Masterclass in Prosthodontics

Aesthetic Rehabilitation
with
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Part 2: Systematic patient evaluation – integrating biology, function and aesthetics

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Introduction
In Part I the importance of comprehensive patient evaluation in the holistic treatment of patients presenting with cosmetic expectations, was emphasized. Standard extra- and intra-oral photographs, radiographs taken with the proper technique and a comprehensive dental charting should be supplemented by, at minimum, a Basic Periodontal Examination (BPE).

An extremely important aspect of the initial patient evaluation is the examination of the occlusion, including both the static and the dynamic occlusal relationships. An occlusal examination will highlight the absence of a mutually protected occlusal scheme and the presence of any premature contacts, interferences and mandibular deviations. Diagnosis and management of occlusal dysfunction is critical, regardless of the main complaint or the desired treatment outcome.

Part II will cover the temporomandibular joint assessment as well as an in-depth smile analysis to objectively perform a comprehensive patient evaluation prior to undertaking any treatment.

Temporomandibular Joint Assessment
Temporomandibular disorders (TMDs) describe various clinical signs and symptoms involving the temporomandibular joints (TMJs), muscles of mastication, and the associated structures. According to Hietaharju et al. (2021), TMDs are reported to be the most common cause of facial pain and can affect approximately 5%–12% of the population.[1]

A detailed examination of the stomatognathic system is necessary to identify possible TMD before embarking on any dental treatment. This typically include a detailed clinical interview with the patient and a physical examination to identify TMD signs and symptoms.

Aspects of the clinical interview:
A detailed history review of a patient with TMD signs and symptoms is the most important part of the examination and accounts for 70% of the diagnostic process.

Relevant medical and dental history[2]
Osteoarthritis, fibromyalgia and other medical conditions might cause generalized pain or even dysfunction in TMD patients. Certain medications might lead to side-effects in the TMJ's.

Some patients might report the onset of pain after a prolonged dental procedure like endodontic treatment or a difficult extraction. Parafunctional habits like bruxism are frequently reported in patients with TMD and can be indicated by signs of tooth surface loss on the incisal and occlusal surfaces of the dentition. Any discrepancy from the normal occlusal evaluation, as previously discussed in Part I, should also guide the clinician towards a possible TMD.

A psychosocial history is also important in patients with TMD, as stress-related factors can contribute to TMD

Establishing TMD pain[2]
Each of the different TMD complaints should be listed. The onset of the symptoms should be noted, as well as the location, intensity and frequency of the pain. The onset of the pain determines if the pain is chronic or acute in nature. This will also guide the aggressiveness of treatment.

TMD pain can be described as a shock-like pain, or even a burning pain which might be indicative of a neurological origin. A throbbing or dull pain can indicate inflammation of the TMJs.
A patient should be able to point to an intra-capsular pain which

is usually localized. Muscle pain is normally diffuse and difficult to localize. This can be aggravated by mastication or movement of the mandible.

TMD pain can either be constantly present, which would require immediate treatment, or it may present with periods of attack indicative of possible neuralgia.

Aspects of the physical examination:

The comprehensive patient interview should be followed by physical examination which aims to determine the source of the pain and the severity of the dysfunction.

Examination of the TMJs[2]

The physical examination should include bilateral palpation of the lateral and posterior aspects of the TMJs, at rest and whilst performing opening and closing movements. Tenderness to palpation of the TMJ might indicate intracapsular pathology.

The TMJ range of motion should be assessed by including the evaluation of the maximum mouth opening. The normal interincisal distance should typically be between 45 to 55mm. This movement should happen in a straight line, as any mandibular deviation might indicate TMJ dysfunction.

The detection by manual inspection or use of a stethoscope of TMJ sounds are useful to diagnose disc-condyle dysfunction. This can include the presence of clicking, popping or crepitations.

Examination of the associated muscles[2]

The temporalis, masseter and medial pterygoid muscle should be examined for tenderness or spasm. Examination should be done bilaterally with the patient in a relaxed position. The suboccipital, sternocleidomastoid and superior trapezius muscle are also important to evaluate.

Muscle palpation can lead to the diagnosis of TMD associated with myofascial pain syndrome

Additional diagnostic tests and imaging[2]

Further tests like diagnostic impressions and articulation, nerve blockage or cryotherapy might be required should the clinician still have doubt about the cause of TMD.

TMJ imaging can be indicated to evaluate bony changes, condylar degeneration and fractures by means of computed tomography. Inflammatory changes and disc perforation and position can be evaluated by means of magnetic resonance imagery (MRI). An experienced clinician should, however, report on these imaging outcomes.

Diagnosing TMDs can be challenging due to their varied aetiologies and clinical presentations, however in the literature the influence of psychological and behavioural factors play an important role. To ensure a comprehensive evaluation of the biopsychosocial aspects influencing TMDs, the "Diagnostic Criteria for Temporomandibular Disorders" (DC/TMD) provide standardized and validated methods for assessment.[3]

DC/TMD consists of "Axis I" and "Axis II". Axis I focuses on the clinical and physical examination as discussed in detail above.

Axis II focuses on the psychosocial and behavioral assessment and includes:

- Standardized symptom-related questionnaires which help to grade their experience of the symptoms and determine how they feel their TMD influences their everyday life and activities.
- Identification of emotional distress (e.g., anxiety, depression).
- Chronic pain grading.
- Pain-related disability to determine which activities are limited and to what extent.[3]

Together, Axis I and II provide a biopsychosocial approach to TMD diagnosis and management.

Possible TMD diagnoses include:

1. Pain-related disorders such as myalgia, myofascial pain with referral, arthralgia and TMD attributed headaches.
2. Disc displacement:
    a. With reduction
    b. With reduction with intermittent locking
    c. Without reduction without limited opening
    d. Without reduction with limited opening
3. Degenerative joint disease.[2]

In summary, TMJ assessment ensures safe, effective, and comprehensive dental care, especially in patients presenting with facial pain, jaw dysfunction, or complex treatment needs. If a clinician does not have the necessary experience to diagnose and treat a patient with TMD, such a patient should be referred to a relevant specialist in the field.

Smile Analysis

An experienced clinician may feel comfortable performing a smile analysis directly during patient examination, however many clinicians will benefit from a less rushed evaluation of extra- and intra-oral photographs to ensure that the smile is comprehensively evaluated. Good quality extra- and intra-oral photographs will facilitate this evaluation of the smile.

In 2007, Sarver and Jacobson published "The Aesthetic Dentofacial Analysis" in the Clinics in Plastic Surgery. According to the authors the three major components of the smile analysis are the macro-, mini-, and microaesthetics divisions.[4]

The macroaesthetics evaluates the face in all three planes of space. Miniaesthetics focuses primarily on framework of the smile, which is bordered by the upper and lower lips, and includes assessments such as excessive gingival display on smile, inappropriate gingival heights, and midline deviations. Microaesthetics includes a closer assessment of tooth proportions, gingival colour and contour, tooth shades, etc..[4]

This article by Sarver and Jacobson (2007) is very comprehensive, specifically when evaluating patients for orthodontic treatment and/or orthognathic surgery. For a more in-depth list of aspects to evaluate please consult the article directly. The aspects of the smile analysis that are relevant for cosmetic evaluation will be discussed in more detail below.

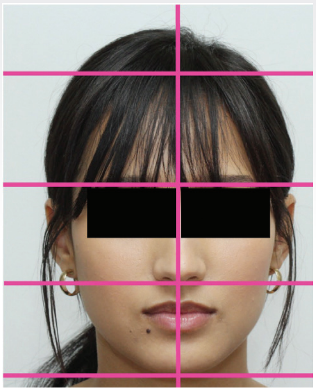

Figure 1: A vertical line down the midline and horizontal lines to indicate the facial thirds

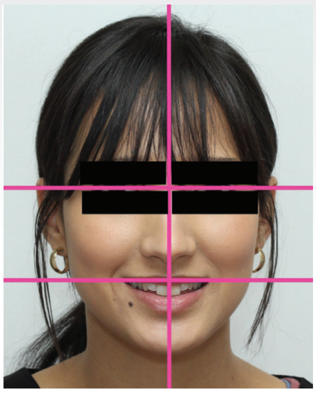

Figure 2: Horizontal lines perpendicular to the midline to indicate level of the eyes and the oral commissures

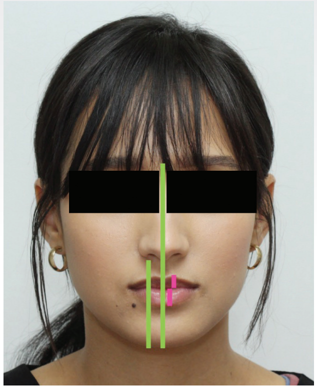

Figure 3: Ideally the upper lip should comprise one third of the lower facial third, and the lower lip and chin the remaining two thirds

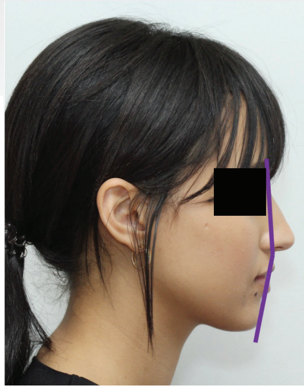

Figure 4: Extra-oral photograph indicating patient's profile

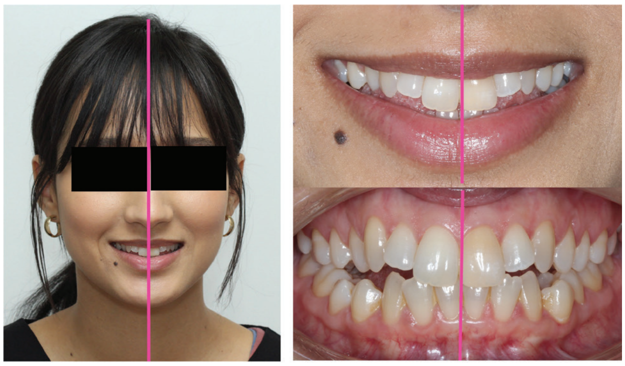

Figure 5: Facial midline (left) compared with close-up smile (top right) a nd intra-oral in occlusion (bottom right)

A: Macroaesthetics

When assessing the macroaesthetics of the face/smile one will start with the frontal view. The general facial balance can be assessed by drawing horizontal lines at the level of the hairline, the glabella, the nasal base and the inferior border of the chin to divide the frontal face into thirds (see Fig. 1). Traditionally the "ideal" face will have equal thirds.

These horizontal lines can also be positioned to coincide with left and right pupils, and left and right commissures on smiling. Both horizontal lines should be perpendicular to a vertical line drawn down the midline of the face (see Fig.2). When examining the ideal lower third of the face, the upper lip comprises the upper third, and the lower lip and chin comprise the lower two thirds (see Fig. 3). There are many dental and skeletal factors that may result in disproportion of the facial thirds and examination of these proportional relationships may help define the factors contributing to the visible vertical dentofacial deformities.[4].

Another aspect of the macroaesthetics is the evaluation of the profile, which can be described as straight, convex or concave (see Fig.4). This aspect leads to the identification of a prognathic or retrognathic Maxilla or Mandible.

The patient's midsagittal plane should be compared with both the maxillary and the mandibular dental midline (see Fig. 5). A discrepancy between these midlines may be due to dental factors or possibly by skeletal rotation of the maxilla.

B: Miniaesthetics

According to Sarver and Jacobson (2007) the vertical characteristics include the "lip-tooth-gingival relationships".[4] Key features are the relationship between the incisal edges of the maxillary incisor teeth relative to the lower lip and the relationship between the gingival margins of the maxillary incisor teeth and the upper lip.[4]

The smile arc is best assessed in the oblique view (see Fig. 6). It is generally accepted that the gingival margins of the upper canines should be coincident with the upper lip, whereas the gingival margins of the lateral incisor teeth should be positioned slightly inferior to those of the adjacent teeth.[4]

Included in the vertical characteristics of the smile is the assessment of the amount of incisor display at rest and when smiling (see Fig.7). This can also be coupled with an

Figure 6: The smile arc visualized using oblique views of the close-up smile

Figure 7: Incisal display at rest (top) and when smiling (bottom)

Figure 8: Buccal corridors can be either wide or narrow (as in the image)

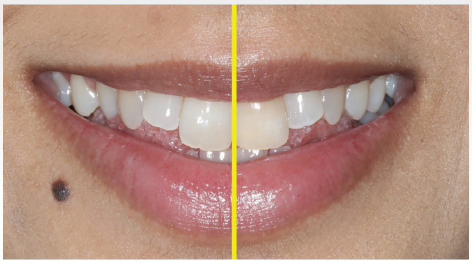

Figure 9: A line drawn down the midline facilitates comparison of the left and right sides of the smile

Figure 10: Visualization of the overjet and inclination of the maxillary incisor teeth

assessment of the amount of gingival display on smiling. Excessive gingival display may be due to vertical maxillary excess, requiring orthognathic treatment, or due to short clinical crowns, requiring gingivectomy or surgical crown lengthening. The final decision as to whether the amount of gingival display proves to be an aesthetic problem requiring treatment remains a subjective choice.[4]

There are three transverse characteristics of the smile, namely: the arch form, the buccal corridors and the transverse cant of the maxillary occlusal plane.[4] The arch form is typically classified as being oval, square or tapered in form, whereas the buccal corridors are typically wide or narrow (see Fig. 8). A narrow arch form and wide buccal corridors results in the smile also appearing narrow. Often orthodontic expansion is sufficient to laterally project the premolar and molar teeth into the buccal corridor thereby 'widening' the smile. When assessing the presence of a maxillary occlusal plane cant, a line drawn down the midline of the smile will facilitate comparison of the left and right sides, however full frontal views are required to confirm initial findings (see Fig. 9).

It is important to note that smile asymmetry may be due to asymmetric elevation of the upper lip, and this should not be confused with a transverse cant.[4]. The accurate assessment of these aspects are best done during clinical examination or with the use of digital video clips as static photographs do not always sufficiently capture these features.

When assessing the miniaesthetics in the profile view, one can assess the overjet and incisor angulation (see Fig. 10).

A: Microaesthetics

The microaesthetic evaluation focuses primarily on the dentogingival relationships of the teeth forms, contacts and the appearance of the gingival tissues.[4] Sarver and Jacobson believe that the shape of the teeth and the health of the gingival tissues have a major impact on the appearance of the smile.

Teeth are usually either square, oval or triangular in shape. It is important to note that within the same individual there may be several different tooth shapes. Tooth shape asymmetries can be corrected by several restorative interventions, from direct composite resin restorations, to ceramic veneers and full coverage restorations.

One can assess the gingival shape (height, length of interdental papillae), colour and overall contour for symmetry (see Fig. 11). Simple periodontal intervention can correct asymmetrical or incorrect gingival morphology. If visible racial pigmentation of the gingiva is an aesthetic concern to the patient, then laser treatments may help to improve the appearance thereof.

Another important aspect of the microaesthetics is the emergence profile and axial inclination of the teeth. This can be viewed and assessed from both the frontal and lateral views (see frontal view in Fig.12).

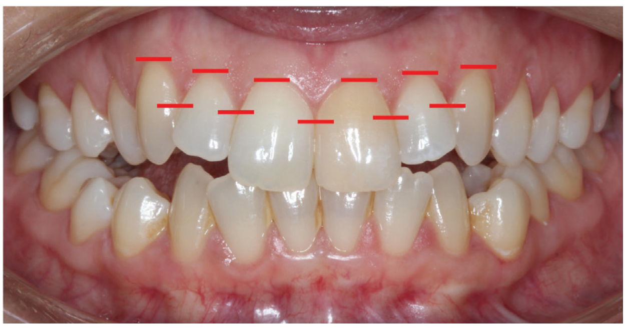

Figure 11: Red lines indicate gingival heights and lengths of interdental papillae

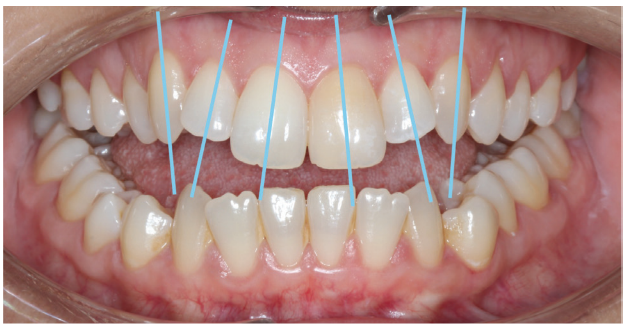

Figure 12: Blue lines to indicate axial inclination in the frontal view.

Figure 13: Contact points (light pink) indicated in the frontal view (left) and lateral view (right)

Figure 14: Length of connectors indicated in blue

Figure 15: Size and position of embrasures indicated in orange

One should also evaluate the contacts, connectors and embrasures. As seen in Fig.13, the contact points need to be viewed both from the frontal view and the lateral views to accurately determine the location thereof.

In the same way, the length of the interproximal connectors, and the size/shape of the incisal embrasures should be assessed for symmetry (see Fig.14 & 15).

Conclusion

When examining a patient that presents with an "aesthetic" main complaint, the clinician should not get tunnel-vision and only examine and treat the area of concern.

It remains our ethical obligation to comprehensively evaluate every patient, as the missed diagnosis of periodontal disease, occlusal disharmony or TMD is inexcusable.

Evaluating the macro-, mini- and microaesthetics of the smile will allow the clinican to objectively evaluate the aesthetic main complaint. Regardless of whether the treatment is orthodontic, restorative or surgical in nature, an objective smile analysis will ensure correct diagnosis prior to any treatment being initiated.

References

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