ORIGIANL STUDY

The effect of smartphone usage on the upper extremity performance among Saudi Youth, KSA

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ABSTRACT

The current study aims to investigate the effect of smartphone usage on the upper extremity performance among Saudi youth. A goniometer to measure the Range of Motion (ROM), the Smartphone Addiction Scale (SAS), McGill Pain scale and Chattanooga stabilizer were used to perform the current study on a sample of 300 university students from Al-Imam Mohammed Bin Saud University. The results have shown that smartphone addiction is negatively correlated to the elbow flexion, shoulder flexion, shoulder extension, shoulder abduction, shoulder adduction, and both shoulder internal and external rotation. Furthermore, the results have shown that McGill pain scores were positively correlated to elbow flexion, shoulder flexion, shoulder extension, shoulder abduction, shoulder adduction, and both shoulder internal and external rotation. The study has concluded that smartphone usage among Saudi youth negatively affects the upper extremity and causes a significant increase in the pain intensity. The study has recommended that there is an urgent need for a significant awareness campaign to warn the community regarding the impact of using smartphones for long periods of time.

KEYWORDS: smartphones, range of motion, upper extremity.

INTRODUCTION

Smartphones are considered to be the natural evolution of computers, which have contributed significantly to reduce the popularity of these devices after several decades of dominance. Smartphones have pushed the path towards the development of tablet PCs, which is a compromise between a smart phone and personal computers1.

Smartphones differ from traditional phones in that they provide a number of functions, advanced computing capabilities and advanced communication along with other traditional phone functions2.

Smartphones evolve day after day, their capacities and capabilities increasing spectacularly. Some of these phones have become equipped to use the fingerprint, for example, as a kind of safety to unlock the phone. On the other hand, some of them use the technique of following the eyes movement to surf the internet or view the images by just performing an aerobic pointing by the hand3. In general, almost all the functions of the smartphones require the individuals to stare sharply downwards or to hold their arms out in front of them to view the screen4.

Smartphone utilization is growing exponentially in the world, especially in Saudi Arabia5. According to a study performed by Nielsen Holding, it has been indicated that about 67% of the Kingdom population above sixteen years old use a smartphone. Investigating the youth category, the study reported that 73% of those using smartphones are under the age of 15. In a study conducted by Alhassan et al. in 2016 it has been indicated that 52.7% of the males and 46.9% of the females ranging in age between 18 and 23 are addicted to using smartphones6. In a more recent study conducted by Alosaimi et al. it has been reported that 27.2% of the individuals ranging in age between 20 to 24 use their smartphones more than 8 hours7,8.

Several studies examined the impact of smartphones on the musculoskeletal system. For example, Alabdulwahab et al. performed a cross-sectional study entitled “smartphone use addiction can cause neck disability”, that aimed to identify the level of smartphone addiction and its correlation to the neck function4. The study sample was composed of 78 healthy young adults that were subjected to a Smartphone Addiction Scale (SAS) and Neck Disability Index (NDI). The findings have shown that there is a strong association between smartphone use and different degrees of neck problems among the participants4.

Earlier in 2011, Berolo et al. conducted a study that aimed to investigate the musculoskeletal symp-
toms among mobile hand-held device users and their relationship to device users. The study sample was composed of 140 university students, staff and faculty members. The results showed that 84% of the study participants reported pain in at least one body part. The right hand pain was the most common at the base of the right thumb. Moreover, there was a strong association between the total time spent using a mobile device and neck and right shoulder pain.

In a retrospective study conducted by Sharan et al., that aimed to describe the risk factors and clinical features of the musculoskeletal disorders arising due to the usage of hand-held devices, the study sample was composed of 70 subjects characterized by having a musculoskeletal disorder affecting the upper extremities. The results showed that all the study participants reported pain in the thumb and forearm with associated burning, numbness and tingling around the thenar eminence of the hand. The study has reported that there is a correlation between mobile design and anthropometry of the user in causing discomfort and fatigue in hand, elbow and shoulder, while using hand-held devices.

Although there are a number of studies investigating the impact of hand-held devices on the musculoskeletal system, there is still a clear shortage in data and responses regarding their impact. Studies have varied among the cross-sectional, retrospective and experimental designs, which indicate the absence of a fixed research approach to achieve the study aim of identifying the musculoskeletal disorders resulted from hand-held devices.

Furthermore, the majority of the studies did not include a rehabilitation protocol that could help the individuals to recover completely from the symptoms of the musculoskeletal disorders.

In the context of Saudi Arabia, there is a clear shortage of studies and data insufficiency regarding the musculoskeletal disorders caused by using the hand-held devices.

In the light of the studies shortage, the current study will be conducted to identify the impact of smartphone devices on the musculoskeletal disorders among a randomly selected sample of the community members varying in age range. Moreover, this study will contribute efficiently to enriching the available literature review concerning the musculoskeletal disorders due to the usage of smartphones, as it is a growing problem that has a large impact globally.

Finally, the on-going study proposes an effective sequenced rehabilitation program that helps in the recovery of the affected individuals.

The current study aims to investigate the effect of the smartphone usage on the upper extremity performance among Saudi youth.

**MATERIAL AND METHODS**

**Research design**
A cross-sectional study – observational study

**Study setting**
Al-Imam Mohammed Bin Abdul Aziz University.

**Study Subject**
The study sample will include 300 students enrolled in Al-Imam Mohammed Bin Saud University.

**Inclusion criteria**
- Age 18 – 25
- Voluntary participation
- Students enrolled in Al-Imam Mohammed Bin Saud University.
- Acceptable level in English (Speaking, reading and writing)

**Exclusion criteria**
- Non-student individuals
- Pregnant females

**Study instruments**
1. **Goniometer**
A goniometer is usually made of plastic and it is often transparent. Occasionally, goniometers are made of metal. There are two "arms" of the goniometer: the stationary arm and the moveable arm. Each arm is positioned at specific points on the body and the centre of the goniometer is aligned at the joint to be measured.

Steps to using a Goniometer:
1. Align the fulcrum of the device with the fulcrum or the joint to be measured.
2. Align the stationary arm of the device with the limb being measured.
3. Hold the arms of the goniometer in place while the joint is moved through its range of motion.
4. The degree between the endpoints represents the entire range of motion.

Assessment of elbow range of motion steps:
- Sitting study participant on a chair
- (Arm position): Arms are supported on the table
- Shoulder flexion (90 degrees)
- Then measure the range of motion

Assessment of shoulder range of motion:
- Trace arc while reaching forward with elbow straight (forward flexion).
- Should be able to move hand to position over head - normal range is 0 to 180 degrees.
- Reverse direction & trace arc backwards (extension).
- Should be able to position hand behind their back.
- Direct patient to abduct their arm to position with hand above their head.
• Movement should be smooth and painless.
• Normal range is 0 to 180.

2. The Smartphone Addiction Scale (SAS)\textsuperscript{12}

The assessment will include:
1. Duration of smartphone use on a typical day.
2. Frequency of smartphone use on a typical day.
3. Duration of time until first smartphone use in the morning upon waking.
4. The smartphone function with the most personal relevance.

Smartphone addiction will be assessed using the SAS: 10-item self-report instrument. The SAS addresses the following 5 content areas:
- daily-life disturbance
- withdrawal
- cyberspace-oriented relationship
- overuse
- tolerance

3. McGill Pain Scale (Melzack, 1987)\textsuperscript{13}

• A scale of rating pain developed at McGill University by Melzack and Torgerson
• A self-report questionnaire
• How to use:
  - Users first select a single word from each group that best reflects their pain.
  - Users then review the list and select the three words from groups 1–10 that best describe their pain.
  - Two words from groups 11–15.
  - A single word from group 16.
  - and then one word from groups 17–20.
  - Users can use some words more than once.

4. Chattanooga stabilizer pressure biofeedback – Muscle isometric contraction

Muscle isometric contraction will be tested with Chattanooga stabilizer pressure biofeedback. The participant will be tested while moving the upper limb; the therapist will resist the movement using the stabilizer with his arm against the wall to prevent the substitution of the subject.

Statistical analysis

Data will be presented as mean and standard deviation, minimum and maximum values. Spearman and Pearson correlation coefficients will be used for assessing the relation between different variables.

RESULTS

Results shown in Table 1 represent the mean and standard deviation scores of the study variables. The same variable can be seen also in Figure 1.

| Table 1 | Mean and standard deviation scores of the variables evaluated in the study. |
|---------|------------------|------------------|------------------|------------------|------------------|
| Variable | Mean    | Standard deviation |
| Elbow flexion | 133.33 | 19.84 |
| Elbow extension | 3.76  | 5.12  |
| Shoulder flexion | 164.55 | 7.34  |
| Shoulder extension | 42.24 | 7.35  |

Results show that the mean score for the elbow flexion was 133.33±19.84, for the elbow extension was 3.76±5.12, for the shoulder flexion was 164.55±7.34 and for the shoulder extension was 42.24±7.35.

Table 2 shows the Spearman’s rho correlation factor values between the participants’ body mass index (BMI) and their elbow flexion, extension and shoulder flexion and extension.

The results show that:
- BMI is negatively correlated to elbow flexion (-0.159), shoulder flexion (-0.342) and shoulder extension (-0.235).
- There is a weak positive correlation between participants’ BMI and their elbow flexion (0.11).

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Spearman’s rho correlation results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BMI</td>
</tr>
<tr>
<td>BMI</td>
<td>1.00</td>
</tr>
</tbody>
</table>
The correlation between elbow flexion/extension and shoulder flexion/extension to the smartphone addiction scale and McGill pain scale indicate that smartphone addiction is negatively correlated to the elbow flexion, elbow extension, shoulder flexion and shoulder extension (Table 3). On the other hand, results indicate that McGill pain responses have been positively correlated to the elbow flexion/extension and shoulder flexion/extension.

Results shown in Table 5 indicate that smartphone addiction is negatively correlated to shoulder abduction/adduction and shoulder internal/external rotation.

On the other hand, the McGill pain score was positively correlated with shoulder abduction/adduction and shoulder internal/external rotation measurements (Table 6).

Measurements of the shoulder abduction, adduction, internal and external rotation have yielded a mean score equal to 165.6, 11.3, 83.4 and 84.2, respectively (Table 4).

Findings shown in Table 7 indicate that 65% of the study samples were within the addicted category, while 35% of the female students were within the non-addicted smartphone users. Mean and standard deviation scores have shown that the total SAS score for addicted users was 38.31±3.16, on the other hand, the total SAS score for the non-addicted user was 22.71±1.29

Results shown in Table 8 indicate that there is a significant positive correlation between smartphones and shoulder abduction among the study participants.

Measurements of the wrist flexion, extension, ulnar deviation and radial deviation have yielded a mean score equal to 72.85, 68.93, 42.56 and 31.60, respectively (Table 9).

The investigation of BMI correlation with the wrist flexion/extension and ulnar/radial deviation has shown that BMI is negatively correlated with the wrist flexion, extension, ulnar deviation and wrist radial deviation, as shown in Table 10.
Results shown in Table 10 indicate that smartphone addiction is negatively correlated with wrist flexion and extension, and both ulnar and radial deviation. On the other hand, the McGill pain score was positively correlated with the previously mentioned measurements (Table 11).

Table 8
Correlation coefficient values among SAS scores and ROM of shoulder and elbow.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Shoulder flexion</th>
<th>Shoulder extension</th>
<th>Shoulder abduction</th>
<th>Shoulder adduction</th>
<th>Shoulder external rotation</th>
<th>Shoulder internal rotation</th>
<th>Elbow flex</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAS</td>
<td>0.2248</td>
<td>0.11094</td>
<td>0.45852*</td>
<td>0.10415</td>
<td>0.2719</td>
<td>0.01992</td>
<td>0.09088</td>
</tr>
</tbody>
</table>

Table 9
Mean and standard deviation values for the wrist flexion/extension, and ulnar/radial deviation.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist flexion</td>
<td>72.85</td>
<td>28.9558</td>
</tr>
<tr>
<td>Wrist extension</td>
<td>68.93</td>
<td>16.77814</td>
</tr>
<tr>
<td>Ulnar deviation</td>
<td>42.56</td>
<td>7.5893249</td>
</tr>
<tr>
<td>Radial deviation</td>
<td>31.60</td>
<td>8.503987</td>
</tr>
</tbody>
</table>

Table 10
Correlation coefficient values among BMI and the wrist flexion/extension and ulnar/radial deviation.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist flexion</td>
<td>-0.077</td>
</tr>
<tr>
<td>Wrist extension</td>
<td>-0.562</td>
</tr>
<tr>
<td>Ulnar deviation</td>
<td>-0.261</td>
</tr>
<tr>
<td>Radial deviation</td>
<td>-0.264</td>
</tr>
</tbody>
</table>

Table 11
Mean and standard deviation values for the wrist flexion/extension, and ulnar/radial deviation.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Smartphone Addiction</th>
<th>McGill pain score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist flexion/extension</td>
<td>-0.231</td>
<td>0.381</td>
</tr>
<tr>
<td>Ulnar/ Radial deviation</td>
<td>-0.136</td>
<td>0.163</td>
</tr>
</tbody>
</table>

Results presented in Table 12 show that study participants were divided into four subgroups according to the McGill pain questionnaire responses. The moderate pain group constituted 45% of the total study sample, followed by the mild pain group that represented 35%, the severe pain subgroup (15%), and finally the no pain subgroup that constituted 5% of the total study sample.

Table 12
Mean and standard deviation values for the McGill pain questionnaire responses.

<table>
<thead>
<tr>
<th>Pain subgroup</th>
<th>N</th>
<th>%</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>1</td>
<td>5%</td>
<td>0.81</td>
<td>0.39</td>
</tr>
<tr>
<td>Mild Pain</td>
<td>7</td>
<td>35%</td>
<td>1.16</td>
<td>0.76</td>
</tr>
<tr>
<td>Moderate Pain</td>
<td>9</td>
<td>45%</td>
<td>2.07</td>
<td>0.63</td>
</tr>
<tr>
<td>Severe Pain</td>
<td>3</td>
<td>15%</td>
<td>2.89</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Table 13 shows the correlation results among the McGill pain scores and elbow, shoulder and wrist ROM. McGill pain score was positively correlated with the elbow flexion/extension, shoulder extension/ flexion, shoulder abduction/adduction, shoulder internal/external rotation and wrist flexion/extension (Table 13).

Table 13
Correlation coefficient values among BMI and the wrist flexion/extension and ulnar/radial deviation.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>McGill pain score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow flexion/extension</td>
<td>0.206</td>
</tr>
<tr>
<td>Shoulder extension/flexion</td>
<td>0.137</td>
</tr>
<tr>
<td>Shoulder abduction/adduction</td>
<td>0.183</td>
</tr>
<tr>
<td>Shoulder internal/external rotation</td>
<td>0.246</td>
</tr>
<tr>
<td>Wrist flexion/external</td>
<td>0.381</td>
</tr>
<tr>
<td>Ulnar/Radial deviation</td>
<td>0.163</td>
</tr>
</tbody>
</table>

DISCUSSIONS

Results are consistent with Golden et al.14 results which indicated that BMI was negatively correlated with the elbow range of motion, elbow flexion. Also,
they are in accordance with Wong et al. study results which reported that BMI is significantly correlated with the wrist flexion and extension\textsuperscript{15}.

Moreover, the current study results are consistent with the results of Gill et al.\textsuperscript{16} study results who found that shoulder flexion, abduction and internal rotation were not significantly affected by body mass index (BMI).

Correlation results regarding the elbow, shoulder and wrist, the smartphone addiction and pain intensity are compatible with El-Azab et al.\textsuperscript{17} results that reported that severity of the symptoms in the upper extremity is significantly associated with time for daily use of smartphones, and revealed that an increased duration of use of smartphones increase its negative effects due to faulty posture, pain and muscle fatigue. The study aimed to investigate the effect of smartphone usage on the upper extremity performance among Al Jouf University female students, by studying a random sample composed of 20 female students. The results showed that 65% of the studied female students were addicted smartphone user.

Moreover, our results are consistent with Berolo et al. and Um who found that pain and muscle fatigue increased with longer duration of smartphone usage\textsuperscript{18}. By comparing our results to the previously performed studies results, the current study results were inconsistent with Alhassan et al. findings, which reported that 26.7% of the medical students are addicted to smartphone usage\textsuperscript{5}.

Moreover, results are not in accordance with Alosaimi et al. who reported that 27.2% of the university students spend more than 8 hours per day using their smartphones\textsuperscript{6}.

The findings have indicated that wrist flexion and extension are negatively correlated with the smartphone addiction scale scores, and positively correlated with McGill pain scores. In 2015, Inal et al. reported that wrist flexion or extension is linked to increased carpal tunnel pressure, and it also decreases the amount of space available for the median nerve in the carpal tunnel\textsuperscript{19}. So, they hypothesized that repetitive wrist flexion and extension during smartphone use may also impact the median nerve, as indicated by larger median nerves in high smartphone users. According to them, the extensive flexion/extension of the thumb and wrist occurs when an individual uses a smartphone. Placing thumbs and wrists in static postures will likely lead to an increased load on these joints, associated with a decreased strength of muscles and tendons. These findings could explain the positive correlation between smartphone usage and the McGill pain scores\textsuperscript{19}.

The current study findings are consistent with Inal et al.\textsuperscript{19} who found that Visual Analogue Scale (VAS) pain in movement was also found to be significantly higher in the high smartphone-user group than in the lower smartphone-user group.

In 2006, Woo et al. found that ulnar and radial deviations are negatively affected by the prolonged usage of smartphones\textsuperscript{20}. They have reported that the gradual reduction in the cross sectional area of the median nerve, with thumb opposition together with the wrist in ulnar deviation, cause the greatest extent of deformation of the median nerve.

Our study results have been consistent with Cote et al. findings which indicated that pain intensity measured using the McGill pain scale was positively correlated with the shoulder and wrist range of motion\textsuperscript{21}.

At the same time, our findings are in accordance with Inal et al. study results that have reported a significant correlation between pain intensity and upper extremity ROM among smartphone users\textsuperscript{19}.

Conflict of interest: The authors have no conflict of interest.

Contribution of authors: All authors have equally contributed to this work.

Ethical Approval: The study was performed under the institutional research and ethics committee.

Acknowledgements: Authors acknowledge the unlimited support and encouragement of the colleagues in the medicine department and the administration of Al-Imam Mohammad Bin Saud Islamic University for facilitating the current study.

REFERENCES


Sinupret® acute

Stronger action against symptoms of rhinosinusitis
- secretolytic
- anti-inflammatory
- antiviral
- antibacterial

Antibacterial effect of Sinupret acute

Sinupret acute effectively inhibits the indicator bacteria of rhinosinusitis. In the agar plate assay, Staphylococcus aureus, Streptococcus pyogenes, and Streptococcus pneumoniae proved to be especially sensitive to a lyophilisate of the Sinupret drug combination. The minimum bactericidal concentration (MBC), at which 99.9% of bacteria are killed, was 200 μg/ml for Streptococcus pneumoniae and 390 μg/ml for Staphylococcus aureus and Streptococcus pyogenes. The efficacy against multiresistant staphylococci (MRSA) is also notable, with a minimum inhibitory concentration of 390 μg/ml being measured (internal data, Bionorica SE).

Tests in mice using the bacterial rhinosinusitis model have confirmed the bacteria-reducing effect in vivo. Compared to an untreated negative control, treatment with both an antibiotic (amoxicillin) and with a corticosteroid (dexamethasone), and treatment with a preparation of the Sinupret drug combination led to similar results. Bacterial colonisation, number of inflammation cells, and histopathological changes in the mucous membrane were examined (Tcacencu et al., 2002).

These findings should be assessed as an indication to perform a more careful risk-benefit analysis of the use of antibiotics in human medicine and to consider the use of herbal alternatives.
CASE REPORT

Odontogenic suppurative rhinosinusitis with oculo-orbital and cerebral complications - case series

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ABSTRACT

BACKGROUND. Odontogenic rhinosinusal suppurations have a high potential for major ocular-orbital and cerebral complications because of the presence of anaerobic bacteria flora, with continuity, contiguity and haematogenous propagation mechanisms. This pathology is often diagnosed in other departments than ENT such as ophthalmology, neurosurgery or OMF surgery.

MATERIAL AND METHODS. We present three clinical cases of odontogenic rhinosinusal suppurations with major complications: a 36-year-old patient with odontogenic pansinusitis complicated with orbital phlegmon and cerebral frontal lobe abscess; a 19-year-old patient with complicated maxillary-ethmoidal-frontal sinusitis complicated with frontal subdural empyema and frontal bone osteomyelitis (with a history of craniofacial trauma one year before); a 66-year-old patient with odontogenic maxillary-ethmoidal sinusitis complicated with orbital apex syndrome.

RESULTS. The treatment was surgical, by external approach, with endoscopic nasal control, in interdisciplinary teams. We have associated massive antibiotic therapy. Surgical drainage for complicated rhinosinusitis should be done in emergency, within the first 24 hours after admission, according to guidelines. The bacteriological examination for aerobic and anaerobic flora can guide the diagnosis - two cases associated maxillo-ethmoidal aspergilloma lesions. The evolution of the cases was favourable.

CONCLUSION. Interdisciplinary teams have successfully solved these complicated odontogenic rhinosinusal suppurations. Two of the cases were admitted and cured within 2 weeks, in the context of very hot weather, which exacerbated dormant dental infections.

KEYWORDS: odontogenic suppuration, surgery, complications, multidisciplinary team.
edema with visual acuity preserved; orbital periostitis; subperiosteal abscess; orbital phlegmon – amaurosis in high feverish context; orbital apex syndrome (Rollet) - affecting the vessels and nerves from upper orbital fissure and the optical channel; retrobulbar optic neuritis.

**CASE REPORT**

**CASE 1**

A 34-year-old male patient with upper affected maxillary teeth (25 and 26) for at least 3 months, with fetid rhinorrhea for 6 months, was admitted with left maxillary pain, left temporal-parietal headache and fever. Subsequently he was transferred from the Ophthalmology Department with left red eye, followed 3 days after nose blowing by left painful exophthalmia. Visually, he perceived hand motion with the affected eye. Also, the patient presented: WBC (white blood cell count) = 20,400/mm³; fibrinogen = 971 mg%; ESR (erythrocyte sedimentation rate) = 94 mm/h; RCP (reactive C protein) = 56.57 mg/dl. The cranio-facial computed tomography revealed a cerebral abscess in the left frontal lobe, 13 mm in diameter, with a thin capsule (Figure 1).

In this case, the possible mechanisms of spreading for the suppurative process were through continuity (oro-antral fistula, ethmoidal ceiling) and contiguity (orbital ceiling fissure).

The surgical approach involved radical Caldwell-Luc maxillary sinus cure, with transantral ethmoidectomy under nasal endoscopic control. Further, the extraction of 26, 28 teeth with oro-antral fistula closure (via vestibuloplasty) were performed. A broad drainage of the upper left palpebral abscess was the next step. An upper orbitotomy associated with upper and internal orbital quadrants abscess drainage was made under the ophthalmologist’s supervision. We also adopted a conservative attitude for the cerebral abscess, which was smaller than 1.5cm (Figure 2).

The bacteriology result confirmed the presence of an anaerobic flora (gram positive cocci), aerobic flora (coagulase-negative staphylococcus) and the histopathology demonstrated aspergilloma development.

Associated medical treatment was complex: Meroopenem 3 g/day + Metronidazole 2 g/day (7 days); followed by Ceftriaxone 4 g/day + Vancomycin 2 g/day (2 weeks); Fluconazole 400 mg/d (7 days) with Corticotherapy IV (intravenous) Dexamethasone 2 amp/day (2 weeks), 1 amp/day (1 week), along with Group B vitamin therapy (3 weeks).

![Figure 1 Clinical aspect and CT findings for Case 1.](image-url)
CASE 2

Male patient aged 19, with a history of cranio-facial trauma 1 year before, presented with suppurative left pansinusitis and affected teeth (24, 25, 26) leading to left eye preseptal orbital cellulitis and epicranial fronto-temporal abscess. On the CT scan, a left frontal subdural empyema could be identified (Figure 3). The patient was transferred from the Neurosurgery Department with normal vision. Blood tests revealed: WBC = 16,400 / mm³; fibrinogen = 465.64mg%; ESR = 59 mm / h and RCP = 11mg%.

Figure 2 Surgical aspect and post recovery aspect for Case 1.

Figure 3 Clinical aspect and CT imaging for Case 2.
Bacteriology results showed anaerobic flora (gram-negative bacillus), aerobic flora (staphylococcus aureus). The mechanism of spreading for the suppurrative process could be through continuity by oro-antral fistula, posterior and anterior wall of the frontal sinus.

The patient associated cerebrospinal fluid leak for a few days which required decompressive lumbar punctures.

On the CT scan there was no left subdural empyema and, apparently, the posterior wall of the frontal sinus was intact.

The surgical treatment consisted in radical Caldwell-Luc left maxillary sinus cure, with left transantral ethmoidectomy under nasal endoscopic control. Our OMF surgeon extracted 24-25-26 teeth with oro-antral fistula closure (vestibuloplasty). Moreover, for the drainage of the left fronto-temporal epicranial abscess we performed an Ogston-Luc incision (Figure 4).

Associated medical treatment used: Meropenem 6 g/day + Metronidazole 2 g/day preoperatively, Ceftriaxone 4 g/day + Vancomycin 2 g/day (3 weeks); with Corticotherapy IV Dexamethasone 2 amp/day (2 weeks), 1 amp/day (1 week) along with Group B vitamin therapy (3 weeks) with a total antibiotherapy for 3 weeks.

These first two cases were admitted and cured within 2 weeks, in the context of a very hot weather, which exacerbated dormant dental infections.

CASE 3

We present the case of a diabetic female, aged 66, with recent history of incisor 22 extraction and edentulous on the left hemimaxillary. Three hours after extraction the patient accused painful left exophthalmia, chemosis and fever. This patient also presented a history of left fetid rhinorrhea for 6 months. The case was transferred from the Ophthalmology Department with no light perception on the left eye, associated ophthalmoplegia (III, IV, and VI), loss of pupillary reflex, neuralgia and hypoesthesia V1.

Blood workup showed: WBC = 14.400/mm³, fibrinogen = 553 mg%, ESR = 50 mm/h. Therefore, the patient developed left eye orbital cellulitis and orbital apex syndrome with imminent cavernous sinus thrombosis. Imaging underlined the presence of a left suppurrative maxillo-ethmoidal rhinosinusitis (Figure 5).

The most probable mechanism of the suppurrative process spreading was hematogenous, after traumatic teeth extraction. Emergency lateral orbitotomy revealed no pus and thus we maintained the anticoagulant therapy with LMWH (Low Molecular Weight Heparin). We continued with radical Caldwell-Luc left maxillary sinus surgical cure associated with left transantral ethmoidectomy under nasal endoscopic control (Figure 6). Bacteriology exam revealed anaerobic flora with gram-positive cocci and the histopathologic diagnosis of aspergilloma.

Associated medical treatment implied Ceftriaxone 2 g /day plus Aminoglycoside 160 mg /day plus Metronidazole 2 g/day (3 weeks), Fluconazole 400 mg/day (1 week), IV corticotherapy -Dexamethasone 2 amp/day (2 weeks), 1 amp/day (1 week), with supplementary Group B vitamin therapy (3 weeks) and LMWH anticoagulant treatment. Antibiotherapy was maintained 3 weeks and anticoagulant therapy for 3 months at the neurologist’s indication.

DISCUSSIONS

Surgical drainage for complicated rhinosinusitis should be done in emergency, within the first 24 hours after admission, after the initiation of antibiotherapy. Moreover, surgical treatment should be initiated in less than 6 hours if visual impairment is associated°.
We propose an interdisciplinary team therapeutic protocol - ENT surgeon, OMF surgeon, neurosurgeon, ophthalmologist and anaesthesiologist. It is mandatory to eradicate the affected sinus and teeth\textsuperscript{10}. Massive antibiotherapy penetrating the hematoencephalic barrier according to guidelines should be maintained for 3-4 weeks with a preoperative mandatory dose\textsuperscript{11}. Another major indication is for corticotherapy, pre and postoperatively, as aggressive as possible\textsuperscript{12}.

External Caldwell-Luc approach allows complete lesion control with oroantral fistula closure via vestibuloplasty\textsuperscript{13}. During these procedures, the use of atraumatic burr bone approach will avoid additional septic dissemination and haemostasis needs to be very rigorous\textsuperscript{14}.

**CONCLUSIONS**

An interdisciplinary team joining the ophthalmology surgeon and the neurosurgeon, depending on complications, is a requisite for successfully managing these complex cases. All three cases were transferred from other departments (Ophthalmology, Neurosurgery).

Surgery has as main objectives the drainage of the affected sinus and extraction of the affected teeth. Ethmoidal lesions should be approached with the aim of surgical radicality putting pressure on inexperienced ENT surgeons.

The bacteriological examination for aerobic and anaerobic flora should be done intraoperatively. An-
aerobic flora is always present in odontogenic RS and the associated antibiotherapy must include the anaerobic flora. Proof to this aspect is the fact that two of the presented cases associated maxillo-ethmoidal aspergilloma lesions.

**Conflict of interest:** The authors have no conflict of interest.

**Contribution of authors:** All authors have equally contributed to this work.

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### REFERENCES


