OphthalSuite</th>
<th>With OphthalSuite</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRA2 / HRA+OCT</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>TRC-50IX</td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>OCT-SLO</td>
<td>2</td>
<td>48</td>
</tr>
</tbody>
</table>

Average nr. of examinations saved digitally/year

- Without OphthalSuite: 2,302
- With OphthalSuite: 20,176

BlueWorks - Medical Expert Diagnosis Ltd. is a technology based company that has as main objective the development of innovative systems to support the diagnosis and therapy, and is currently developing solutions primarily to the area of Ophthalmology. Improving the quality of health cares, optimizing processes and supporting health professionals in clinical practice is our mission.