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The Inevitable Change

Since the Focal Infection Theory in 1904, there has been a huge amount of dental and medical literature that put all of us at the forefront of knowledge.

Indeed, biomedical literature is roughly doubling every ten years, which helps a lot those, among us, who wish to keep up with recent developments in dentistry and dental medicine.

But, despite overabundance of information, time remains relatively limited, a large number of papers are rarely (if never) cited and many of these unknown papers represent real failures, and this reminds us that approaching scientific papers will always require reasoning, rigor, objectivity, accuracy and evidence.

Being surrounded by a world driven by information technology, gene therapy, tissue engineering and super sophisticated implantology, the average—non academic—dental general practitioner needs to gather the makes–sense critical spirit and the naïve reason mind in order to read and rely on a few well–chosen periodicals that will keep his/her memory fresh and his/her spirit open to innovations.

Being a refereed journal, the JLDA still remains on the scientific battleground because of its editorial independence and its constant eagerness to further the quality of its content through its referees and editorial consultants.

Nowadays, dentistry is undergoing its most prosperous times ever and our journal is becoming more and more committed to technical and clinical excellence to assist general dentists in sharing the latest scientific knowledge.

Far from pretending to provide our readers with the ongoing and most advanced basic research, worldwide, the JLDA attempts to “integrate new knowledge into the inquiry–based learning and teaching models” (H.C. Slavkin, 1996), and, within this comprehensive and multidisciplinary context, we have launched, in this issue, two columns that are now absolutely necessary for a good practice: occupational diseases encountered in dental learning and practice and dental management of medically compromised patients (through questions and answers – Q’s and A’s).

Our world is constantly changing, tomorrow’s dentist is striving to familiarize with stem cells, micro arrays (DNA chips), in situ hybridization and molecular biology, and soon, somatic cell gene therapy will occupy a dominating role in the treatment of oral diseases. Fortunately, all colleagues motivated by scientific curiosity are constantly endeavoring to put dental science into daily practice and this arduous task will always lead us to follow the … inevitable change.

Philippe E. Aramouni, DCD, DEA, M.Sc.D, FICD
Editor-in-Chief
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Prosthetic considerations of contemporary all-ceramic fixed partial dentures: a review of the literature

Foudda R. Homsy, DESP, Habib L. Abi-Aad, CESP, Sanaa G. Rizkallah, DESP

Abstract

New core/framework materials in high strength all-ceramic systems are used nowadays in fixed partial dentures (FPDs). Published long term clinical results are still limited and more evidence based studies are needed. However, these alternative treatments to conventional FPDs are appealing especially for their cosmetic value in the anterior region or for patients who are allergic to non-precious metals.

This review will look at the literature related to the framework design of all-ceramic FPDs published from 1997 to 2006, with emphasis on framework design and clinical longevity of these prostheses.

Metal free ceramic restorations offer a highly esthetic appearance by increasing depth of translucency and light transmission across the entire restoration, as well as biocompatibility, color stability, high wear resistance and low thermal conductivity.

Conventional non precious metal-ceramic crowns tend to cause graying of free gingival margina, an effect caused primarily by metal substrate. Additionally, metals used in these restorations may cause allergic or toxic reaction within adjacent soft or hard tissues.

As a result of the successful use of ceramic crowns and patient demand for esthetic and metal-free restorations, ceramic systems for fixed partial dentures were developed. However, dental ceramics are brittle and their low fracture resistance and relatively low flexural strength still limit the possibility of manufacturing fixed partial dentures using all-ceramic frameworks.

In attempt to meet the requirements for improved strength and toughness of dental materials, new high-strength ceramic core materials for all-ceramic fixed partial dentures have been developed.

Whereas traditional dental ceramics comprised a glass matrix with a crystalline phase as filler, newly developed ceramic materials are primarily crystalline in nature. These new materials – often referred to as oxide ceramics- are based on crystalline alumina, magnesia, or zirconia. The fabrication of fixed partial dentures has been made possible by the use of these oxides in combination with new processing techniques. The strength and fracture toughness are higher than those of the ceramics used previously, thus increasing the material’s resistance to crack propagation.

A dental material should have high stability in order to spontaneously withstand extreme stresses and high fracture toughness in order to show the optimal tolerance level towards defects. Various examinations prove higher stability of infiltrated ceramics than of glass ceramics. Next to the initial stability, especially the long-term stability is the deciding factor in the clinical success of the different systems. H₂O in the saliva leads to so-called stress corrosion in systems containing glass (glass ceramic and infiltrated ceramic). The water (saliva) reacts with the glass, leading to increased crack propagation velocities and consequently to long-term strength issues. On the other hand, systems having a polycrystalline microstructure, such as ZrO₂ or Al₂O₃ are to a greater extent glass-free and display excellent long-term stability.

Because clinical data evaluating their performance are limited, the use of these systems in a predictable
manner is considered by many to be controversial and metal-ceramic fixed partial dentures remain the gold standard in term of predictability. In a recent clinical retrospective study evaluating 515 metal-ceramic fixed partial dentures, Walton calculated that the cumulative survival rate of fixed partial dentures was 96% for 5 years, and 87% for 10 years of service. Other study of five-year evaluation of posterior all-ceramic three-unit (In-Ceram) fixed partial dentures found a clinical success rate of 82.5%-95.0%.

Cambell and Sozio found, in an in vitro study evaluating statically loaded all-ceramic and metal-ceramic fixed partial dentures, that ceramic fixed partial dentures developed vertical cracks in the connector region before failing, whereas the metal-ceramic fixed partial dentures developed cracks at the intaglio surface of the pontic before failing. Kelly et al. demonstrated (in vitro and in vivo) that the exclusive mode of failure in all-ceramic was a fracture of the connectors with approximately 80% of failures originating at the ceramic-core interface.

The all-ceramic restorations can be fabricated with a variety of ceramic crown systems including: In-Ceram, Empress II, Procera and Yttrium Tetragonal Zirconia Polycrystals (Y-TZP). The aim of this article is to review the properties of these materials, their indications, their advantages and disadvantages, the criteria for patient selection, and the framework design of these restorations.

**GENERAL PRINCIPLES OF PREPARATION**

It was not only necessary to use a strong a material, but also to fabricate the fixed partial dentures with the best fit possible. The making of well-fitting fixed partial dentures requires good preparation design and an appropriate luting space (30µm). The abutment teeth are prepared with a cervical shape, which implies a 1mm to 1.5mm deep circumferential well defined 90° shoulder and a slightly rounded inner angle with no significantly stepped differences in level. Abundant evidence indicates that the mode of preparation and especially the cervical shape are important for the strength of ceramic crowns. The fracture resistance of all-ceramic fixed partial dentures supported by shoulder preparations was significantly higher than that of fixed partial dentures supported by chamfer preparations, but no significant differences in marginal gap were found between the two finish line designs. A shoulder of uniform thickness may round the preparation excessively and compromise resistance form. The preparations were made without undercuts and were to allow a minimum material thickness of 1.7mm to 2mm occlusally and 1.5mm buccally, approximally and lingually. A 12° to 15° angle of convergence was aimed at, and the preparation margins were placed within the borders of gingival sulcus.

**CONNECTORS DESIGN**

The in vitro and clinical fracture resistance of fixed partial dentures is related to size, shape, and position of the connectors and to the span of the pontic. The basis for proper design of connectors and pontics is the law of beams: Deflection of a beam increases as the cube of its length, it is inversely proportional to its width, and it is inversely proportional to the cube of its height. To prevent failure of fixed partial dentures, connectors must be sufficiently high and wide, and span of the pontic should not exceed a certain length. The strength and therefore the minimal critical dimensions of these connectors are exclusively dependent on the type of ceramic material used for the core material. The minimal critical dimensions recommended for the connector to ensure long-term success of anterior metal-ceramic are 2.5 mm (occlusogingival height) and 2.5 mm (buccolingual width), providing a connector surface area of 6.25mm². This is not the case for all-ceramic fixed partial dentures. The required connector dimensions are larger than the ones recommended for metal-ceramic fixed partial dentures. This may be a major contributing factor in restricting the versatility of their use. A larger radius of curvature at the gingival embrasure will reduce the concentration of tensile stresses, thus affecting the fracture resistance of the fixed partial dentures.

**ALL-CERAMIC AVAILABLE SYSTEMS: EMPRESS II**

The Empress II system (Ivoclar-Vivadent, Schaan, Liechtenstein) uses a lithium-disilicate glass framework that is veneered with fluoroapatite-based...
veneering porcelain. The framework is fabricated with the lost-wax and heat-pressure technique or is milled out of prefabricated blanks. The transverse flexural strength of the framework material ranges between 350 and 400 MPa\(^5,8\). The fracture toughness ranges between 2.8 and 3.5 MPa/m\(^{1/2}\)\(^5,8,9\). The IPS-Empress II has a high luminance because of the great translucency of the material\(^14\). It is recommended that these restorations be etched and adhesively luted to enhance their strength and longevity\(^8\).

E-MAX (EMPRESS III)
- E-Max press/ E-Max CAD/CAM
- Cosmetic ceramic: E-Max Ceram
- Ingots: SiO\(_2\) > 57%
- Indicated for anterior and posterior crowns and bridges

IN-CERAM

In-Ceram (VITA Zahnfabric, Bad Sackingen, Germany) is supplied as one of three core ceramics: In-Ceram Spinell (ICS), In-Ceram Alumina (ICA), and In-Ceram Zirconia (ICZ). Because of the variation in strength, the primary indications for these core ceramics vary\(^9,15\).

**In-Ceram Spinell (ICS):**

It relies on MgO-Al\(_2\)O\(_3\) as the major (85% vol.) crystalline phase\(^16\). The MgAl\(_2\)O\(_4\) improves the translucency of the crown coping relative to Al\(_2\)O\(_3\), and thereby enhances esthetics. However, the flexural strength of In-Ceram Spinell (283 to 350 MPa) is lower than of In-Ceram Alumina (500 MPa), therefore is indicated for anterior crowns.

**In-Ceram Alumina (ICA):**

The In-Ceram Alumina system (ICA), which uses high-temperature sintered-alumina glass-infiltrated copings for all-ceramic crowns, was the first restorative system introduced for the fabrication of 3-unit anterior fixed partial dentures\(^3\).

To fabricate the framework, the ceramist can use either the slip-casting technique or milling out of prefabricated partially sintered blanks. The flexural strength of the framework material ranges between 236 to 600 MPa, and the fracture toughness ranges between 3.1 and 4.61 MPa/m\(^{1/2}\)\(^17\). The minimal critical dimensions for the connectors are 4 mm occlusogingivally and 3 mm buccolingually\(^3,8,9\). Sorrensen et al., in a clinical study on 61 three-unit fixed partial dentures, reported 35% failure rate of posterior fixed partial dentures at the 3-year recall\(^18\). Fracture always occurred in the connector area in the early stages of the study\(^15\). A similar evaluation was made by Vult von Steyern et al. who recommended with reluctance the use of ICA fixed partial dentures in the posterior region\(^15\). It is stressed that the fabrication process of ICA fixed partial dentures, at least the slip cast technique, is very sophisticated, and mistakes made during this process may lead to fracture\(^15\).

**In-Ceram Zirconia (ICZ):**

The ICZ system combines the use of glass-infiltrated alumina with 35% partially stabilized zirconia for the core material. As with the ICA, the ceramist may use the slip-casting technique or milling out of prefabricated partially sintered blanks to fabricate the framework\(^3\). The flexural strength ranges from 421 to 800 MPa\(^5,8,9,17\). For the glass-infiltrated alumina core material, the fracture toughness ranges between 6 and 8 MPa/m\(^{1/2}\)\(^5\). The recommended thickness of the coping/core for anterior teeth is 0.3 mm on facial aspect and 0.7 mm on palatal and proximal aspects; a 1 mm thick palatal collar is suggested\(^7\). The recommended minimal critical dimensions for the connectors are 4 to 5 mm occlusogingivally and 3 to 4 mm buccolingually\(^5,7,8\). Because of esthetic limitations resulting from opacity of the framework, the system is recommended for posterior ceramic fixed partial dentures\(^7\). An observation time of 3 years demonstrated that ICZ is an acceptable treatment alternative for 3-unit posterior fixed partial dentures\(^8\).

However, observation periods exceeding 5 years are desirable to evaluate long-term success before the
system can be recommended as an alternative to conventional fixed partial dentures19.

PROCERA ALUMINA

The Procera All-Ceram crown (Nobel Biocare, Göteborg, Sweden) was introduced in 1993 by Andersson and Oden20. In the Procera system, the core material consists of a densely sintered high-purity alumina (99.9%) that can be veneered with porcelain to achieve optimal esthetics. Its hardness is one of the highest among ceramics used in dentistry9. The coping fabrication process utilizes CAD-CAM technology and a scanned image of the original master die to produce a larger milled die, compensating for 20% shrinkage of the coping that occurs during sintering at high temperature9. Procera premolar crowns show good adaptation, such as a marginal gap of 55 µm on average and an internal gap of less than 100 µm10.

The Procera high-alumina coping allows the possibility of replacing metal and providing copings that can be designed to support porcelain marginal ridges and still fit with a good chance of clinical success16,20. Various types of tests measuring the flexural strength of the framework material demonstrated a range from 487 to 699 MPa5,9. For this core material, the fracture toughness ranges between 4.48 and 6 MPa/m1/2. The recommended connector height is 3 mm, and the recommended connector width is 2 mm1. They may be suitable for posterior crowns and fixed partial dentures, although long-term data are needed17.

Their radiopacity is similar to that of dentin. This feature makes it possible to diagnose changes in underlying tooth structure supporting the coping21. It should be noted, however, that alumina core of Procera crowns permits the use of both resin luting agents and conventional cements, for example, Zinc phosphate, for cementation. Light-polymerized resins are often preferred to chemical- and dual-polymerized materials because of their color stability and their polymerization-on-demand features21. Silica coating and silanization using the Rocatec system in densely sintered alumina ceramics also promote a significant increase in the bond strength to bis-GMA-based resin cement22.

YTTRIUM TETRAGONAL ZIRCONIA POLYCRYSTALS (Y-TZP)

During the past few years, partially stabilized zirconia has been integrated into restorative dentistry. First introduced as a hip-replacement material in the early 90s, this material is stabilized with yttrium oxide, and exists as yttria-tetragonal zirconia polycrystals (Y-TZP) at room temperature23. In dentistry, zirconia ceramic has been clinically used to create orthodontic brackets, dowels and cores1, implants and abutments1 and hard framework cores for crowns and fixes partial dentures1.

Yttrium oxide is a stabilizing oxide added to pure zirconia to stabilize it at room temperature and to generate a multiphase material known as partially stabilized zirconia5,8. These particles are densely sintered under industrial conditions, resulting in a final microstructure in which voids, flaws, and cracks are reduced to a minimum18. The high initial strength and fracture toughness of Y-TZP result from the physical property of partially stabilized zirconia5. Tensile stresses acting at the crack tip induce a transformation of the metastable tetragonal zirconium oxide form into the monoclinic form. This transformation is associated with a local increase of 3% to 5% in volume. This increase in volume results in localized compressive stresses being generated around and at the tip of the crack which counteracts external tensile stresses acting on the fracture tip. This physical property is known as transformation toughening5,8 or martensitic-like23 transformation. This transformation is dependent on temperature, vapor, grain size, micro- and macro-cracking of the material, and the concentration of stabilizing oxide4. In-vitro studies of Y-TZP cores specimens demonstrated a flexural strength of 900 to 1200 MPa2, therefore it is an interesting material for potential use for all-ceramic fixed partial dentures in premolar and molar regions1. Y-TZP-based materials have demonstrated a fracture toughness of 9-10MPa/m2, which is almost double the value demonstrated by alumina-based materials, and almost 3 times the value demonstrated by lithium disilicate-based materials5. This allows preparations requiring less aggressive tooth reduction than with most systems currently on the market. Instead of coping thickness of 1mm, a framework/coping wall thickness of 0.5 mm or
0.3 mm are considered adequate. The Zirconia possesses an excellent initial stability of more than 1100 MPa in vitro and values of more than 700 MPa were determined for all probes after a period of 3 years in vivo. In a laboratory investigation of the fracture strength of three-unit all-ceramic fixed partial dentures, all-ceramic fixed partial dentures made of partially stabilized zirconia ceramic revealed the highest failure loads of all fixed partial dentures tested (ICA, ICZ).

The biocompatibility of Y-TZP was evaluated in both in vitro and in vivo studies with no reported local or systemic adverse effects from the material. Y-TZP-based cores present with a metal-like radiopacity that enhances radiographic evaluation of the restoration.

As a result of their mechanical and physical properties, Y-TZP-based fixed partial denture frameworks require a relatively small connector area compared to other all-ceramic core materials ranging between 7 and 16 mm. Adhesive cementation may be used but is not mandatory, and traditional luting agents, including glass-ionomer cements, resin-modified glass ionomer cements, and composite-resin luting agents, may be used.

A Y-TZP-based fixed partial denture framework is designed using conventional waxing techniques or computer-assisted design CAD. Dental restorations using prefabricated Y-TZP ceramic blanks are manufactured in two ways:

1- by milling enlarged restorations out of homogenous ceramic green body blanks of zirconia which are then sintered and shrunk to the desired final dimensions.

2- by milling the restorations directly with the final dimensions out of highly dense sintered prefabricated zirconia blanks.

The Cercon System (Dentsply Ceramco, Burlington, N) and Lava systems (3M ESPE, St Paul, Minn) use partially sintered Y-TZP-based blanks for milling the infrastructures, whereas the DC-Zirkon (Dentsply Austenal, York, Pa) infrastructures are milled from fully sintered Y-TZP-based blanks by the DCS-President system.

Each of DCS-Precident and Lava system uses a different type of CAD technology with different features and design options. After scanning directly the preparation or the master-die, data is transferred to a milling unit for fabricating the framework. With a partially-sintered milled framework, size has been increased to compensate for prospective shrinkage (20%-25%) that occurs during final sintering. The milling is faster and the wear and tear of hardware is less than the milling from a fully sintered blank. The proponents of partially sintered frameworks claim that microcracks may be introduced to the framework during the milling procedure of a fully sintered blank, whereas the proponents of milling of a fully sintered blank claim that the marginal fit is superior because no shrinkage is involved in the process.

To improve the esthetic appearance, the milled frameworks or copies are veneered with ceramics suitable for the Y-TZP ceramic used. The Lava Y-TZP core is relatively translucent and has a masking ability that allows successful coverage of metal cores or discolored teeth. Once milled, it can be colored into one of seven shades before final sintering procedures. This allows the development of the shade of restoration from its intaglio surface all the way to the outer aspect of the veneering porcelain. The ability to control the shade of the core may also eliminate the need to veneer lingual and gingival aspects of the connectors in those situations where inter-occlusal-distance is limited and required connector dimensions are minimally achieved. In addition, palatal aspect of anterior crowns and fixed partial dentures may be fabricated of the core material exclusively in situations of extensive vertical overlap and lack of space for lingual veneering porcelain. A clinical study, evaluating posterior 3-unit fixed partial dentures created with the Lava system, demonstrated good performance in terms of clinical fracture resistance, marginal integrity, marginal discoloration, and secondary decay after short-term (18 to 36 months) service.

**PATIENT SELECTION AND LIMITATIONS**

The selection of patients for all-ceramic fixed partial dentures must follow certain criteria. An adequate prospective connector height for the framework material and veneering ceramics is required. A 4mm clinical measurement with periodontal probe from interproximal papilla to
marginal ridge of the prospective abutment for posterior fixed partial dentures, or to the incisal embrasure for anterior fixed partial dentures, indicates adequate connector height for most contemporary all-ceramic systems\textsuperscript{5,8}. The following clinical scenarios lead to reduced interocclusal distance; therefore, alternative treatment options rather than all-ceramic fixed partial dentures must be considered:

1- A deep vertical overlap with a reduced horizontal overlap leading to a deep bite in the anterior maxillary segment (class II division II) that may not allow sufficient labiolingual connector width

2- An opposing tooth that is supraerupted into the edentulous space that cannot be corrected with minor enamoplasty only and that may be accompanied with mesial drift of a prospective molar abutment tooth into the edentulous space

3- Prospective abutment teeth with short clinical crowns that may restrict height of the connector\textsuperscript{8}.

The creation of heavy stresses in connector area increases the risk of catastrophic fracture\textsuperscript{5}. Therefore, the use of ceramic system is contraindicated for cantilever fixed partial dentures (the pontic acts as a lever that is depressed under occlusal forces) and periodontally involved abutment teeth that exhibit increased mobility\textsuperscript{7}. Finally, heavy bruxers who exhibit severe parafunctional activity that cannot be controlled may not be candidates for all-ceramic fixed partial dentures\textsuperscript{8}. With all-ceramic system for fixed partial dentures, if the framework does not fit precisely, a new definitive impression must be made, because the framework cannot be sectioned and joined as with metal-ceramic fixed partial dentures\textsuperscript{8}.

### COMPARATIVE TABLE

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<th>Ceramic Type</th>
<th>Flexural Strength MPa</th>
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<th>Connector Design</th>
<th>Indications</th>
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<td>Empress II</td>
<td>lithium disilicate-reinforced glass-ceramics</td>
<td>2.8-3.5</td>
<td>12-20 mm$^2$</td>
<td>Anterior crowns and 3-unit FPDs and second premolar</td>
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<td>Inceram Alumina</td>
<td>$\text{Al}_2\text{O}_3$ ceramic</td>
<td>200-600</td>
<td>3.1-4.61</td>
<td>Anterior and posterior crowns and anterior FPDs</td>
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<td>Inceram spinell</td>
<td>MgO-Al$_2$O$_3$ ceramic</td>
<td>350</td>
<td>2.27</td>
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<td>$\text{Al}_2\text{O}_3-\text{ZrO}_2$ ceramic</td>
<td>421-600</td>
<td>0.6</td>
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<td>487-699</td>
<td>4.48-6</td>
<td>Crowns and FPDs</td>
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<td>Y-TZP</td>
<td>500-1200</td>
<td>9-10</td>
<td>Crowns and FPDs</td>
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CONCLUSION

All-ceramic prosthesis represent the most aesthetically pleasing, but also the most fracture-prone prosthesis\(^9\). Yet all-ceramic crowns suffer from near-surface damage, limiting their clinical success, especially on posterior teeth\(^25\).

Most of these systems require large connector dimensions, and may require the use of more technique-sensitive clinical procedures such as adhesive cementation\(^1\).

However, some considerations must be taken for successful restorations:
- selection to the appropriate treatment option.
- correct tooth preparation and excellent quality impression\(^26\).
- a ceramic with reasonably high flexural strength and high fracture toughness\(^9\).

New technologies (CAD/CAM) may allow the production of consistent high quality Y-TZP frameworks in terms of design and fabrication, strength, fracture toughness, and stress-corrosion resistance\(^9\). Although, clinical data on the success of these restorations are limited. Long-term results of clinical studies are critical to the assessment of long-term success and for the establishment of more specific guidelines for their use.

REFERENCES


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Individual appraisal of facial soft and hard tissues with the mesh diagram

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Abstract
The lateral cephalometric mesh diagram analysis presents advantages not readily available in conventional cephalometric methods. The face is oriented on the patient’s natural head position, which provides comparability between cephalometric findings and the clinical facial examination. The patient’s profile is not directly compared with the population norm but with an “individualized norm” derived from the application of the population norm to a grid scaled on the patient’s facial shape namely, the upper face height (N-ANS) and facial depth (N-S). Each landmark is assessed by its proportionate location in the mesh diagram grids. Thus, facial form is evaluated in one single display easily interpretable without computation of linear and angular measurements. These principles are illustrated for diagnosis of malocclusions and treatment with a combination of orthodontics and orthognathic surgery. The discrepancies between hard and soft tissues are readily ascertained and measured through the mesh display, and allow the formulation of conclusions on treatment and outcome. The mesh diagram is a flexible cephalometric analysis that should be incorporated in the routine dentofacial diagnosis and treatment planning.

Practitioners who deal with facial esthetics determine facial disharmony most efficiently by proportional analysis.¹ Artists use canons of proportionality to create the face. In contrast, the orthodontist and surgeon who deal with facial dysmorphology work to change the disproportional features toward a proportional canon such as embedded in the mesh diagram analysis. While the norm proportions of the human face are used as a guide for treatment objectives, the process does not sacrifice the patient’s individuality.²

The mesh diagram analysis graphically conveys for orthodontic diagnosis the proportions and relationships among facial components, including the soft-tissue profile.³,⁴ The simultaneous display of hard and soft tissue is unique to this method. The objectives of this paper are to: 1- review the basic principles underlying the analysis, namely head orientation, individualized norm, and proportionate evaluation of structures; 2- demonstrate the versatility of the analysis in the process of diagnosis and treatment planning, particularly when orthognathic surgery is indicated.

NATURAL HEAD POSITION
Critical to facial assessment is the orientation of the mesh coordinate system on natural head position. In 1861 Broca⁷ defined this position “when a man is standing and when his visual axis is horizontal.” To standardize the study of skulls that no longer could assume an upright head posture, anthropologists in the nineteenth century defined the Frankfort horizontal (FH) connecting orbitale and porion, two anatomic landmarks that approximate the horizontal head position. In living patients, upright head posture can be registered directly for cephalometric radiographs, but all intracranial references must be evaluated properly, because the relation of the vertical location of the defining landmarks is subject to biologic variation.⁸,⁹

Accordingly, FH does not always correspond to the true horizontal.¹⁰,¹¹ and when so judged, adjustment is required of the measurements made to this line, whether angular (e.g. Tweed’s FMA, FMIA¹²) or linear (made to a perpendicular to FH through nasion,¹³ pterygoid point,¹⁴ or other landmarks). Without the

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correction, the information can lead to errors in the cephalometric diagnosis.²

The sella-nasion (SN) line cant to the natural head position also must be assessed in the individual record as it can influence cephalometric outcome (Fig. 1). For example, a low position of sella relative to nasion would decrease the values of SNA and SNB and lead to misinterpretation of retrognathism of the respective jaw, whereas a normalization of the anterior skull base inclination would rectify the values to correspond to the clinical examination (Fig. 1a). Indeed, a major advantage of orienting the face in natural head position is the comparability between findings from the clinical examination and cephalometric analysis. When cephalometric analyses do not compensate for the variation in inclination of intracranial reference lines relative to the natural head position, they may not match clinical judgment. Erroneous conclusions are detrimental if relied on in orthognathic surgery when drastic alterations are possible by displacing one or both jaws.

The natural head posture can be easily registered in the cephalostat, applying common sense to prevent an occasional strained position when the patient turns the head up or down. Although standardized, natural head position lacks mathematical precision. Variations in its reproducibility are thought to be smaller than the often evident differences in the inclination of the Frankfort horizontal or the anterior skull base (SN).²,⁶

THE INDIVIDUALIZED NORM

The mesh analysis provides a global and comprehensive description of craniofacial hard structures and soft tissue profile based on

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**Fig. 1.** Variation in the position of sella (S) relative to nasion (N) results in an upward (cephalad) or downward (caudad) inclination of the SN reference line and consequently an overestimate and underestimate of the jaws’ anteroposterior positions (SNA and SNB).

*a- Lateral cephalometric tracing of a 10 years 5 months old boy with a Class II division 1 malocclusion. The sagittal discrepancy (ANB=8°; norm: 2°) appears to be caused by a retrognathic mandible with SNA=80° (norm: 82°), and SNB=72° (norm: 80°). However, the cant of SN to the horizontal (H) recorded from the natural head position is 15° instead of the norm (red line) of 8° (7°-9°). When the difference of 7° (15° minus 8°) is added to the values of SNA and SNB to correct for the SN inclination, the angular measurements become SNA=80°+7°=87°; SNB=72°+7°=79°, yielding the correct diagnosis of maxillary prognathism and “normal” mandibular position.

*b- Lateral cephalometric tracing of a 14 years 10 months old boy with Class III malocclusion (ANB=–3°) seemingly relating a normally positioned maxilla (SNA=82°) and a prognathic mandible (SNB=85°). Yet, correction of the SN cant to horizontal (H) from an acute 4° to the average of 8° (red line) decreases the SNA angle to 78° (82°−4°), and the SNB angle to 81° (85°−4°), adjusting the diagnosis to maxillary retrognathism.
individualized assessment. The patient’s profile is not compared to the population norm as in all traditional analyses; it is related to an individualized norm derived from the application of the population norm to the patient’s individual grid.

The patient’s profile is inscribed in a grid of 24 rectangles, scaled on two basic facial measures: upper face height, defined as the distance between nasion and the projection of ANS (anterior nasal spine) on a vertical through nasion, and the length of the anterior skull base (SN), projected on the horizontal through nasion. To obtain the grid, these core vertical and horizontal distances are divided into two equal horizontal (H) and vertical (V) units (red lines in Fig. 2). The vertical unit is transferred once above nasion and three times below ANS; the horizontal unit is transferred once in front of nasion and once behind sella.

The vertical and horizontal location of landmarks in the patient’s mesh diagram are compared to the location of corresponding landmarks in the mesh norm. To facilitate landmark location and subsequent comparisons, vertical grid lines are labeled numerically, and horizontal lines alphabetically. Landmarks are identified and marked alphabetically on the soft tissue outline and numerically on hard tissues (Fig. 2). The 24 rectangles are identified alphabetically from a to x.

Each landmark occupies a position within a rectangle. The median proportionate position of the landmark is determined in its respective rectangle on the patient’s mesh diagram, just as in the norm. Certain landmarks are located on grid lines: point ANS is on line D at 13% in front of the corner of rectangle .d. and point A on line 2 at 20% from the corner of the same rectangle. Most landmarks are not on grid lines. Within its rectangle (.d.), labrale superior is at 50% from the anterior side (line 1) horizontally, and at 30% from the base (line E) vertically. Gonion’s mean position within its rectangle (.w.) is horizontally at 14% from the anterior vertical line (4) and vertically at 27% from the upper horizontal line (E).

The individualized norm outline is drawn by connecting the proportionately located landmarks of the profile and hard tissues (bone and teeth). The individualized norm can be drawn manually or generated by a computer program (originally developed at the University of Pennsylvania in cooperation with Michael Bailey, personal communication, 1989) by simply entering the patient’s face depth (the distance sella turcica–nasion) and upper face height (nasion to the projection of ANS on the vertical through nasion).

Fig. 2. Mean proportionate location of hard and soft tissue landmarks in the norm mesh diagram for 18-year-old women (see text for details of mesh construction). Selected landmarks are identified and labeled alphabetically on the soft tissue outline and numerically on hard tissues: A, glabella; B, nasion; C, pronasale; D, subnasale; E, labrale superior; F, stomion; G, labrale inferior; H, supramentale; I, pogonion. 1, glabella; 2, nasion; 3, sella turcica; 4, basion; 5, ANS; 6, point A; 7, PNS; 8, maxillary incisor edge; 9, maxillary incisor axis; 10, mandibular incisor edge; 11, mandibular incisor axis; 12, point B; 13, symphysis superior (lingual aspect); 14, pogonion; 15, menton; 16, symphysis inferior; 17, gonion; 18, ramus posterior (Rp); 19, ramus anterior (Ra); 20, articularae; 21, condyle (anterior); 22, anterior limit of occlusal plane; 23, posterior aspect of occlusal plane (2 cm from # 22). Each landmark in the mesh diagram is located within a rectangle (marked a2.x.). Number 24 refers to the core maxillary structure defined by landmarks bordering the orbit anteriorly, pterygomaxillary fissure posteriorly, and the key ridge inferiorly.
Gender differences were found insignificant in the initial research on the mesh diagram. Therefore, preference was given to using the female norm, because certain references were delineated with less variations for practical use (Fig. 2): the vertical through nasion intersects point A and the tip of the mandibular incisor; the anterior and posterior nasal spines are both located on the same horizontal, and a horizontal also intersects both the tip of the mandibular incisor and the anterior aspect of the line representing the functional occlusal plane, suggesting a slight average curve of the mandibular occlusal plane.

PROPORTIONATE ASSESSMENT

An essential tenet of the mesh diagram is the proportionate evaluation of structures, which are readily related to each other. The variances of the landmarks are expressed in proportion to cranial (SN) and facial (upper face height) structures. Since the mesh norm includes a graphic display of the skeletal and soft tissue outlines (Fig. 2), comparison of the patient’s tracing to the norm defines facial form and the presence, extent, and site of soft tissue and skeletal facial disharmonies.

A- Comparison of structures

The patient’s tracing is superimposed on the plot, registered at nasion, and rotated until the vertical lines through nasion of both tracing and individualized norm align exactly (Fig. 3). Any deviations from the “individualized” norm disclose the dysmorphologic parts of the patient’s facial configuration, as well as implications on treatment. The tracing of the same patient shown in Fig. 1A is displayed inscribed in its mesh in Fig. 3. Readily observed are the low position of sella and the contribution of maxillary prognathism to the Class II malocclusion. Although mandibular position is normal, the decreased thickness of the soft tissue chin explains the clinical observation of mandibular retraction, at least relative to the nose and lips. Thus, treatment would favor enhancing differential growth with forward mandibular stimulation, rather than only maxillary distalization. Given that the nose will also grow, this treatment approach may be the most beneficial if supported by clinical findings.

Gauging the differential thickness of teguments along the profile is a distinct feature of the mesh analysis. In Class II, division 1 malocclusions, projection of the chin within the face was associated with soft tissue thickness: high correlations were observed between the thicknesses of upper and lower lips, as well as upper lip and soft tissue chin landmarks.

B- Regional superimpositions

Additional proportional assessment can be achieved through superimposition of patient tracing and individualized norm relative to facial structures, for example relative to the nose if rhinoplasty is not planned, by shifting the patient’s tracing to make the
patient’s pronasale coincide with his norm’s pronasale (Fig. 4). Other shifts to superimpose the occlusal planes or stomions, as needed in individual patients, allow more localized assessments of soft and hard structures.

The patient in Fig. 4 presents with a Class II malocclusion underlaid by a skeletal dysplasia. Upon superimposition of patient tracing and mesh norm, registered at nasion (Fig. 4a), the following observations are made: small nose, low sella, nearly average position of maxilla and upper lip, protruded lower lip, normally positioned mandible and soft tissue chin. When the tracing is shifted over norm for superposition on pronasale (Fig. 4b), maintaining the vertical through the tracing and the mesh parallel, a different conclusion emerges: the maxilla is prognathic. Yet, since the nose is small, treatment should not be directed to maxillary distalization, which would require bodily movement of the upright maxillary incisors.

The most revealing observations are noted when tracing and mesh norm are shifted, with their respective verticals maintained parallel, to registration at stomion (Fig. 4c). The upper and lower lips are close to normal. The prognathic maxilla, because of a reduced thickness of the upper lip, supports the normal position of this lip. The soft tissue chin is moderately deficient, though the mandible is in normal position relative to stomion and the lips. Based on these evaluations, treatment would be directed at enhancing mandibular growth to buttress a more forward projection of the soft tissue chin.

C- Appraisal of orthognathic surgery with the mesh diagram

Orthognathic surgical planning is a primary application of the unique graphic and proportional evaluation that the mesh analysis provides of the lower face soft and hard structures among themselves and relative to those of the upper face and nose.

The pre and posttreatment cephalographs of a young adult female patient were evaluated with the mesh diagram (Fig. 5). The cephalometric diagnosis, derived from the mesh diagram, guided the planning of her combined orthodontic-orthognathic surgery treatment. Upon registration on nasion of the pretreatment tracing over the normalized profile (Fig. 5a), the cephalometric diagnosis revealed these deviations: a large nose, prominent lower lip, retruded chin consistent with mandibular retrognathism and

Fig. 4. a- Tracing of a 9 years 11months old boy with a Class II, division 1 malocclusion. Superimposition on the individualized plot, registered on nasion, reveals a small nose, a close to normal maxilla and a well-positioned mandible. b- When the patient’s tracing is shifted forward to make the patient’s pronasale coincide with his norm’s pronasale, maintaining the vertical lines (black and red) through nasion parallel, a more prognathic maxilla is observed (relative to the small nose). c- Superimposition of patient tracing and norm at stomion. Lips are normally positioned, the upper lip buttressed by the prognathic maxilla. The normal position of the mandible does not support the extension of the chin because of decreased thickness of the soft tissue chin.
also with reduced soft tissue chin thickness. Components of the long face syndrome were evident: hyperdivergent pattern with increased long face height, maxillary vertical excess and steep mandibular plane.

When tracing and norm were shifted and registered on pronasale (Fig. 5b), the maxilla was retrognathic relative to the nose, and the lower face was further retruded, suggesting the need for maxillary advancement and chin extension. With further shifting down of the patient tracing on her norm to make the occlusal planes coincide (Fig. 5c), while maintaining the pronasale level anteroposteriorly, a more accurate diagnosis was formulated and several therapeutic hints were observed: the level of maxillary intrusion was illustrated by the deviation of the patient’s maxilla over the palatal plane on the norm; the maxilla required advancement to buttress the upper lip at a level proportional to that of the nose; the lower lip was at an adequate level, but the chin needed further advancement through genioplasty, beyond the mandibular forward rotation that follows maxillary intrusion and the forward advancement of the corpus.

Following presurgical orthodontics, the deviations could be corrected surgically with intrusion of the maxilla (6.5mm), that would also induce an estimated 3 mm forward rotation of the mandible, as well as maxillary advancement (6mm), mandibular advancement (7mm), and genioplasty (5mm). The effectiveness of this treatment was gauged upon
superimposition of the posttreatment cephalometric tracing on the individualized norm and registered on pronasale while the vertical references were kept parallel (Fig. 5d). The posttreatment results closely matched the individualized mesh diagram, with a remarkable correspondence between the soft tissue outlines and incisor positions. Although it led to maxillary prognathism, the maxillary advancement supported the position of the upper lip. Since surgical modification of the patient’s large nose was discarded, the tip of the nose (pronasale) would not be altered, and served for registration of the patient’s tracing on the computerized norm for final posttreatment evaluation.

Therefore, the patient’s tracing was manipulated over the norm in as many ways as necessary to generate a more complete diagnosis and formulate treatment alternatives before adopting a final treatment plan commensurate with clinical observations. Indeed, registering the superimposition of the patient’s tracing and the norm on the occlusal plane as in Fig. 5 (or sometimes on the maxillary incisor tip) allows the evaluation of the severity of the mandibular deformity.

In the context of surgical planning, the cephalometric errors of magnification that result from the projection of a three-dimensional head on a cephalometric film must be considered. While the magnification should ideally be corrected, that of condylion-pogonion was shown to bring this distance closer to the actual anatomic size\(^{17}\), allowing for more accurate extrapolations in orthognathic treatment planning that is based on direct cephalometric measurements.

**CONCLUSIONS**

1- Information gathered from traditional linear and angular measurements is fragmented and must be integrated to obtain the necessary guides for treatment planning after verifying the reliability of the references used for measurement. The mesh diagram analysis provides a simultaneous display of hard and soft tissues, which can be evaluated separately and relative to each other. Any variations in the teguments’ thickness at different levels of the face (upper lip, lower lip, chin) may create or compensate for a disproportion.

2- Orientation of the mesh coordinate system on the patient’s natural head position allows the gauge of correspondence between the clinical examination and cephalometric analysis. The natural head position remains a needed standard to evaluate even the “horizontality” of the Frankfort horizontal. Reliance on SN, FH, or basion–nasion as basic cephalometric references cannot replace sound clinical judgment as it can mislead cephalometric diagnosis in an individual patient.

3- A patient’s profile is not directly compared with the population norm but with a “patient norm.”

4- Patients with severe facial dysmorphic features are particularly suited for a proportional analysis with the mesh diagram, which serves as a template for planning surgical correction of facial deformities and malocclusions.

5- The analysis allows the comprehensive manipulation of the patient’s tracing over the individualized norm in a series of registrations (regional superimpositions). Such manipulation offers flexibility of utilization in one single graphic display of dysmorphologies and malocclusions unparalleled with other analyses, and facilitates the generation of treatment plans to establish optimal facial harmony within the limitations of the patient’s facial type. Clinicians should use the mesh diagram analysis, particularly that a computerized program is available.

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Ossifying (cemento-ossifying) fibroma: a case report

Rima Abou-Tayeh¹, Elie Sidnaoui², Waël Khalil³, Tamim Zaouk⁴, Antoine Berbéri⁵

INTRODUCTION

Ossifying Fibroma (OF) is “a benign, slow-growing, nonodontogenic tumor of the jaws that is often clinically and microscopically similar-if not identical- to cementifying fibroma” (J.C.B Stewart, 1999). It occurs most frequently in second and third decades of life and it is more common in mandible than in maxillofacial region, and in females²,³, and “its presentation is similar to that of fibrous dysplasia (FD) in that it causes expansion of the bone without violating the cortical plate”(J.J. Sciubba, J.E. Fantasia, L.B. Kahn, 2001).

This tumor was first described in 1872 by Menzel, and it was named ossifying fibroma in 1927 by Montgomery¹. It may cause malocclusion and cosmetic deformities, and if maxillary region is affected, orbital, nasal and antral deformity may result (in neglected or untreated cases, deformity may be very severe).

It is classified as one of the benign fibro-osseous lesions of the jaws, and historically has been referred to as “fibro-osteoma”, “osteofibroma”, and “benign fibro-osseous lesion of periodontal ligament origin” (table 1).

OF is considered neoplastic in origin by many authors²,³,⁶, among them Pindborg (1951), Waldron (1953), Thoma (1956), Sherman and Sternbergh (1948), and Neville et al.²,³,⁶.

Table 1: Neoplasms and other lesions related to bone (J.J. Sciubba, J.E. Fantasia, L.B. Kahn, 2001).

<table>
<thead>
<tr>
<th>I-Fibro-osseous lesions:</th>
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<tbody>
<tr>
<td>- Fibrous Dysplasia (FD)</td>
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<tr>
<td>- Ossifying Fibroma (OF) and Juvenile OF (JOF)</td>
</tr>
<tr>
<td>- Periapical Cemental Dysplasia (PCD)</td>
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<tr>
<td>- Florid Cemento- Osseous Dysplasia (FCOD)</td>
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<table>
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<th>II-Nonodontogenic lesions of the jaws:</th>
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<tr>
<td>- Giant cell lesions</td>
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<tr>
<td>- Osseous lesions</td>
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<tr>
<td>- Cartilaginous lesions</td>
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<td>- Fibrous lesions</td>
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<tr>
<td>- Vascular lesions</td>
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<tr>
<td>- Synovial lesions</td>
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<tr>
<td>- Neuroectodermal lesions</td>
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<tr>
<td>- Hematopoietic/lymphoid/histiocytic lesions</td>
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(In, Atlas of Tumor Pathology/Tumors and Cysts of the Jaw, AFIP-Armed Forces Institute of Pathology, Washington, DC, USA).
ETIOLOGY AND PATHOGENESIS

Many clinicians and pathologists consider OF as being a benign neoplasm that develops from undifferentiated cells of periodontal ligament origin: this neoplastic etiology is supported by many examples of ossifying fibromas that achieve a very large size, exhibit a particularly aggressive behavior and produce significant osseous destruction.

In only very few reported cases of OF, chromosomal translocations have been identified (20).

Other authors regard this lesion as a typical example of a localized dysplastic process.

Similarities between OF and cementifying fibroma (CF) are numerous: similar age groups and locations, comparable clinical features, undistinguishable microscopic characteristics, identical biologic behavior, and the only distinction between both processes may in fact be academic and it is most often based on the nature of the calcified product in the tumor (J.C.B.Stewart, 1999).

This is the reason why many oral surgeons and pathologists use the term cemento-ossifying fibroma (COF) to describe this lesion.

CLINICAL FEATURES

OF is slow-growing, asymptomatic (when discovered), expansile lesion that -with very rare exceptions- arise in teeth-bearing regions of jaw (mostly in mandibular premolar/molnar area- rare cases have been reported in craniofacial bones other than the jaws).

Because of expansion of the lesion, thinning of the cortices may happen but perforation and mucosal ulceration are rare.

OF is an uncommon lesion that occurs during second, third (and sometimes fourth) decades of life. There is a definite female predominance and most of lesions occur most commonly in a solitary fashion (rare multiple ossifying fibromas have been reported).

RADIOGRAPHIC FINDINGS

The sharply defined and well-circumscribed border is the most important radiographic feature of OF: indeed, the “involved bone is expanded by a well-delineated radiolucent or mixed-radiolucent and radioopaque-lesion, and the margin may be slightly sclerotic” (J.J.Sciubba, J.E. Fantasia, L.B. Kahn, 2001).

As a matter of fact, radiographic appearance of OF is variable and it depends on the maturation or the amount of calcification present (early lesions usually appear as unilocular or multilocular radiolucencies that considerably resemble odontogenic cysts, and this initial radiolucent stage will normally-and gradually-progress to a mixed stage as calcified material is deposited within the tumor. At last, mature lesions will present as dense, radioopaque mass surrounded by a well-defined radiolucent rim).

Roots of teeth are frequently displaced or resorbed (less commonly) as the lesion expands, and it may also displace inferior alveolar canal, whereas, in FD, teeth are rather enveloped by the lesion.

HISTOPATHOLOGIC FINDINGS

OF consists of a cellular, collagenous, fibrovascular stroma that contains various numbers of uniform spindled or stellate cells, and this stroma is relatively well vascularized in many instances, but only in some cases, it is fibrotic and avascular.

Grossly, OF is very well circumscribed, and consequently, it can be readily surgically dissected and easily curetted or enucleated from surrounding (adjacent) normal bone.

OF shows an architecture that is similar to that of FD: spicules of osteoid (or woven) bone, of varying shape that are set in a vascularized stroma. Woven(=immature) bone is lined by active osteoblasts.

Calcified deposits are observed throughout fibrous stroma and if woven bone(=irregular trabeculae) is most consistently noted in this tumor, lamellar bone(=mature) is also observed in a large percentage of cases.

“Additional patterns of calcified material include small, ovoid to globular, basophilic deposits and anastomosing trabeculae of cementum-like material. The observation of these deposits in many of these lesions has led some investigators to conclude that OF and FD are similar if not identical lesions”(J.C.B.Stewart,1999).

“Unlike FD, in which matrix formation proceeds directly from the stromal fibrocytic type cells, the stromal cells in OF evolve into rimming osteoblasts...
which line the bony spicules. As in FD, cementicles might constitute a minor or major portion of the mineralized matrix” (J.J.Scuibba, J.E.Fantasia, L.B.Kahn, 2001).

The term juvenile ossifying fibroma (JOF) designates lesions with a highly cellular stroma and cell-rich osteoblastic cords, and patients with this variant are usually diagnosed at an earlier age.

Most ossifying fibromas exhibit a mixture of the different types of calcified products.

**DIFFERENTIAL DIAGNOSIS**

Distinguishing between OF and FD was (and remains) the primary differential diagnostic challenge: both processes may exhibit similar clinical, radiographic, and microscopic features.

Table 2 addresses similarities and differences between OF and FD:

**Table 2**

<table>
<thead>
<tr>
<th>Similarities</th>
<th>Differences</th>
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<tbody>
<tr>
<td>1-Both occur in similar age groups and location</td>
<td>1-Distinction between the two processes is often based on the nature of calcified product in the tumor</td>
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<tr>
<td>2-Both exhibit comparable clinical characteristics</td>
<td>2-The most helpful feature distinguishing the two processes is the radiographic and clinically well-circumscribed appearance of OF and the ease with which it can be separated from normal bone</td>
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<tr>
<td>3-Microscopic features are indistinguishable in many instances</td>
<td>3-FD may involve several bones concomitantly(polyostotic FD)</td>
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<td>4-Biological behavior is identical in both</td>
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Table 3 is a brief reminder of differences between OF and other relatively common lesions that could be confused with it:

**Table 3**

**Differential Diagnosis (DD) with other kinds of lesions**

| DD with osteoblastoma and osteoid osteoma | 1- Osteoblastoma and osteoid osteoma are evident in a slightly younger group and are often characterized by pain. 2- Osseous trabeculae in these lesions are rimmed by abundant plump osteoblasts. |
| DD with cementoblastoma | Cementoblastoma may ARISE with a similar clinical and radiographic presentation. However, this lesion is FUSED to the root of the involved tooth (usually a permanent mandibular molar). |
| DD with focal sclerosing osteomyelitis | In focal sclerosing osteomyelitis, a source of INFLAMMATION is evident. Pain, tenderness, swelling or lymphadenopathy are also common. |

**TREATMENT AND PROGNOSIS**

OF is most often treated by surgical removal, using curettage or enucleation. As stated earlier in this paper, the sharp circumscription of the lesion lends itself readily to surgical enucleation: OF can be very easily separated from surrounding (normal) bone, and recurrence is rarely described after removal. However, “long-term follow-up is advocated with conservative excision of lesions that might recur after curettage” (J.C.B.Stewart,1999).

Sciubba and Younai observed only a single recurrence in 18 cases of OF, the majority of which were managed by conservative excision.

The use of liquid nitrogen cryotherapy for the treatment of OF has also been reported but its efficiency was never proved by evidence-based studies.

JOF (that has been described in children and young adults) commonly involves paranasal sinuses and periorbital bones, leading to exophtalmos, proptosis, sinusitis and nasal symptoms: this rare lesion is known to behave much more aggressively than OF and, according to many authors and clinicians, it may require more extensive therapy. For this reason, a more radical resection is often necessary for some surgeons, although others still prefer conservative curettage or resection.
Radiotherapy is contraindicated in treating JOF, and until today, there has been no single (written) report or oral presentation of evolution of JOF into a sarcoma.

True relationship between OF and JOF awaits elucidation and warrants further studies.

THE CASE REPORT

A 45 year old lady consulted us for dental osseointegrated implant placement. She has no systemic disease and was not following any medical or surgical treatment.

Intra-oral and panoramic examinations (Fig.1 and 7) revealed an acceptable oral hygiene, a good general periodontal status, absence of teeth (18, 25, 26, 28, 36, 37, 38, and 46) and presence of dental restorations (amalgam restorations on 48, 27, 17; ceramic crowns on 36, 37, 25, 15, 14; composite restorations on 11, 12, 21, 22; ceramic bridges on 45 to 47)

Panoramic(fig.7) and periapical(fig.5) radiographs displayed a well circumscribed unilocular radiolucency of ~10mm of diameter, located in the left permanent mandibular canine (33) periapical area: dental clinical examination was performed again in this specific location and displayed a vital 33 that responded, indeed, to vitality tests (cold and pulp tester), no signs or symptoms of inflammation and a normal vestibule.

A computerized tomography (CT) scan (dentascan) revealed the accurate boundaries of the radiolucency (fig.8).
Treatment planning included the following:
endodontic treatment of 33, and surgical removal
of radiolucency using enucleation and curettage.
Antibiotic was prescribed to the patient
(Amoxicillin, 500 mg tablets, one tablet each 6 hours)
24 hours before operation schedule, and it was
continued for 6 days after operation, together with 0.12%
chlorhexidine digluconate mouthrinses (3 minutes
each 3 hours and after each meal).
A full-thickness mucoperiostal flap was
raised(fig.2) under local analgesia (lidocaine 2% with
1/100,000 epinephrine) after performing a buccal
sulcular incision, encompassing teeth 32 to 35 with a
mesial releasing incision. Lesion’s access and
enucleation were easy by cutting 3mm of the root of 33
(Fig.6) in its apical region and after curettage, a
copious irrigation with serum saline was performed
and the flap was sutured by using 3/0 silk separated
sutures (fig.4).
Macroscopically, the enucleated lesion was almost
1 cm long (fig.3), well circumscribed, whitish and
relatively hard on cutting.
Microscopic examination revealed a fibroblastic
and osseous, benign proliferation. Observed bone was
of lamellar structure, with osteoblasts and rare
osteoclasts. No cytonuclear atypia or mitosis or
necrosis could be observed.

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Effectiveness of a hand file and two nickel-titanium rotary instruments for removing gutta-percha in severely curved root canals during retreatment: an in-vitro study

Richard M. Gergi*, DCD, DESE

Abstract

**Purpose:** To evaluate in vitro, the effectiveness of hand files, ProTaper and R-Endo rotary instruments for removing gutta-percha in curved root canals.

**Material and Methods:** Ninety severely curved teeth were divided into 3 groups. The teeth were enlarged and obturated using vertically condensed gutta-percha. Removal of gutta-percha was performed with the following devices and techniques: Hedström files (Vereinigte Dentalwerke, Munich, Germany), ProTaper (Maillefer, Ballaigues, Switzerland) and R-Endo (Micro-Mega, Besançon, France). All techniques were used with the solvent eucalyptol. The amount of filling debris remaining on root canal walls was assessed radiographically; the images were digitized and analysed using AutoCAD 2000 software. Total canal area, area of the cervical, middle and apical thirds, and area of remaining filling material from 2 directions were outlined by two operators and calculated. Statistical analysis was performed using the Kruskal-Wallis test.

**Results:** Comparisons of the percentages of remaining filling material in the entire canal did not reveal any significant differences between the methods of removal. However, when each third was analysed separately, significant differences for remaining debris were present in the apical third of the 3 groups, while the cervical and the middle thirds were significantly cleaner (P = 0.005).

**Conclusion:** Under the experimental conditions, ProTaper and R-Endo NiTi instruments proved to be efficient and safe devices for the removal of gutta-percha in severely curved root canals.

**Keywords:** gutta-percha, eucalyptol, ProTaper, R-Endo, retreatment, NiTi instruments.

INTRODUCTION

Safe and efficient removal of material filling from canal systems is essential for optimal endodontic retreatment outcomes. To a possible extent, all obturation material and its sealer should be removed from all canal walls as bacteria can be harbored under a previous obturation that remains. The aim of canal retreatment is to remove the existing root canal filling material completely, thereby allowing the root canal system to be cleaned. The most common root canal filling material to be removed is gutta-percha. However, the removal of gutta-percha filling material, particularly from apparently well-condensed root canals may be time consuming. Unfortunately, this is essential for the success of retreatment.

Gutta-percha removal is accomplished usually by the use of hand instruments (both K files and Hedström files), rotary instruments, and a combination of hand and rotary files with or without solvents. Heat carrying and ultrasonic instruments are also helpful devices.

A new generation of endodontic instruments made of nickel titanium (NiTi) has been developed. Several reports have confirmed the advantages of NiTi instruments, including maintenance of the canal shape without “zip” and ledges and significantly faster preparation for the rotary devices when compared to hand instruments.

Although NiTi instruments have been proposed as an alternative to hand instrumentation for removing gutta-percha, few studies have investigated and compared the effectiveness of these instruments in the removal of filling material.
These studies found residual root canal filling material on dentine walls and a high risk of NiTi instruments fracture. To the authors knowledge, there are no comparative studies investigating the behaviour of NiTi rotary ProTaper® system (Dentsply, Maillefer, Ballaigues, Switzerland) and R-Endo® system (Micro-Mega, Besançon, France) for gutta-percha removal in severely curved root canals. Therefore, the purpose of this study was to compare the cleanliness of root canal walls after retreatment using 2 engine-driven rotary instruments ProTaper® and R-Endo® and hand instruments (Hedström files).

**MATERIAL AND METHODS**

**Specimen preparation**

Ninety extracted teeth with severe angle $25^\circ<\alpha<70^\circ$ (Schneider 1971) and severe radius $r<10$mm (Lopez et al. 1998) of curvature were obtained and stored in 10% buffered formaline. Access openings were made into the pulp chamber using a high speed 1557 carbide bur and water spray.

A size 10 K-type file (K-file; Dentsply Maillefer, Ballaigues, Switzerland) was placed into the canal until it was visible at the apical foramen and the working length established 0.5 mm short of this length. For more uniform samples, the crowns were flattened using steel discs and a final dimension of 18 mm working length was achieved for each tooth.

**Canal preparation**

The same operator using a standardized technique prepared all canals. The canals were instrumented with sizes 15 and 20 K-Files using a step back technique to the working length. Canals that were patent to greater than ISO size 20 were discarded. In this way the final size of the apical preparation could be standardized as it was intended to instrument all canals to master apical size 20. This was followed by a preparation with two rotary NiTi Hero 642 files (Micro-Mega, Besançon, France), 0.5 mm short to the working length. The files were rotated at 300 r.p.m. Canals were irrigated between instruments with 3 ml NaOCl (5.25%) using a disposable syringe. When the instrumentation of root canals was completed EDTA (17%) was applied for 1 min for smear layer removal and the canals flushed again with 5.25% NaOCl. Finally the root canals were dried with paper points.

**Obturation**

A fine feathered cone (Kerr, Romulus, MI, USA) lightly coated with sealer (Pulp canal sealer EWT, Kerr) was trimmed to fit at the working length with “tug back”. A System B condenser 0.04 taper ISO size tip 30 (Analytic Technology, Redmond, WA, USA), marked with a rubber stop, was inserted 3 mm short of the working length. The system B unit was set at 200°C and power 10 obturation. All points were seared off at the canal orifices. The activated condenser was then pushed apically into the gutta-percha until just short of the pre-measured length. At this point the condenser was seated to length without heat and apical pressure maintained for approximately 10s. A second burst of heat was used to remove the condenser. Canals were back filled using thermomechanical compaction.

The standard of obturation was assessed using bucco-lingual and proximal radiographs. A filling was deemed adequate when it appeared to be dense and contained no voids; inadequately filled canals were recondensed. The prepared roots were randomly assigned to one of the two groups. All teeth were stored at 100% humidity and 37°C for a period of 7 days to allow the sealer to set completely.

**Retreatment techniques**

Using an endodontic syringe all ninety roots divided randomly into three groups had a few drops of eucalyptol applied to the gutta-percha for 3min.

All rotary files were used in a crown-down technique on an engine driven motor (Teknika Vision, ATR, Pistoia, Italy) with constant speed (400 rpm), low torque (4N/cm) and light apical pulses of pressure to remove gutta-percha and its sealer.

**ProTaper:** ProTaper finishing files (F3, F2, F1) of 21mm length were used. When the file F3 (0.09 taper ISO tip 30) could not progress apically the following file F2 (0.08 taper ISO tip 25) was used until the file F1 (0.07 taper ISO tip 20) reached the apex. Adherent material was removed from the file during instrumentation and eucalyptol replenished. Apical enlargement was performed to file F1.
**R-Endo:** R-Endo files (Re, R1, R2, R3) were used to remove gutta-percha and its sealer. All R-Endo files have an ISO tip 25 but different tapers: 0.12 for Re, 0.08 for R1, 0.06 for R2 and 0.04 for R3. During retreatment when a rotationg file could not progress apically, the following file was used until the file R3 reached the apex. However apical enlargement was performed to file R2. Therefore, after R3 reached working length, the file R2 was used again to the working length.

In both groups, if rotating files could not reach working length, a stainless steel file MMC 15 (Micro-Mega, Besançon, France) was used to negotiate the canal. After negotiation, rotary files were used to working length.

**Hedström files:** The canals were re-instrumented with H-type files with sizes 35, 30 and 25 in a circumferential quarter-turn push-pull filing motion to remove gutta-percha and sealer from the canal.

Eucalyptol was constantly renewed and NaOCl (5.25%) irrigation was used until no more filling material debris (gutta-percha and sealer) was observed in the instrument flutes or in the irrigation solution. Retreatment was then considered complete.

**Evaluation methods**

When filling removal and re-instrumentation of the root canals were concluded, mesiodistal and buccolingual radiographs were taken. Exposure time was 15 seconds and the distance between the X-ray source and film was set at a constant distance of 4cm. The images were digitized using a scanner with the resolution set at 600 dpi, brightness 132, and contrast at 142. Images were evaluated with the AutoCAD 2004 software (Mechanical Desktop Power Pack, Microsoft, Redmond, WA, USA). The area of the remaining filling material of the mesiodistal and the buccolingual images were measured.

Remaining filling material was identified and quantified by two different operators through the difference of radio-opacity and outlined (Figs 1-2). If they did not agree with the outline areas, the measurement was repeated until consensus was reached. Then each root canal was divided in apical, middle, and cervical thirds, which were evaluated separately in square millimeters.

**ANALYSIS**

For statistical analysis, measurements of means and standard deviations of areas and remaining filling material were obtained with the Kruskal-Wallis test for the global null hypothesis to identify any significant differences among the 3 groups. The level of significance was set at 5% (Table 1).

**Table I. Areas of remaining obturation material**

<table>
<thead>
<tr>
<th>Method</th>
<th>A1</th>
<th>SD</th>
<th>A2</th>
<th>SD</th>
<th>A1 + A2</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProTaper</td>
<td>1.18</td>
<td>1.03</td>
<td>1.41</td>
<td>1.30</td>
<td>2.59</td>
<td>2.29</td>
</tr>
<tr>
<td>R-Endo</td>
<td>1.10</td>
<td>1.01</td>
<td>0.86</td>
<td>0.76</td>
<td>1.96</td>
<td>1.72</td>
</tr>
<tr>
<td>Hedström</td>
<td>1.44</td>
<td>1.05</td>
<td>1.68</td>
<td>1.18</td>
<td>3.12</td>
<td>2.16</td>
</tr>
</tbody>
</table>

The number of teeth was n = 30 in all groups.

**RESULTS**

All roots displayed severe angles between 25 and 45 degrees of curvature (mean 30.5 degrees, standard deviation 4.0 degrees). Mean of radii of all roots was 7.5 mm (standard deviation 3.5 mm). There were no significant differences among the groups concerning angles of curvature (P = 0.56; Kruskal-Wallis test) and radii (P = 0.87; Kruskal-Wallis test).

Regarding areas of remaining obturation material, there was no significant difference between the 3 groups (P > 0.05). However, imaged in mesiodistal direction, the Hedström group (P < .05) and the
ProTaper group (P < .01) revealed significantly larger areas of remaining obturation material than the R-Endo group. Also after the summation of the areas measured in buccolingual and mesiodistal directions of each specimen, canals retreated with R-Endo showed fewer areas of remaining gutta-percha and sealer than specimens retreated with ProTaper files (P<.05; Table I). The apical third had the most remaining filling material compared to the middle and cervical third. It was only possible to make a semiquantitative evaluation of the amount of debris remaining. Evaluation was subjective, and observer performance is known to be variable in many cases where diagnosis is required.

None of the instruments used fractured. Deformation of NiTi instruments was visible for both systems. These instruments were disposed (Figs 3-4).

**DISCUSSION**

Removal of sealer and gutta-percha from inadequately prepared and obturated root canal systems seems essential in root canal retreatment because it uncovers remaining necrotic tissues or bacteria that may be responsible for periapical inflammation and failure.

In the present study, the teeth were flattened coronally and the working length of each root canal was standardized at 18 mm so that varying lengths could not exert influence on the results.

The following study used reciprocating systems connected to electric motors for removal of filling material. The same minimal speed was selected (400 rpm) for the two devices and torque was adjusted according to the information provided by the manufacturers. Gambarini reported that instrumentation with low torque increased tactile sensitivity and, consequently, control of rotary instrumentation. This led to a decreased risk of ledges, perforations and fractures of NiTi instruments. Yared et al. pointed out that systems powered by air could not control torque, and air pressure variation might affect the rotational speed and torque. Such findings justified the use of reciprocating systems powered by an electric motor.

All root canals in this study were prepared initially to size 20 with a 4% taper.

This was assumed to represent rather narrow and often underprepared root canals, which frequently are found in retreatment cases. Probably, preparation to sizes 30 or even 25 with a 6% or 8% taper may have been more appropriate from a clinical prerogative.

Most previous retreatment studies have used teeth obturated by lateral condensation which does not create a homogeneous mass of gutta-percha but tends to entrap pools of sealer in the filling mass and concentrates the condensation more to the middles and coronal thirds rather than the apical third. The thermoplasticized gutta-percha technique used with vertical condensation was found to give consistent homogeneous obturation with gutta-percha. By taking radiographs in the buccolingual and mesiodistal direction for each tooth, density and completeness of obturation could be checked. The aim was to fill all dimensions of the root canals densely with gutta-percha and sealer and thus provide a greater challenge for the subsequent retreatment.

One of the most important and critical points in the study is the method of evaluation of the amount of remaining filling material. Different methodologies have been reported: longitudinal cleavage of teeth which may displace debris of the material to be

![Fig 3](image3.png)

![Fig 4](image4.png)
evaluated\(^{16}\); association of longitudinal and transverse cleavage for evaluation in thirds\(^{17}\); and cleavage and photographic recordings\(^{4}\). Hülsmann & Stotz\(^{9}\) used visual examination through cleavage and photography in association with radiographic examination. The problems with sectioning are that it can disturb the remaining filling material and it is unpredictable\(^{16}\).

The present analysis was carried out using the method reported by Barletta & Langranha\(^{11}\) without longitudinal cleavage and with radiographs being analysed by means of a software package developed for civil engineering and architecture, the AutoCAD 2000. This method is more reliable since remaining gutta-percha or sealer might get lost by splitting the roots\(^{6,12-16}\). However, this method has limitations as radiographic images provide only two-dimensional information on a three-dimensional structure and may be subject to magnification and distortion.

In the present study complete removal of root canal filling material was difficult to achieve. Only one third of the teeth (4/30 for ProTaper\(^{®}\) system and 5/30 for R-Endo\(^{®}\) system) showed completely clean root canals. Most of the canals showed radiographically persistence of filling material, a finding that is consistent with previous reports\(^{4-11}\). The evaluation of total percentage of remaining filling material did not reveal any statistically significant differences in technique effectiveness for the groups studied.

However when the analysis was stratified by thirds, a difference was revealed when comparing the apical third with the other two thirds for both groups (P<0.05).

The apical third left a mean percentage of remaining filling material higher then the middle and the cervical third in both groups. There is an increase in the anatomical variability and difficulty of instrumentation in this region. The existence of deep grooves and depressions on dentine walls in the apical third may well explain the presence of these less-instrumented areas\(^{6,10}\). Moreover, according to Hülsmann and Bluhm, it is very difficult from a clinical point of view if not impossible, to direct NiTi instruments against curved root canal walls at least in the apical region\(^{10}\).

Deobturation of root canal walls was done one month after obturation. Other studies using NiTi rotary instruments for retreatments were performed after a period ranging from 7 days to one year\(^{6,11-16}\). They were all unable to completely clean root canal walls especially in the apical third.

Ferreira et al. found that retreatment of root canal walls with curvatures between 25 and 45 degrees using K-Flexofiles, Hedström files, and ProFiles 0.04 files produced similar results.

Imura et al.\(^{16}\) in a comparative evaluation quantified the amount of remaining gutta-percha or sealer on the walls of root canals following retreatment with two engine driven NiTi instruments (Quantec and ProFile) and two hand instruments (K-File and Hedström file). The results revealed that all instruments left filling material inside the root canal\(^{17}\).

From the results of the present investigation using curved root canals the NiTi rotary instruments seem to be useful during retreatments but not enough.

**CONCLUSION**

Under the experimental conditions, both rotary NiTi systems proved to be helpful and safe devices for gutta-percha removal in endodontic retreatment.

Nevertheless, the results showed that overall all instruments may leave filling material inside the root canal especially in the apical third. Rotary instrumentation should be followed by hand instrumentation to achieve optimal cleanliness of root canal walls.

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Numerous patients have been lately consulting regarding head and neck pain associated to pain in the arms; the symptoms described initially appeared to be those of a cranio-mandibular dysfunction irradiating to neck, shoulders and arms. Through a more detailed screening and after repeated consultations of many patients describing the same symptoms, all of them had computer related jobs or activities.

Numerous cases of neck, shoulder and arm pain and dysfunction healed after conventional TMJ treatments, therefore, cranio-mandibular dysfunction was among possible etiologies presumed; but after a complete screening, the symptoms described were those of a computer related pain, a modern disease.

As the use of personal computers has increased, a very common contemporary disease among young and middle aged population related to computer work actually rose\textsuperscript{1,3,5} where some symptoms tend to be similar to irradiated myofacial dysfunction cases. Through a review of the literature\textsuperscript{2,3}, many epidemiologic studies found possible evidence for the relationship between computer work and neck, hand and arms painful and dysfunctional pathologies such as Tendinitis, Bursitis, Tenosynovitis / DeQuervain’s Syndrome, Tendinosis, Thoracic Outlet Syndrome, Trigger Finger/Thumb, Myofacial Pain Syndrome, Cubital Tunnel Syndrome, Epicondylitis.

The following paper summarizes series of scientific articles and researches concerning what is called “the computer syndrome”.

Burt et al.\textsuperscript{4} studied 834 employees using computers. They found a statistically significant occupational risk of 2.8 for elbow/shoulder’s symptoms in newspaper employees who reported typing 80%–100% of their working day compared to those not typing (Table 1).

**WHAT IS COMPUTER RELATED PAIN?**
Computer related pain\textsuperscript{1} is described as part of occupational overuse syndrome (OOS) or more commonly the repetitive strain injury (RSI); another name for the condition is Cumulative Trauma Disorder that results from:
- repetitive tasks - performing the same movement repeatedly;
- awkward or fixed posture or holding the same position for a long time;
- fast pace - having to work quickly; and/ or duration of task with Insufficient Recovery Time - inadequate rest breaks.

<table>
<thead>
<tr>
<th>Body part</th>
<th>Risk factor</th>
<th>Strong evidence</th>
<th>Evidence</th>
<th>Insufficient evidence</th>
<th>Evidence of no effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck and Neck/shoulder</td>
<td>Repetition</td>
<td>...</td>
<td>++</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>Force</td>
<td>...</td>
<td>++</td>
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</tr>
<tr>
<td></td>
<td>Posture</td>
<td>+++</td>
<td>...</td>
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<td>...</td>
</tr>
<tr>
<td></td>
<td>Vibration</td>
<td>...</td>
<td>...</td>
<td>+/0</td>
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</table>

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Table 1. Relationship between physical work factors and musculoskeletal disorders
Rheumatic Strain Injuries occur from repeated physical movement. The rise of computer use and flat, light-touch keyboards that permit high-speed typing have resulted in an epidemic of injuries of the neck, hands, arms, and shoulders. Thousands of repeated keystrokes and long periods of clutching and dragging with mice slowly accumulate damage in the body (Table 1).

SYMPTOMS OF A COMPUTER PAIN^4

- Tightness, discomfort, stiffness, soreness or burning in the hands, wrists, fingers, forearms, or elbows
- Tingling, coldness, or numbness in the hands
- Clumsiness or loss of strength and coordination in the hands
- Pain waking up the patient at night
- Need of massaging hands, wrists, neck and arms
- Pain in the upper back, shoulders, neck or base of the head (occipital area)
- Recurrent or severe headaches
- Possible jaw pain (temporalis or/and occipital), earaches accompanied by dizziness, tenderness on the sides of the face
- Redness and watering of eyes
- Irritability
- Poor Concentration

THE MOST COMMON CONDITIONS RELATED TO COMPUTER PAIN^1^4

1-Forward Head Posture (FHP)

This posture generates pressure on the front of the cervical discs and pushes the fluid in the disc to the rear. Forward head posture causes the muscles at the base of head and neck to tighten, which restricts circulation through head, neck and arms.

Additionally, forward head posture makes it necessary to tilt the head backwards in order to see something directly in front of us, which compresses the spine (fig1) and can cause neck pain, thus contributing to carpal tunnel syndrome, cervical disc herniation, thoracic outlet syndrome, and TMJ dysfunction, as well as pressure on nerves, which can cause headaches and shooting pain down the arms.

People at risk include those who practice poor posture at the computer, FHP, holding the head in one position for a long time, dentists who hold the phone on their shoulder for long periods of time while talking. Blurry vision contributes to forward head position also: in fact, if our vision is blurry, we may lean forward and crane our necks to get a closer look.

2-Tendinosis and tendinitis:

Some activities hurt a tendon on a microscopic scale. When enough harm accumulates, pain starts. This injury is chronic. On the other hand, acute tendon injuries are sudden tears that cause immediate pain and obvious symptoms (fig 2-3).

People at risk: Assembly line workers, mail sorters, computer programmers, writers, court recorders, data entry processors, sign language interpreters, cashiers, professional athletes, and musicians.
3-Carpal Tunnel Syndrome

It is a common problem of wrists and hands. Carpal tunnel syndrome is caused by irritation of the median nerve, which runs through the wrist, the carpal tunnel and into the hand to supply sensation to the thumb, index finger, middle finger and half of the ring finger (Fig 4-5 and 6). The median nerve also supplies sensation to the thenar muscles (muscles of the thumb). The carpal tunnel is an opening into the hand made up of the bones of the wrist on the bottom and the transverse carpal ligament on top. Carpal tunnel syndrome is caused by any activity that puts repeated pressure on the median nerve. Such conditions can include repetitive actions of the hands and wrists such as typing, arthritis, a wrist fracture that heals abnormally, or anything that puts excessive pressure on the median nerve.

Symptoms can include burning pain, numbness and tingling of the hand that often runs up the arm to the neck, clumsiness and weakness in the affected hand. Pain and numbness often worsen at night. Another important sign is deterioration of the muscles that move the thumb. If left untreated, carpal tunnel syndrome can progress to the point of limiting thumb opposition and movement, which can result in inability to perform simple tasks, such as buttoning a shirt or holding a pencil.

People at risk: computer users, those with occupations that require repetitive wrist motions, pregnant women (due to fluid retention and joint swelling), people of 50 years of age or older, and smokers (due to decreased circulation).

4-Cervical Disc Herniation

Cervical Disc Herniation is a condition in which the gelatinous material within a cervical disc escapes the fibrous outer coating that holds it in place and presses on the nerves exiting from the spine in the cervical, or neck region. Trauma, such as car accidents, is a leading cause of these herniations. Another common contributing factor is leaning forward and sitting in forward head posture, which places pressure on the front of the cervical discs and pushes the fluid in the disc to the rear. Repeated pressure of this kind can eventually stress the disc to the point of bulging. Further stress can lead to a herniated or ruptured disc.

However, Cervical Disc Herniation can also result from excessive tilting of the head to the back, left or right. Either condition, bulging or herniating, can put pressure on nearby nerve roots, which causes pain, tingling and numbness. Because many nerves originating in the neck run all the way down the arms, a herniated cervical disc can cause pain, tingling and numbness down the arms and even into the hands. (Table 2)

Symptoms can include pain in the neck and shoulder, as well as numbness and tingling down the arm into the hands. In addition weakness of the arm and hand muscles can be associated with more severe cases.

People at risk: those who continuously sit in an awkward posture with their head tilted too far forward (Forward Head Posture), backward, or to either side.

5-Thoracic Outlet Syndrome

This condition affects the shoulder, arm and hand, and is characterized by pain, weakness and numbness in these areas. Thoracic Outlet Syndrome occurs when the five major nerves and the two main arteries that leave the neck are compressed between the two scalene muscles in front of the neck and the first rib (Fig 7). Thoracic Outlet Syndrome is caused by repetitive actions with the arms held overhead or extended forward, which can result in irritation and compression in this area. In addition, forward head posture, slouching or dropping the shoulders forward can cause
tension in the muscles at the side of the neck, which constricts arteries and nerves and contributes to Thoracic Outlet Syndrome. Other causes include an extra first rib or an old clavicle fracture, since these both limit space in this region. Violent injuries that tear the scalene muscles of the neck, such as whiplash, can lead to a buildup of scar tissue, which also restricts space around nerves and arteries, leading to Thoracic Outlet Syndrome.

Symptoms can include pain, weakness, numbness, tingling, swelling, fatigue, or coldness in arms and hands. Waking up with a “dead arm” is also characteristic of Thoracic Outlet Syndrome. This syndrome is often difficult to diagnose since its symptoms mimic those of other conditions, such as Herniated Cervical Disk, Carpal Tunnel Syndrome, or bursitis of the shoulder.

People at risk include those whose occupations involve repetitive actions with arms extended, such as computer users, waiters, painters and dentists.

6-Neck Pain

It is a general term that often describes symptoms of sprains and strains of the neck, excess muscle tension or myalgia, wry neck or stiff neck, Thoracic Outlet Syndrome and Cervical Disc Herniation. Risk factors for developing neck pain include prolonged flexion of the neck and sitting at work for 95% of working time.

Symptoms of neck pain can include pain, stiffness, decreased range of motion, tingling and numbness anywhere from the neck to the hand, skin changes of the neck, arm, and hand, and weakness of the muscles of the neck, arm, and hand.

People at risk: those who perform repetitive overhead activities such as painting and filing, computer users who type in an awkward posture,
telephone users who continuously tilt their head to one side, and people who sleep with too many pillows.

Besides, the main problem with laptops is that the screen and keyboard are so close to each other. Without the aid of peripherals, laptop users have two choices, neither of which would win them any points for posture. They can cramp their neck down (fig 8) to view the monitor or elevate the machine to eye level, which can wreak havoc on shoulders and arms.

7-Shoulder Impingement Syndrome
It is a condition of the shoulder joint caused by rubbing or pinching action (impingement) when the tendons that glide through the subacromial space get squeezed between the head of the humerus (top of the arm) and the acromion (tip of the shoulder) (fig 9). Shoulder Impingement Syndrome is caused by any repetitive action that irritates the shoulder bursa. Working with the arms overhead, excessive throwing motions, and poor posture can all lead to irritation of the shoulder bursa and tendons. Poor alignment of the shoulder joint, as well as bone spurs in the area can cause Shoulder Impingement Syndrome since they limit the motion of the arm and decrease circulation. Symptoms can include pain of the shoulder area, sharp pain when lifting the arm to the side or in front of the body, pain and generalized soreness after repeated movement or prolonged activity.

People at risk: athletes involved in “hand” sports such as baseball pitchers and tennis players, as well as computer users who repeatedly reach forward to their keyboard or mouse, people who practice poor posture at the computer (sitting with rounded shoulders pinches the tendons that run through the shoulder region), swimmers, window washers, waiters, painters or anyone else who performs activities involving reaching over the head.

8-Tennis Elbow (TE) or Lateral Epicondylitis
It is a condition characterized by inflammation of the common extensor tendon (Fig10), the tendon that begins just under the elbow on the forearm side of the arm and then branches out into the wrist extensors4.

Tennis elbow is caused by repetitive actions and stress placed on the common extensor tendon:
1) cyclical flexion and extension of the elbow
2) cyclical pronation, supination, extension, and flexion of the wrist that generates loads to the elbow/forearm region. The constant stress of holding the wrists at an awkward angle while working at a computer places continuous stress on the tendon, which can lead to TE.

Symptoms can include increased pain in the elbow after activities involving the wrist and hand, stiffness in the elbow joint, difficulty straightening the elbow, and pain when the wrist extensor muscles (top of the forearm) are stretched.

People at risk: those with occupations involving repetitive use of the forearm muscles such as computer users, tennis players, musicians, dentists, those who carry objects for prolonged periods of time.

9-Trapezius myositis /spasm
It is an inflammation of the muscle from repetitive trauma and/or overexertion injury.

Symptoms include muscle guarding, pain between neck and shoulder, limited neck range of motion and pain in another area such as base of the head (occipital).

People at risk: computer users. Tense shoulder muscles are strongly related to stress, the tension being more than necessary for the movements involved in work.

10-Mouse arm
Seems to be a general label for various kinds of symptoms, which are localized anywhere between the neck and the fingers and appear during, or shortly
after, prolonged and uninterrupted working sessions with a mouse. If the symptoms have not subsided by the next day, and use of the mouse has perhaps made the symptoms worse, the condition is then labeled ‘mouse arm’.

What causes the disorders? An important aspect in such precision work is that the hands and arms make very small, carefully controlled movements. The smoothness of these actions, and thus the result of the work, is controlled by visual inspection. The material and equipment needed for the work are located, for practical reasons, on a work surface to which the eyes and hands are directed. The whole upper body must be still, if the coordination of the eyes and fingers is to proceed smoothly. The upper limbs are a ‘kinetic chain’ of bones and joints which begins with the collarbone and shoulder blade and ends with the tips of the fingers. To control the fingers properly, the earlier parts of the chain must remain rigidly in the right position, which means that the shoulder and elbow joints and the wrist must not move. To achieve this, the muscles controlling the movement of these joints are held in tension. The neck and shoulder muscles are also strained to keep the head in position. Continuous static muscle tension leads to muscle fatigue, accumulation of harmful metabolic by-products in the muscles, and local swelling. The final result consists of symptoms which vary from a feeling of discomfort and stiffness to aches and pains, although knowledge of physiological phenomena from muscle fatigue to muscle pain is still fairly poor.

11- Myofacial pain dysfunction or TMJ dysfunction

Includes pain in masticatory muscles and/or the temporo-mandibular joint (TMJ). Poor posture is an important factor. For example, holding the head forward while looking at a computer all day strains the muscles of the face and neck (fig 12-13-14-15). The intermaxillary relation is tightly dependent from the head and neck posture. Forward head posture leads to forward mandibular position resulting in interferences and malocclusion, a major reason for grinding the teeth and provoking hyperactivity of the muscles and TMJ compression.

Symptoms of TMJ Dysfunction can include jaw pain, recurrent or severe headaches, toothaches, earaches accompanied by dizziness, tenderness on the sides of the face, a burning, tingling sensation in the tongue, mouth, or throat, and neck pain, shoulder pain, difficulty opening the mouth completely, locking of the jaw, and clicking or popping noises when opening or closing the mouth.

People at risk: those who practice poor posture at the computer, Forward Head Posture, those who hold the phone on their shoulder for long periods of time while talking, those who have suffered jaw injury,
those who clench and grind their teeth, and those who have improper bites.

12-Pain and eye strain
Common among computer users. Two major causes (Fig 16):
1. Constantly gazing at a near distance (at the monitor)
2. Decreased rate of blinking
Convergence Fatigue: When looking at a near object, eyes converge to gaze at the target. Prolonged viewing of the monitor at close distance leads to fatigue of convergence and its weakness / insufficiency. This consequently leads to eye strain, pain and headache.
Infrequent Blinking: Being in front of a computer for more than 20 minutes at a time, the decreased rate of blinking leads to instability of the tear film of the eyes, leading to dryness, irritation, redness and a reflex watering from the eyes.

TREATMENT
The different pathological cases are treated differently. But a common treatment for the acute phase of pain and dysfunction indicated by many specialists is pain killers, muscle relaxants, NSAIDs, lubricant eye drops, stretching and exercises; surgery and other more aggressive treatments will not be discussed in this paper.

Physiotherapy, mobilization,
• Active physiotherapy, mobilization and manipulation may provide short-term relief.
• Transcutaneous electrical nerve stimulation (TENS):
  Evidence from two small trials suggests that TENS or pulsed electromagnetic field therapy may provide relief from neck and arm pain on the short term. There is a paucity of high-quality evidence on the effectiveness of TENS. Published trials do not provide information on the stimulation parameters required for optimum pain relief from TENS, nor do they answer questions about long-term effectiveness of TENS or pulsed electromagnetic field therapy.

Acupuncture
There is inconclusive evidence from sound clinical trials on the efficiency of acupuncture for neck and arm pain.

Miscellaneous therapies (heat, cold, LASER, traction, biofeedback, patient education).

Physical medicine modalities include a large variety of therapies: cervical orthoses, therapeutic heat or cold applied in several ways, massage, stretching, and traction. There is no good quality evidence on the effectiveness of these treatments.

Drug therapy
• Analgesics taken when required may be sufficient.
• Analgesia is effective for short-term symptomatic relief.
  - Paracetamol (acetaminophen) should be considered as the first-line choice for pain relief.
  - Ibuprofen may be used at an analgesic (low) dose.
  - Analgesics are more effective taken at regular intervals than ‘when required’.
  - Over the counter products are sufficient for many patients with neck pain.
  - If pain relief is inadequate, then consider paracetamol plus codeine phosphate (combined use, separate prescriptions) at doses titrated to meet the patient’s needs.
• Alternatively, consider using a nonsteroidal anti-inflammatory drug (NSAID) taken at regular intervals.
• Combinations of paracetamol and high-dose weak opioids may be effective alternatives when paracetamol or NSAIDs alone do not provide adequate pain control. No high quality studies compare their relative efficiency in neck pain, and their long-term use in chronic neck pain is not well established.
• Compound analgesics are often associated with an increased incidence of adverse effects. Separate prescriptions of paracetamol and codeine are preferred to facilitate titration of the most effective and safe analgesic dose to match the patient’s requirements.
• Diazepam for 3 to 7 days may be used for patients with significant muscle spasm.
• A trial of amitriptyline for one month may be helpful for people with chronic pain.

• Muscle relaxants
  There is limited evidence from the literature to support use of muscle relaxants in neck pain. Their efficiency in reducing acute low back pain is fairly well established and they may provide relief in acute episodes. Diazepam is widely used, inexpensive, and licensed for use as a muscle relaxant. It is therefore the preferred agent of choice. Muscle relaxants have significant adverse effects, including drowsiness and potential physical dependence even after relatively short courses, i.e. one week. For these reasons, they should only be used in patients who have significant spasm. The optimal course length is 3 to 7 days.

• Antidepressants
  Antidepressants are not licensed for use in pain control and there are no randomized controlled trials on their use in neck pain. Tricyclic antidepressants (TCAs) are widely used for chronic pain of many causes and despite their uncertain benefit, a trial of therapy for one month may be worth considering.

• Corticosteroid injections: periradicular/cervical/ epidural
  There is no evidence from randomized controlled trials on the benefits of periradicular and epidural corticosteroid injections for cervical radiculopathy. There are few case reports of adverse effects such as infection and bleeding following injections of corticosteroids.

• Botulinum toxins type A and B
  Injections of botulinum toxins type A and B have been found to successfully treat muscle spasm of cervical dystonia. Administration of these injections would normally be in a secondary care environment. Their use may be associated with severe adverse effects. Treatment with botulinum toxins is expensive.

• Lubricant Eye Drops
  Lubricant eye drops instilled 3-4 times a day help in soothing the eyes and relieving irritation and redness. Many preparations are available on the market.

PREVENTION
  The best treatment is rest and prevention. There is some scientific evidence of the beneficial effects of individual ergonomic measures on musculoskeletal symptoms. Here are the recommendations from official governmental and medical organizations:
  1. While typing, the wrists should not rest, and should not be bent up, down, or to the side (Fig 17, 18). The arms should move the hands around instead of resting the wrists and stretching to hit keys with the fingers. When we stop typing for a while, we should rest the hands in our lap and/or on their sides instead of leaving them on the keyboard.
  2. Wrists also should not be bent to the side,
  3. Fingers should be in a straight line with the forearm as viewed from above.
  4. Increasing the font sizes. Use of small font size encourages one to hunch forward into the monitor to read things, putting pressure on nerves and blood vessels in the neck and shoulders.
6. Using two hands to perform double-key operations like Ctrl-C or Alt-F, instead of twisting one hand. Better move the whole hand to hit function keys with strong fingers instead of stretching to reach them.

7. Taking lots of breaks to stretch and relax. Changing position and moving is a necessity.

8. Holding the mouse lightly, not gripping it hard or squeezing it.

9. Keeping arms and hands warm. Cold muscles and tendons are at much greater risk for overuse injuries, and many offices are over-air-conditioned.

10. Considering voice recognition. Software that allows computer control or full voice dictation is becoming more powerful.

11. Not tucking the telephone between shoulder and ear so that we can type and talk on the phone at the same time.

12. Both the chair seat and its back should be adjustable. With the back against the chair back, worker should be able to sit up straight and the feet should rest firmly on the floor.

13. The top of the monitor should be about level with the top of the head, i.e., the worker should be looking straight into the screen.

14. Setting up the computer in a position that avoids reflections in the monitor from windows or overhead lights. Reflections will create eyestrain and tend to make the worker tense because he/she cannot read what is on the monitor.

15. Proper Visual Hygiene
   - Monitor should be placed about 2-3 feet from the eyes.
   - Eyes should be taken off the screen every 5-10 minutes.
   - Every half an hour or so, eyes should be closed for 1-2 minutes to rest them.
   - Special computer glasses.

    Regular eye exercise such as pen convergence exercise can help prevent the problems caused by working on computers or even heavy reading or writing work. These exercises are advised for all computer professionals, students, office workers, etc.

17. Use of other pointing devices.
    Many devices exist on the market and are capable of replacing the mouse and its negative long-term impact: eye sensor, tablet notebooks, touch screen, writing pen, 3D wireless mouse,…

18. Regular neck and jaw exercises at work.
    Even with ergonomic furniture, it is still possible to suffer neck, shoulder, arm, wrist and finger pain. It is advisable that every computer user performs hourly exercises to fingers, hands, back and shoulders (Fig 19).
CONCLUSION

“The computer syndrome” seems to be the appropriate nomination of different signs and symptoms related to long period of stational computer work. The time spent in static, stationary body positions during each day would have amounted to minutes rather than hours. In the evolution of human specie, the structure and operation of the shoulder and upper limb muscles have adapted more to performing movements than to continuous static tension. Long periods of uninterrupted computer work appears to be one of the most important risk factors in musculoskeletal disorders leading to pain and dysfunction. Holding the same posture for hours without a break can be seen as the principal disadvantage of working at a computer or in other precision work.

Epidemiological information and everyday observations strongly indicate that long periods of uninterrupted work in the same body position are harmful to the neck, head and arms. The different pathological entities depicted seem to have direct effect on daily life of computer users. The different drugs, physiotherapy and preventive measurements seem to have effect on the regression of acute symptoms. The complete regression of the dysfunctions still seems a difficult task in the cited pathologies. An ergonomic posture position, appropriate devices and regular hygiene exercises seem the best preventive treatment for this contemporary evolutive disease.

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Oral Medicine Reminder: the QUESTIONS.

Prepared by Ziad E.F. Noujeim, DCD, CES, FICD, FACOMS,

1- If a bleeding problem is suspected in a dental patient, what laboratory tests should be ordered and what are their normal values?

2- What are the symptoms of hypoglycemia in the dental surgery?

3- What should be done if a patient with a history of cardiac disease develops chest pain during dental treatment?

4- What are the most common oral manifestations of HIV (Human Immunodeficiency Virus) infection?

5- What are the dental procedures for which antibiotic premedication is recommended in patients identified as being at risk of infective endocarditis (IE) and what are the antibiotics and dosages recommended by the American Heart Association (AHA) to prevent IE?

6- What are the concerns that we might face while treating a patient with alcoholic hepatitis in the dental surgery?

7- What are the available long-acting local anesthetics?

8- What are the oral manifestations of patients with renal failure?

9- What laboratory tests should be ordered in a patient with recurrent aphtous ulcers?

10- What are the most common causes of oral candidiasis and what is the most appropriate local therapy?

11- What is desquamative gingivitis and what about its clinical significance?

12- What are the drugs that cause gingival swelling (hyperplasia)?

13- What is oral purpura and what about its clinical significance?

14- What is the appropriate local treatment of oral herpetic infections (HSV- Herpes Simplex Virus?)

15- Why is spontaneous gingival bleeding dangerous?

Answers: page 61
The Lebanese Orthodontic Society was founded in 1965 by Professor Pierre Riskallah. As one of the oldest orthodontic societies in the region, it counted, at that time, four members only. This number grew considerably to exceed one hundred in 2007.

The society takes it as its responsibility to ensure professional development for its members through various periodic seminars and conferences during which the best and most recent orthodontic techniques and treatments are discussed.

The L.O.S. is a member of the Arab Orthodontic Society (A.O.S.) and the World Federation of Orthodontists (W.F.O.), it also has a partnership with the Société Française d’Orthopédie Dento-Faciale (S.F.O.D.F.), and all L.O.S. members benefit from several services offered by these societies.

The Lebanese Orthodontic Society, through its active members, is the only official society that officially represents qualified orthodontists in Lebanon. The primary goal of this society is to promote awareness of patients regarding importance of orthodontics and choice of their orthodontist.

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An approach to class II division 2 treatment: a case report

Patrick Anhoury*, DMD, MSD,

Abstract

A prevailing strategy for treating Class II Division 2 type malocclusions consists of converting these problems to division 1 malocclusions in the initial phase of treatment. As a result, an overjet is created increasing both treatment complexity and time. In this article, a case report is presented to illustrate an alternative approach that purposely avoids the conversion from division 2 to division 1. A protocol for treating Class II Division 2 malocclusions and advantages of this approach are described.

One controversial issue in orthodontics is the presumed association between Class II Division 2 malocclusions and posterior mandibular displacement. In fact, there is a strong belief, based on clinical observation, that during closure into the intercuspal position in Class II Division 2 malocclusions, the mandible is trapped by the steep upper incisors and forced backwards. Consequently, proclining the upper incisors and opening the bite in the initial phase of treatment will presumably “unlock” the mandible so that it can spontaneously move forward and simplify the orthodontic correction of the distal occlusion.

However, there is little evidence in the literature to support this concept. For example, Demisch et al. moved incisors forward in 22 subjects with Class II Division 2 malocclusions and tracked the movement of the mandible cephalometrically and gnathologically. They noted no forward movement of the mandible. Similarly, Thuer and colleagues evaluated the chewing pattern and muscular activity of a similar group of patients before and after moving the incisors forward and again found no differences. In another study, the pre and post treatment distance from basion to articulare (Ba-Ar) was measured in patients with Class II Division 2 malocclusions and no statistical differences were noted when compared to controls, indicating that the mandible did not systematically move forward during treatment. These findings are in agreement with the tomographic data that document that there is no relationship between condylar position and bite depth.

Since anterior movement of the maxillary incisors does not systematically result in forward repositioning of the mandible in Class II Division 2 malocclusions, an alternative approach that does not convert the division 2 to a division 1 has been advocated by Gianelly. It consists of moving the molars distally to the class I position in the initial phase of treatment (no brackets on the incisors). The incisors are then aligned into the space created in the posterior segment. As a result, no overjet will be present at the end of phase I. This approach has at least two advantages. One advantage is the reduction in treatment time. For example, a 4-5 mm overjet takes an additional 4-5 months of treatment, if we consider that the rate of tooth movement is approximately 1mm/month. This increase in overjet and treatment time leads to the problem of anchorage control. An increased overjet will place more burden on the posterior teeth, increasing the risk of anchorage loss. Once the incisors are aligned posteriorly, any remaining spaces can easily be closed with conventional mechanics.

CASE REPORT

A 20.4-year-old man presented for orthodontic treatment with a chief concern of wanting “straight teeth”. His medical history was noncontributory while his dental history included some endodontic and
restorative work and broken upper central incisors during childhood. Extraoral examination revealed a well-balanced face in the frontal view. In profile, the patient exhibited a hypodivergent facial pattern, an average nasolabial angle, a retrusive lower lip, a deep labio-mental sulcus, and a prominent chin (Fig 1). Intraorally, the patient presented with a classic Class II Division 2 deep bite malocclusion. He had a 2mm Class II molar relationship on the right side and a 5mm Class II molar and canine relationship on the left side. A deep overbite of approximately 75% and 1.5 mm overjet with upright upper central incisors and flared upper lateral incisors were noted. The upper midline was 1 mm off to the right side in relation to the facial midline while the lower midline was deviated 2 mm to the left side. The lower curve of Spee was moderate to severe. In addition, there was mild mandibular crowding and moderate maxillary crowding (Fig 2).
No discrepancy was found between habitual occlusion and centric relation and no signs or symptoms of temporomandibular joint dysfunction were noted.

The malocclusion was further complicated by a retained maxillary right deciduous canine. The panoramic radiograph revealed impaction of the upper right permanent canine and a missing lower left first molar resulting in severe mesial tipping of the second molar on this side (Fig 3). All third molars were present. Additionally, the upper central incisors were endodontically treated and restored with composites while the mandibular right first molar was endodontically treated and restored with a porcelain fused to metal crown.

Cephalometric analysis revealed a mild Class II apical base discrepancy with an ANB of 3°. The lower facial height was decreased in relation to the upper facial height. The upper central incisors were severely upright and the mandibular plane angle flat (Figs 3 and 4 and table 1).

**TREATMENT OBJECTIVES**

The principle objectives of treatment were to attain a Class I relationship, correct the deep bite, obtain proper torque and position of the maxillary anterior teeth, and establish proper interdigitation. Maxillary and mandibular crowding would be resolved, addressing the impacted maxillary right canine and the mesially tipped mandibular left second molar.

**TREATMENT PLAN AND PROGRESS**

Based on the diagnostic records and patient history, the plan was to correct the Class II malocclusion by a nonextraction protocol involving molar distalization. To this end, a decision was made to extract the maxillary third molars to facilitate the molar distal movement. In addition, the retained maxillary right deciduous canine would also be extracted to help the eruption of the underlying permanent canine. In the mandibular arch, the lower left third molar would be extracted as well to allow uprighting of the second molar into a more favorable position.

After referral of the patient to the oral surgeon and extraction of the requested teeth, the maxillary first and second molars were banded. During the same time, a modified Nance appliance fixed to the

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**Table 1. Cephalometric summary**
maxillary first premolars was fabricated and cemented to reinforce the anterior anchorage unit (Fig 5, A). The appliance is extended anteriorly to touch the incisors and a 1 mm bite plate is added to disclude the molars. Superelastic NiTi coils were then placed on a sectional .016 x .022 in stainless steel wire which extends from the first premolar to the second molar and activated to deliver approximately 100 gm of force (Fig 5, B). Both first and second molars were thus being moved distally at the same time. No brackets were placed on the incisors and the erupted canine. As a result, the anterior teeth were not aligned in the initial stage of treatment.

Simultaneously, the mandibular arch was banded and bonded with a pre-adjusted appliance and nickel-titanium wires were used to level and align the arch. Bonding of the mandibular arch was made possible because of the bite opening effect of the anterior bite plate (Fig 5, C). A few months later, a .018 x .022 in stainless wire was inserted in the mandibular arch and an open coil placed between the left second premolar and the second molar to regain the space of the first molar in view of a future implant in this area. Approximately six months after the start of molar distalization, the Class II molar relationship was overcorrected by 2 mm on the right and 1 mm on the left side. At that point, the modified Nance appliance was removed (Fig 5, D) and brackets were bonded on the maxillary anterior teeth. A heat-activated .018 x .022 in NiTi wire (NeoSentalloy) was inserted in the

Fig 5 A. Modified Nance appliance fixed to maxillary first premolars and space gained from molar distal movement. B. Molar distalization with NiTi open coils and sectional wires; note that incisor crowding is still present. C. Bite opening due to bite plate incorporated in the Nance appliance. D. Palate after removal of the Nance appliance. E. Incisor position immediately after insertion of NeoSentalloy wire. F. Incisor position 3 months after insertion of NeoSentalloy wire. G. Lateral views with Class II elastics after incisor alignment; note absence of overjet.
maxillary arch with hooks between the lateral incisors and canines. Light Class II elastics were then attached to help the incisors get aligned into the space created by the distal movement of the molars (Fig 5, E). Three months later, the incisors were aligned and no overjet was created (Fig 5, F and G). During this time, the premolars continued to drift distally into a Class I relationship. At that point, the upper right canine had spontaneously erupted with the increase in space and incorporated into the appliance. The lower left second molar had been uprighted and moved back. The remaining extra spaces in the maxillary posterior segment were then easily closed with elastic chains on a .018 x .022 in stainless steel wire.

Final detailing/intercuspation was done during the last three months before the patient was debonded.

Lastly, a maxillary wraparound retainer and a mandibular Hawley retainer with acrylic covering the edentulous space were placed for retention and the patient was referred to the oral surgeon for implant placement.

RESULTS

Overall, favorable esthetics and excellent occlusal results were achieved (Figs 6 and 7). A Class I canine and molar relationship was obtained through molar distal movement. The severe overbite was corrected and proper torque of the upper incisors was established as seen on the final cephalometric radiograph and tracing (Fig 8, Fig 9, and table 1). Maxillary and mandibular crowding was eliminated.

The posttreatment panoramic radiograph showed that the mandibular left second molar was uprighted and adequate space and good root parallelism was achieved for an accurate and safe placement of an implant in this area (Fig 8). The roots of the teeth were fairly parallel with the exception of the upper left canine and first premolar. Additionally, the upper left first molar was slightly tipped back, a consequence of the substantial distal movement on that side. The impacted upper right canine was properly positioned into the arch. The upper and lower midlines were coincident with each other and with the facial midline. The lower incisors were proclined and the mandibular plane angle was slightly increased due to the extrusion of the posterior teeth which contributed to the opening of the bite. As a consequence, an increase in the lower facial height was seen in conjunction with some downward and backward rotation of the mandible (Fig 10).

FINAL EVALUATION

Because no growth was possible in this case, the success of the treatment was solely dependent on the ability to move the molars distally. The molars were moved back in approximately six months with minimal patient cooperation. Minimal anchorage loss was possible because of the use of the modified Nance appliance against the entire anterior palate and all lingual surfaces of the anterior teeth. Discluding the posterior teeth with the anterior bite plate incorporated in the fixed appliance facilitated the distal movement

Fig 6. Posttreatment facial photographs.
Fig 7. Posttreatment intraoral photographs.

Fig 8. Posttreatment radiographs.

Fig 9. Posttreatment cephalometric tracing.

Fig 10. Superimposition of pretreatment and posttreatment tracings.
of the molars into an overcorrected position. The bite plate further helped in the overbite correction and enabled bonding of the mandibular arch early in treatment. Molar distalization was also beneficial in creating more space for the eruption of the impacted maxillary right canine. A focal point of the correction of this malocclusion was the ability to align the maxillary incisors without creating an overjet, by placing light Class II elastics after the space was created in the posterior part of the arch. This reduced both treatment complexity and time.

Slight flaring of the lower incisors and some downward and backward rotation of the mandible resulting in an increase in the lower facial height contributed to a much improved profile. In addition, the achievement of proper torque of the upper incisors and the decrease in the interincisal angle should favor the stability of the overbite correction. At the end of treatment, the patient was referred to his restorative dentist and oral surgeon for the replacement of the mandibular left first molar with an implant. The patient was also planning to replace the old composite restorations of his maxillary incisors with veneers which would further enhance his anterior dental esthetics.

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Management of a radicular cyst arising from primary molars and in relation with impacted permanent mandibular teeth: a case report.

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INTRODUCTION
Radicular cyst arises from periapical granuloma that contains epithelium organized into a true cyst. Clinical presentation and radiographic pattern are often identical to periapical granuloma and definitive diagnosis is always made after histological examination of the whole pathological piece (Neville, Damm and White, 2003).

Radicular cyst is the most common type of odontogenic cysts of the jaws¹. Apical periodontitis after pulp therapy in primary teeth can delay eruption of permanent successors 2 and cause displacement of these teeth: its size may vary from a small pea-sized periapical lesion, to one which may obliterate maxillary antrum or cause mandibular fracture³. Management of such cases includes surgical and sometimes, orthodontic therapy.

CASE PRESENTATION
An 8-year-old male was referred to the Lebanese University Department of Oral and Maxillofacial Surgery: he presented with a moderate swelling of the buccal left side of the mandible. He was healthy, with a non contributory medical history, not complaining of any pain. Intra-oral examination revealed the presence of a large compressible expansion of the buccal left side of the mandible. A panoramic radiograph revealed (fig 1.):
- a non vital (endodontically treated) first and second left temporary mandibular molars.
- a radiolucent lesion in relation with first temporary left mandibular molar, with poorly defined margins.
- a germ of left mandibular canine displaced under the apex of left second mandibular incisor, on upper aspect of inferior border of the mandible.
- germs of first and second left premolars displaced.

ORTHODONTIC PLANNING
The patient presented a skeletal hyperdivergent class II, class I bi-protrusion. Treatment consisted of:
- extraction of teeth 5.4-5.5-6.4-6.5-7.3-7.4-7.5-8.3-8.4-8.5.
- maxillary arc levelling.
- mandibular arc levelling.
- brackets placement on mandibular teeth in order to pull left mandibular canine on mandibular arch.
- traction of left mandibular canine.

During orthodontic treatment, the orthodontist decided to extract left second mandibular incisor to secure a place for impacted left canine.
SURGICAL PLANNING
Surgery was performed under local analgesia. Angular incision was performed and a mucoperiostal (full-thickness) flap raised. The totality of the lesion was enucleated and during surgery, the orthodontist placed a bracket on left mandibular canine with a wire to enable its traction.

HISTOLOGICAL EXAMINATION
Under light microscopy, the radiolucent lesion proved to be lined by stratified squamous epithelium that most probably originated from rests of Malassez. The lesion was an odontogenic cyst (of radicular type) with altered multistratified malpighian epithelium and with important inflammatory and fibrotic changes, but without any suspected sign of malignancy.

DISCUSSION
Radicular cyst arises “from epithelial residues in the periodontal ligament as a result of inflammation”. Inflammation usually follows death of dental pulp. Most cases seen at adult age and very few during the first decade: “The low frequency in first decade has been shown in a number of studies and indicates that although dental caries is very common in children during the first decade, radicular cysts are not often found associated with deciduous teeth”.

The sine qua non for diagnosing a radicular cyst is the related presence of a tooth with non-vital pulp. Radiologically, it is often difficult to differentiate between a radicular cyst and an apical granuloma.

Regarding pathogenesis of this kind of cysts, it
- phase of initiation
- phase of cyst formation
- phase of enlargement.

Mechanisms involved in the 3 phases remain unclear and controversial but most authors agree that epithelial linings of these cysts are derived from epithelial cell rests of Malassez present in the periodontal ligament. We still don’t know precisely how these epithelial cells are stimulated to proliferate.

Former immunological studies (Pulver WH et al., 1978 – Torabinejad M et al., 1978 – Torabinejad M et al., 1981) helped somehow to explain the formation of periapical granuloma but failed to explain the proliferation of epithelial cell rests.

Former electrophoretic studies (Toller P, 1970) provided evidence that radicular cysts contain fewer, if any, of the larger protein molecules than the patient’s own sera. Alpha-globulins are greatly decreased, gamma-globulin varies greatly in quantity but it was observed that it was present in small concentration within cysts which are not inflamed.

Beta 2-globulin is usually absent but small molecular sized albumin and beta 1-globulin are present in quantities that are comparable with serum.

Radicular cysts may be treated by marsupialization, decompression or enucleation followed by either open treatment or primary closure (Shear, 1983). Main purpose of decompression or marsupialization is to relieve intracystic pressure by opening a window into cyst. Marsupialization can be performed with complete or incomplete removal of cyst lining and opening into the cystic cavity must be kept patent mandatorily until the whole space has filled in from base to margins (Shear, 1983).

In case of a large radicular cyst in contact with displaced impacted teeth, the question that should be asked is if we have to perform orthodontic traction or extract these teeth. We must consider that orthodontic treatment-related root resorption is correlated with the distance the apex moves and the length of time the treatment takes. In these situations, collaboration between surgical and orthodontic teams can solve the problem, but treatment becomes more and more complicated if detection and treatment are not installed early.

CONCLUSION

Infections of deciduous teeth must not be ignored. In addition to infectious problems, a radicular cyst arising from a primary molar(s) can cause displacement of permanent tooth to lower border of mandible and lead to serious complications; therefore, clinical and radiological follow-up of primary teeth that have undergone pulp therapy procedures should be performed until eruption of succedaneous teeth. In these situations, collaboration between surgical and orthodontic teams can solve the problem, but treatment becomes more and more complicated if detection and treatment are not installed early.

BIBLIOGRAPHY


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Oral Medicine Reminder: the ANSWERS.

Prepared by Ziad E.F. Noujeim, DCD, CES, FICD, FACOMS

1
a- Bleeding Time (BT): Normal Value < 9 minutes
b- Platelet Count (PC): Normal Values = 150,000-450,000/mm³
c- Prothrombin Time (PT): Normal Value = 10-14 seconds
d- Partial Thromboplastin Time (PTT): Normal Value = 25-35 seconds

2
Hunger, nausea, sweating, tremulousness, palpitations and tachycardia, and, in absence of any therapeutic intervention, these symptoms may lead to convulsions and coma.

3
a- discontinue dental treatment immediately after pain arises
b- Take vital signs (Blood Pressure/ Pulse/ Respiratory Rate) and have your nurse record them. Chest pain from myocardial ischemia is either substernal or more diffused (mandible sometimes, left upper limb): it is described by patients as being heavy, pressure and crushing, and it sometimes radiate to arms, shoulders, back or neck. If the patient has a history of angina (angor), give her/him nitroglycerin and continue to monitor her/his vital signs and if pain doesn’t stop after 2-3 minutes, give her/him a second dose and if after 3 doses of nitroglycerin in a 8-10 minutes period, pain doesn’t subside, call immediately a medical emergency service or ambulance and have the patient transported to an emergency medicine (or cardiology) department to rule out a myocardial infarction (MI). If the patient is not allergic to acetylsalicylic acid-ASA (aspirin), administer one 325 mg tablet orally: aspirin will act as antithrombotic agent (=prevents thrombus formation).

4
a- Intraoral (or lips) herpes simplex lesions.
b- Herpes zoster lesions
c- Acute Necrotizing Ulcerative Gingivitis (ANUG)
d- Aphtous major and minor ulcerations
e- Petechiae
f- Kaposi’s sarcoma
g- Lymphoma
h- Hairy Leukoplakia
i- Oral candidiasis

5
a- Intraligamentary local analgesic injections
b- Initial placement of orthodontic bands (not brackets)
c- Prophylactic cleaning of teeth or dental implants (if bleeding is anticipated)
d- Non surgical and surgical endodontic procedures
e- Dental implant placement
f- Reimplantation of avulsed teeth
g- Dental extractions
h- Periodontal procedures (including scaling, root planning, probing and surgery).
The standard antibiotic regimen recommended by AHA is the following:
Amoxicillin, 2 gm orally, 1 hour before procedure, and if patient is allergic to amoxicillin and penicillin, clindamycin, 600 mg orally, 1 hour before procedure,
or Cephalexin or Cefadroxil, 2 gm orally, 1 hour before, or Azithromycin or Clarithromycin, 500 mg orally 1 hour before procedure.

Alcoholic hepatitis is the most common cause of liver cirrhosis, which is one of the most common cause of death in USA. Concerns in treating patients with alcoholic hepatitis are the following:

a- anemia (secondary to dietary deficiencies) and/or bleeding.

b- qualitative and quantitative effects of alcohol on platelets.

c- increased risk of bleeding during and after surgery (this is due to a decrease in vitamin K-dependent coagulation factors)

Before attempting a surgical procedure, the following laboratory tests should be obtained:

-PT / INR
-PTT
-CBC
-BT

Bupivacaine (can depress cardiac activity and produce dysrhythmias), Etidocaine and Ropivacaine.

But in 2002, several papers confirmed that Levobupivacaine was better than Bupivacaine (less toxic and less pronounced action on the heart).

Renal disease that occurs before puberty affects dentition. Uremia present during development of dentition results in teeth with enamel hypoplasia and brownish discoloration. Also, altered maxillary and mandibular growth-and resulting malocclusion-may occur because of impaired skeletal growth.

b- After puberty -and at any age- the failing kidney produces less erythropoietin and causes diminished RBC production and consequent anemia: gingiva is consequently pale.

Capillary fragility and reduced PC and adhesiveness lead to prolonged bleeding and clotting times and increased blood loss. Bruising is common and hematomas can form after extractions, surgical dentistry, periodontal surgery, or even local analgesia injections.

In renal failure, chronic acidosis increases solubility of bone salts and levels of serum phosphate, causing parathyroid glands to increase activity: this results in osteomalacia, which can be seen in mandible radiographs(changes in radiodensity, changes in periodontium, and partial or total loss of lamina dura). Clinically, increased mobility of teeth may be observed and central giant cell granulomas (of maxilla and mandible) may occur. A panoramic radiograph is mandatory during pre-operative diagnosis to observe any changes and caution should be taken during extractions to avoid fracture of the jaws.

Other symptoms of renal failure may include dry mouth, enlarged tongue, metallic taste, and breath with urea odor.

Patients undergoing renal dialysis, however, often have a low incidence of caries, despite the large sugar intake required in the diet of the patient.

The most common causes of oral candidiasis are:

a- dry mouth (xerostomia)

b- nutritional deficiency

c- association with oral lichen planus

d- undiagnosed diabetes mellitus

e- immune deficiency (HIV…)

Different local therapies are suggested:

- Nystatin oral suspension (Mycostatin*) = take 5ml, hold in mouth for 5 minutes, then swallow (Treatment for 2 weeks)

- Miconazole gel (Daktarin*)=5-10ml held in mouth, 4 times a day (for 2 weeks)

- Clomitrazole troches (Mycelex*, 10mg)= dissolve one troche in mouth, 5 times a day (for 2 weeks). This treatment is very effective to prevent candida albicans proliferation in severely ill patients (ex: leukaemias)
Gingiva presents as erythematous (red), burning, denuded and desquamating.

Desquamative gingivitis—a term no longer accepted, because unspecific—could reveal BMMP (benign mucous membrane pemphigoid), an idiopathic autoimmune process seen mainly in adults and elderly.

BMMP presents with oral vesiculo-bullous eruptions involving:
- attached gingiva
- alveolar mucosa
- palate
- buccal mucosa
- tongue, and
- floor of the mouth.

Intact oral epithelium, especially adjacent to ulcers, can often be stripped away with ease, leaving a raw, denuded bleeding substratum. Skin lesions usually follow oral mucosal lesions and extraoral lesions are usually limited to genitalia (vaginal mucosa), larynx and eye (conjunctiva), and early treatment of eye is of utmost importance, since corneal damage, conjunctival scarring and eyelid changes can lead to blindness. Topical corticosteroids and immunosuppressive drugs are usually prescribed to manage BMMP.

* phenytoin (Dilantin*)
* cyclosporine (Sandimmune*)
* Sodium Valproate (Depakene*)
* Calcium Channel Blockers:
  - nifedipine (Procardia*)
  - diltiazem (Cardizem*)
  - verapamil (Calan*)
  - amlodipine…

Oral purpura is a red spot (or patch) consisting of extravasated blood that develops under oral mucosal membranes: petechia is a very little purpura (<1mm) and bigger purpura is named ecchymosis.

Apart being caused by trauma (including suction), oral purpura could manifest in:
- infections (HIV, rubella, infectious mononucleosis)
- amyloidosis
- platelet and vascular disorders:
  * thrombocytopenia
  * leukaemia
  * Von Willebrand’s disease
  * Scurvy
  * chronic renal failure
- elderly (“senile” purpura)

* Acyclovir 5% ointment (Zovirax*), to be applied on diseased areas six times a day (for one week)
* Penciclovir 1% cream (Denavir*), to be applied every 2 hours for 4 days, and it is advisable to begin treatment as soon as possible (during prodrome or when lesions appear).
Topical antiseptics (0.12% chlorhexidine mouthrinses) are also good as supportive treatment.

Spontaneous gingival bleeding is dangerous, indeed, because it could be caused by:
- leukaemia (a malignant condition characterized by overproduction of leukocytes).

Apart pallor, malaise and cervical lymphadenopathy, leukemic gingivitis is often observed (swollen purple gums + spontaneous bleeding from gingival sulcus).

- agranulocytosis (neutropenia)=decrease in the number of circulating PMN neutrophils
- cyclic neutropenia = periodic decrease of circulating PMN neutrophils
- thrombocytopenia = decrease in the number of circulating platelets (normal PC-platelet count-is 150,000-400,000 cells/mm³ of blood, and if PC<100,000, blood will profusely oozes from gingival sulcus, either spontaneously or after minor trauma, such as tooth brushing)
- thrombocytopathia = decreased function of circulating platelets.
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www.ada.org

**September 23-25, 2007**
American Academy of Periodontology 93rd Annual Meeting
Washington DC- USA
www.perio.org

**September 26-29, 2007**
IADR-International Association for Dental Research
Continental European Division
Thessaloniki- Greece
www.iadrthessaloniki2007.gr

**October 3-6, 2007**
Expodental/ Technodental
Milan-Italy
www.expodental.it

**October 19-21, 2007**
EDAD Turkish Academy of Esthetic Dentistry
Istanbul-Turkey
www.tedad.net

**October 24-27, 2007**
FDI World Dental congress
Dubai-UAE
congress@fdiworldental.org

**October 25-27, 2007**
EAO European Association of Osseointegration
Barcelona-Spain
www.eao.org

**November 16-18, 2007**
14th International College of Cranio-Mandibular Orthopedics
Vicenza-Italy
www.iccmo.org

**November 20-24, 2007**
ADF Association Dentaire Française
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www.adf.asso.fr

**November 23-28, 2007**
Greater New York Dental Meeting
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**February 1-2, 2008**
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www.egycalendar.com

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Particularités de la douleur au niveau de la région de l’articulation temporo-mandibulaire: à propos d’une étude prospective

Ouhala L.*, Henati H*, Slama A*, Dhidah M*, Ben Amor F*, Selmi J.*

Abstract
Les altérations des structures articulaires s’accompagnent de signes cliniques et de symptômes très variés. La douleur y reste le plus important et le plus fréquent.

Par notre enquête nous avons voulu identifier les principales caractéristiques de cette douleur, vérifier la validité d’une échelle d’évaluation simple, mesurable et reproductible, et montrer le degré de correspondance entre signes et symptômes algiques.

INTRODUCTION
Dans le cadre de la pathologie des articulations temporo-mandibulaires, la douleur constitue la cause la plus fréquente de consultation.

En effet, le caractère multifactoriel des altérations des structures articulaires fait qu’elles s’accompagnent souvent de symptômes et de signes cliniques variés; et la douleur y reste le plus important et le plus fréquent et contraignant.

Pour vérifier cette idée, notre étude clinique s’est intéressée à:
• Déterminer les différentes étiologies des douleurs pérarticulaires, leurs fréquences de survenues et leurs caractéristiques.
• Evaluer et quantifier l’intensité de cette douleur selon deux échelles d’autoévaluation: l’échelle verbale simple (E.V.S) et l’échelle visuelle analogique (E.V.A).
• Vérifier s’il y a concomitance entre les symptômes et les signes retrouvés à l’examen clinique.

MATÉRIELS ET MÉTHODES
L’étude a porté sur 50 sujets tirés au hasard parmi les patients se présentant à la consultation d’occlusodontie et au service de médecine et chirurgie buccales à la clinique odontologique de Monastir (TUNISIE) ainsi qu’au service de chirurgie maxillo-faciale de l’hôpital Tahar Sfar de Mahdia (TUNISIE).

1 A.H.U Service de médecine et chirurgie buccales, Monastir
2 A.H.U Service de médecine et chirurgie buccales, Monastir
3 A.H.U service chirurgie maxillo-facial C.H.U. Sah
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5 Professeur en anatomie, Faculté de Médecine Dentaire, Monastir
6 Professeur, Service de médecine et chirurgie buccales, Monastir

Journal of the Lebanese Dental Association
- son siège.
- son étendue.
- sa fréquence.
- l’heure de son apparition.
- l’évaluation de l’intensité de la douleur ressentie à travers l’utilisation des deux échelles d’autoévaluation à savoir; l’E.V.S et l’E.V.A.
- les antécédents douloureux du patient et leur ancienneté.

- L’état psychologique du patient.
- La présence d’éventuelles parafonctions ou de perturbations des fonctions manducatrices.
- Les signes recueillis à travers l’examen clinique:
  1. les signes fonctionnels tels que les bruits articulaires et la réduction ou déviation des mouvements mandibulaires.
  2. la sensibilité à la palpation des structures articulaires et musculaires, en bouche fermée et en bouche ouverte.
  3. les anomalies occlusales.

A l’issue de cette investigation un diagnostic positif étiologique est posé pour chaque situation.

Nos résultats sont interprétés statistiquement par le logiciel EXCEL 2003.

RÉSULTATS ET DISCUSSION

1. Caractéristiques cliniques de la douleur périarticulaire:

1.1 Sexe et âge:

Dans notre étude le pourcentage des patients qui se plaignent de douleurs péri articulaires est nettement plus important chez les femmes (86%) que les hommes (14%).

Chossegros(1) confirme cette idée de prédominance de l’atteinte féminine (85%) à un âge compris entre 20 et 40 ans.

Woda et Pionchon(2) affirment aussi cette forte prédominance féminine (ratio 1/3 à 1/10) en ce qui concerne la demande de prise en charge lors des algies oro-faciales et expliquent ce phénomène par le fait que les hommes soient plus capables que les femmes d’intégrer la douleur dans leur schéma de vie.

Cette différence a été également retrouvée dans les études de Guillaumot G(3) et Kuttilla M & al(4).

Laplanche(5) trouve que la douleur périarticulaire se manifeste plus dans la tranche d’âge 15-45 ans avec toujours une prédominance féminine avec un rapport de 1/7 à 1/9.

D’après McNeill in(6), la prévalence est maximale chez les jeunes adultes et décroissante à partir de la quarantaine.

Ceci peut être expliqué par le fait que les femmes sont plus fragiles que les hommes et que leur seuil de sensibilité à la douleur est plus faible que chez les hommes sans toutefois oublier le rôle que peuvent jouer les hormones féminines dans la «genèse» des pathologies articulaires responsables de ces douleurs ainsi que l’amplification du degré de leur irritabilité.

En effet le rôle des hormones sexuelles féminines s’inscrit dans le cadre plus large des différences biochimiques et physiologiques entre les deux sexes vis-à-vis de la sensibilité à la douleur [(Fillingin et Maixner 1995; Riley et al. 1998)] in(2).

Et, certaines expérimentations montrent que le lien existant entre activité algogène et balance hormonale est du à la présence de récepteurs aux œstrogènes dans le tissu concerné. La question de leur présence et de leur éventuelle fonction dans les conditions normales ou pathologiques est actuellement posée pour les articulations temporo-mandibulaires (LeResche et al. 1997) in(3).

1.2 Étendue de la douleur:

L’étendue de la douleur périarticulaire, évaluée par le patient, varie selon la pathologie responsable. Une atteinte limitée seulement à l’articulation donne des symptômes algiques localisés (40%) avec des points douloureux précis. Par contre des lésions des structures adjacentes sont responsables de la genèse de
la douleur irradiée locorégionale (52%), La douleur diffuse accusée par un petit nombre de patients (8%) est à l’origine d’angoisse et d’anxiété.

Cette dualité résulte d’un phénomène de convergence des informations nociceptives et non nociceptives caractéristiques des douleurs musculaires de la face.

1.3 Facteurs déclenchant de la douleur:

Les facteurs déclenchant interviennent en perturbant brutalement l’homéostasie manducatrice. Un déséquilibre longtemps toléré du fait de son installation lente et progressive chez un individu jeune, devient symptomatique à l’occasion d’une modification brutale, structurelle ou comportementale, de l’appareil manducateur.\(^7\)

Les résultats de notre étude montrent que la douleur articulaire se déclenche chez 48,75% des patients par une mastication prolongée, chez 18,75% des patients par un bâillement et chez 16,25% des patients par une ouverture buccale prolongée.

Le quatrième facteur déclenchant est le stress (14%)

Le cinquième facteur étant le froid: il représente un très faible pourcentage soit 2,5% des facteurs déclenchant.

Selon Fleiter\(^8\) les trois premiers facteurs étudiés dans notre échantillon sont à l’origine d’une perte des micromouvements mandibulaires au profit des macro mouvements. Ainsi la fatigue musculaire (hyperactivité) entraîne des manifestations douloureuses musculaires et articulaires.

Récemment, certains mécanismes neurobiologiques ont été décrits pour faciliter la compréhension de ces manifestations. Des stimulations importantes des tissus sont susceptibles de favoriser le relargage des substances inflammatoires endogènes qui peuvent déclancher des phénomènes d’hypersensibilité des nocicepteurs. Les effets cliniques se traduisent par des douleurs spontanées et des hyperalgésies localisées avec des sensibilités à la palpation.

L’implication du stress conséquent d’un choc émotionnel (deuil, divorce, examen) ou autre, est expliquée par le fait qu’il génère des réactions motrices spécifiques aux douleurs musculo-squelettiques de l’appareil manducateur.

Quant au froid certains auteurs le classe comme un facteur aggravant.

1.4 Intensité de la douleur:

Les facteurs déclenchant interviennent en perturbant brutalement l’homéostasie manducatrice. Un déséquilibre longtemps toléré du fait de son installation lente et progressive chez un individu jeune, devient symptomatique à l’occasion d’une modification brutale, structurelle ou comportementale, de l’appareil manducateur.\(^7\)

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Quant au froid certains auteurs le classe comme un facteur aggravant.
L’évaluation de l’intensité de la douleur articulaire avec l’échelle verbale simple et l’échelle visuelle analogique montre une certaine correspondance dans cette mesure subjective.

Pour 80 à 86% des patients il s’agit de douleur inconfortable à angoissante correspondant aux intervalles [2-4] et [4-6] sur l’échelle visuelle analogique. Une douleur horrible n’est ressentie que par 8% des patients soit le même pourcentage retrouvé dans l’intervalle [6-8] de l’E.V.A. alors que la douleur excruciante correspondant à l’intervalle [8-10] n’est pas retrouvée dans notre échantillon.

2. Profil psychologique:
Les troubles d’humeur, de somatisation et l’anxiété vont concourir à faire passer les manifestations algiques initiales dites douleurs aiguës en manifestations algiques chroniques. Le temps permet aux composantes psychologiques de dominer ou de se substituer aux composantes somatiques (étiologiques)\(^9\).

Dans notre population, 86% des patients présentent des perturbations psychologiques contribuant à la modulation de l’expérience douloureuse. Il s’agit le plus souvent d’une anxiété (49%).

Ces différents facteurs jouent un rôle considérable, perturbant la régulation neurosensorielle et exagérant la symptomatologie.


Gasma in\(^2\) (1994) note que dans de nombreux cas, les troubles psychologiques seraient la conséquence et non la cause de la douleur. Mais des études longitudinales portant sur de larges échantillons de patients présentant des dysfonctionnements de l’appareil masticateur ont montré que les échelles de dépression n’étaient que faiblement prédictives de l’apparition de ce type de douleur musculo-articulaires de la face (Von Korff et al. 1990).

Il en résulte que, comme l’a souligné Okeson in\(^2\) (1996), à propos des dysfonctionnements temporo-mandibulaires, les facteurs psycho-sociaux peuvent prédisposer certains individus à développer des douleurs. Ils peuvent aussi constituer des facteurs d’entretien de douleurs déjà établies.

2. Sensibilité à la palpation articulaire:

2.1 Sensibilité à la palpation articulaire:
La palpation du pôle externe et de la région rétrocondylienne affirme la présence d’une sensibilité uniquement chez 70% des patients se plaignant de manifestations algiques.

La correspondance entre signes et symptômes n’est donc que partielle.

Chez les 30% qui restent patients on note l’existence de pathologie sans signes douloureux, mais la dysfonction générée par la pathologie altère la psychologie du patient et l’incite à se plaindre de douleur.

2.2 Sensibilité à la palpation musculaire:
L’examen des muscles masticateurs montre que 80% des patients se plaignant de douleurs sont sensibles à la palpation musculaire surtout celle des muscles masséters et temporaux. On sait que l’articulation temporo-mandibulaire ne peut pas supporter une pression excessive en raison de la nature de son fibrocartilage, ce qui induit, par phénomène de contiguïté, l’apparition d’une sensibilité à la palpation musculaire\(^11\). Si non, il s’agit de douleurs musculaires primaires qui irradient vers la région articulaire.
2.3 Les parafonctions:
Chez les patients se plaignant de douleurs articulaires, plusieurs parafonctions semblent être bien corrélées avec ces manifestations. 44% de ces patients présentent une crispation dentaire, 18% à 22% souffrent de tics ou de bruxisme.

L'examen occlusal révélant la présence d'interférences chez 72% de l'échantillon, peut expliquer l'installation de ces parafonctions.

Selon Molina in (12), plus de la moitié des patients présentant une pathologie articulaire présentent un bruxisme.

Des études électromyographiques, telles que celles réalisées par Reding (1969) in (12) chez des bruxomanes, ont montré que les réflexes protecteurs qui évitent la mise en contact forcée et fréquente des arcades dentaires sont perturbés ou supprimés.

En effet, plusieurs auteurs (11) pensent qu'en cas de parafonctions, l'ensemble des muscles élévateurs particulièrement très puissants seront en hyperactivité. Or, le muscle protecteur de l’articulation temporo-mandibulaire est fragile et ne peut pas compenser cette hyper contraction d'où l'expression de la douleur articulaire.

En fait, Krief (13) pense que le contact des bruxofacettes engendre une contraction prolongée qui entraîne une demande accrue d’ATP qui aboutit à son épuisement et donc à une impossibilité de relaxation du muscle conduisant finalement à la contracture; La décruce d’ATP entraîne une vasoconstriction, une accumulation des métabolites du catabolisme d’où l’activation des fibres nociceptives à l’origine de la douleur.

Les autres parafonctions telles que la déglutition atypique, la respiration buccale, le grincement ou crispation dentaire et l’onychophagie semblent également bien corrélées avec les dysfonctionnements articulaires sans que les études réalisées ne puissent expliquer leurs pathogénies. [(Vanders, 1995; Widmalm, 1995; Moss, 1995; Miller, 1998; Glaros, 1998; Israel, 1999; Gavish, 2000)] in (12).

CONCLUSION
A travers ces résultats nous pouvons conclure que:
Dans notre échantillon, la douleur périarticulaire est majoritairement en rapport avec des pathologies articulaires, notamment les déplacements discaux et les phénomènes inflammatoires et dégénératifs.
Comme le décrit la littérature, cette plainte est
retrouvée plus fréquemment chez des femmes.

Elle est bien localisée lorsque la pathologie est purement articulaire si non elle est irradiante, voire diffuse lorsque l’atteinte touche les structures adjacentes à l’articulation, en particuliers les muscles masticateurs.

Le symptôme algique est déclenché au cours de la fonction ou suite à une ouverture buccale prolongée.

Le facteur stress intervient au moins pour aggraver ou entretenir la doléance. En effet, il est actuellement admis que les conditions psychologiques sont déterminantes dans le diagnostic étiopathogénique des dysfonctions temporo-mandibulaires et les protocoles thérapeutiques en tiennent compte.

Notre étude a montré que les patients consultant pour des douleurs périarticulaires présentent majoritairement un profil psychologique perturbé ce qui contribue à la modulation de leurs expériences douloureuses et le dérèglement de la régulation neurosensorielle et l’exagération de la symptomatologie.

L’intensité de la douleur périarticulaire évaluée par les deux échelles,

visuelle analogique et verbale simple, est considérée, pour la majorité des patients, inconfortable ce qui correspond à l’intervalle [2,4] de L’EVA ; la douleur horrible [6,8] étant exceptionnelle.

Nous devons donc retenir que la prise en charge de tels patients nécessite un entretien clinique qui permet:

- une évaluation précise de la sévérité de la douleur et ce par des échelles reconnues par leur efficacité.
- une appréciation du profil psychologique de ces patients.

Ce qui permet d’orienter leurs prises en charge et d’éviter l’aggravation de la situation.

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