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ESSENTIALS FOR PREDICTABLE ESTHETIC RESTORATIVE DENTISTRY

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Michael Cohen, " Interdisciplinary Treatment Planning, Quint Dec. 2011"

- **Convenient Engineering vs Multidisciplinary vs Interdisciplinary Treatment Planning**

EXPERTISE

"…to become an expert at performing a complex task takes not only skill and focus, but also takes practice and more practice". Excellence takes practice!!!

THE ESSENTIALS FOR PREDICTABLE ESTHETIC RESTORATIVE DENTISTRY?

1. Management of the Dento-Gingivo-Restorative Interfaces?
2. Hard tissues management?
3. Esthetics design concepts??
4. Data including imaging including photography, radiography, CT and modelling?

Errors Associated With Facebow Transfers

- **Kois, John C, Kois, Dean E, & Chaiyabutr, Yada. (2013). Occlusal errors generated at the maxillary incisal edge position related to discrepancies in the arbitrary horizontal axis location and to the thickness of the interocclusal record. *The Journal of prosthetic dentistry, 110*(5), 414-419.**
    - The magnitude of occlusal error at the central incisor contact ranged from:
        - 0.45 to 1.25 um with a 1mm thickness of the interocclusal record.
        - 1.82 to 5.00 um with a 2 mm thickness.
        - 4.09 to 11.26 um with a 3 mm thickness.

Lux, Laura H, Thompson, Geoffrey A, Waliszewski, Kenneth J, & Ziebert, Gerald J. (2015). Comparison of the Kois Dento-Facial Analyzer System with an earbow for mounting a maxillary cast. *The Journal of prosthetic dentistry, 114*(3), 432-439.

- These studies demonstrated that small effects on the occlusion can be expected when the arc of closure is altered in an anterior or posterior direction, particularly when the occlusal record is of minimal thickness.
- When other considerations are incorporated, such as the use of anterior guidance or canine disclusion, and a thin jaw relation record, the effects of this difference in axis location may be smaller still.

BENEFITS OF FACEBOW

1. Planning cases on the arch of closure allows for changes to VDO while *minimizing AP discrepancy.*
2. Reduces chances of introducing *canting* into final restorations, consider:

What are some of the misconceptions about esthetics?

"Comparing the Perception of Dentists and Lay People to Altered Dental Esthetics", Kokich V. Jr. et al. Journal of Esthetic Dentistry, vol.11, Nos. 6, 1999./ 311-324

1. Incisor crown angulations and incisal plane deviations were noticed almost immediately, at 1mm deviations.
2. Other celebrities have midline deviations which have not been readily detectable e.g. Michael Jordan.
3. Gingival display was considered acceptable up to 2mm but unacceptable at 4mm.
4. Contrast with 1mm normally accepted (Chiche GJ, Pinault A. Esthetics of anterior fixed prosthodontics. Chicago: Quintessence, 1994).
5. Small amounts of gingival display (2 and maybe 3 mm) may NOT be an esthetic compromise.

Mallampati Scores

- Identifies patients at risk for difficult tracheal intubation.
- The classification provides a score of 1-4 based on anatomic features of the airway seen when the patient open their mouth and protrudes the tongue.
- A 2006 study showed that for each 1-unit increase in the Mallampati score, the odds ratio of having OSA (defined by having an apnea-hypopnea index [AHI] > 5) increased by 2.5.

FRIEDMAN SCORE

- Predicts success rate for palatal surgery for patients with mild-moderate sleep apnea.

Treatment Planning for Esthetics

I. Tooth form.
II. Tooth position in all three planes.
III. FGM
    - Gingival Levels
    - Papilla, black triangles
    - The effect of tooth shape, contact position and tooth rotations on papillae height.
    - Limits of instant orthodontics.
IV. Arch shape and its impact on esthetics.
V. Color theory.

PHOTOGRAPHY

1. Critical medical-legal document.
2. Essential for diagnosing esthetic parameters.
3. Critical for communicating these parameters to the patients.
4. Improves communication with the specialist.
5. Accurate communication with technician!

Treatment Planning for Esthetics

I. Incisal edge position.

A. Incisal-gingival
B. Medio-laterally
C. Labial-lingual

A. INCISAL-EDGE POSITION. (incisal-gingival) 3 ways.

i) Incisal Plane/Occlusal Plane Relationship

- Incisal plane may be on the same plane as the occlusal plane (desirable).
- It could be below (coronal) to the occlusal plane typically in class II.
- It may be above (apical) to the occlusal plane typically in class III.

ii) Using Phonetics -The "F" Sound

- Position of incisal edge relative to the wet-dry line of lower lip.
- Changes here are somewhat adaptable, thus need to be evaluated over time (2-3 weeks).
- "F" sound useful in determining when teeth are too long. Severe dimpling of lip.
- "F" sounds are NOT useful in determining if teeth are too short.

iii) Kinetics of tooth display...
JPD 1978 May, 39(5); 502-4.

- Vig and Brundo noted that Caucasian females, age 30 show approx. 3mm of the maxillary incisal edge and 0.5mm of the lower incisal edge at rest.
- 1mm and 2mm resp. at 50 yrs.
- 0 and 3mm resp. at age 70

B. MIDLINE (Medio-laterally)

a. Philtrum = midline of face.
b. Papilla = midline of dentition/teeth.
c. Contact = most variable and visible of midline elements.

C. **LABIO-LINGUAL**
    a. RICKETT'S E-PLANE
    b. ARNETT'S TRUE VERTICAL LINE

GOLDEN PROPORTION

- The Fibonacci series named after Leonardo of Pisa or (Filius Bonacci), alias Leonardo Fibonacci born 1175
- Great book The Liber Abaci, 1202, (on arithmetic), was a standard work for 200 years and is still considered the best book written on arithmetic.

Ufuk et al "Analysis of maxillary anterior teeth. Facial and dental proportions." J Prosth Dec 2005, 94: 230-238.

- There was no existence of the so called "Golden Proportion" found in the images of 100 Turkish dental students viewed from the front, engaged in maximum smiling, and recorded on digital photography.
- ***Esthetics will work with width/length ratios anywhere from 65% to 85%.***

PHONETICS

a) *Sibilants* ('s' sound) results in an incisal separation 1.0 to 1.5 mm.
b) *Nasal consonants* ('n/m' sound) results in an incisal separation 2 to 4 mm (consonant produced with a lowered velum allowing air to escape freely through the nose).
c) *Diphthongs* (a union of two vowel sounds pronounced in one syllable e.g. loud, noise) resulted in an incisal separation 5 to 10 mm.

BIOLOGIC WIDTH

- ***Gargiulo, Wentz, Orban 1961***
    - **287 teeth from 30 autopsy specimens.**
        - **Reported a mean depth of sulcus 0.60 mm**
        - **Mean junctional epithelium measures 0.97 mm**
        - **Mean connective tissue attachment measures 1.07 mm**
    - **Biologic width: Average values, sum of connective tissue attachment (0.97 mm) and epithelial tissue attachment (1.07 mm) around a tooth measures 2.04 mm.**
- ***Vacek J.S. et al, Intl Journal of Prosthodontics and Restorative Dentistry, Vol. 14, #2 1994.***
    - **171 cadaver specimens. Range of values from approx. 1.0 mm to 4.0 mm. Connective tissue was the most consistent.**

PAPILLA HEIGHT (Natural teeth)

- On average:
    - 1 mm connective tissue attachment height
    - 1 mm epithelial attachment

  - 1 mm of sulcus depth labial lingual
  - Total of 3 mm.
- The last 1.5 mm is the *interproximal contact factor* which leads to a 2.5 to 3 mm interproximal sulcus depth.
- This is a direct result of compression of a fixed volume of tissue between two teeth.
- Papillae are both like springs and balloons *(F. Spear, Seattle Institute)*.
- The greater the contour interproximally the greater the compression and the *more coronal and more pointed* the papilla will be.
- Conversely the narrower the interproximal contour the *more apical and more blunted* the papilla will be.

"Comparing the Perception of Dentists and Lay People to Altered Dental Esthetics", Kokich V. Jr. et al. Journal of Esthetic Dentistry, vol.11, Nos. 6, 1999./ 311-324

Gingival Levels and Diagnosis of Gummy smile

1. Short upper lip
2. VME
3. Anterior over-eruption
4. Wear and compensatory eruption.
5. Altered passive recession.
6. Altered active eruption.
7. Hyper-mobile lip
   Average lip length is 20-22mm for females at age 30 and for males, 22-24mm. Measure lip from base to bottom of lip at repose.

DENTO-GINGIVAL-COMPLEX

Papillae will fill embrasure space when contact point between two teeth is within 5mm of bone (Tarnow, D. P., et al J Clin Perio 1992: Dec 63 (12):995-60).

Papillae will regenerate in three years if removed (Van-der-Veldon, U., Journal of Clinical Perio.1982 Nov.9 (6).455-9).

1. On average there is a 1 mm connective tissue attachment height,
2. 1 mm epithelial attachment
3. 1 mm of sulcus depth labial lingual for a total of 3mm.

Cunliffe J. Petty I. 'Patients ranking of interdental "black triangles" against other common esthetic problems'. Europ J Prosth Rest Dent. 12/2009: 17(4):177-181.

1. Least desirable factor in smile is dark caries followed by dark margins.
2. Black triangles were considered esthetically worse than dark teeth or crowded teeth.
3. Public seems to be obsessed with negative spaces.
4. Dark caries, dark margins or black triangles appear to public as undesirable spaces.
5. Dark teeth and crowded teeth with no perception of negative space were least important to public.

Do Implants Have A Biologic Width?

Yes, it averages approx. 1.5 mm.

- An implant has a combined pseudo-connective-epithelial attachment (glycoprotein matrix) of anywhere from 0.5mm to 2.0mm depending on which literature you read, (see Tarnow and Misch).
- The sulcus is more variable.
- The presence of an avascular zone 50 – 100 um wide, of dense dense connective tissue fibers that are in direct contact with the implant body.
- Because there is no cementum layer around an implant most connective tissue fibers are oriented in a direction parallel to the implant surface.
- It is supra-crestal on natural teeth and therefore the papilla are more incisal.
- It is subcrestal on implants and therefore the papilla between implants is only 3.5 mm in height compared to natural teeth, where the papilla measure 5.0 mm in height.

Salama and Garber, 'Practical Periodontics Aesthetic Dentistry', 1998: 10: 1131-1141.

ANGLE OF DISCLUSION

- The angle-of-disclusion effects torsional stress on the restoration/tooth.
- For every 10-degree increase in the angle-of-disclusion, there is approximately a 30% increase in torsional stress on the abutment. *(Weinberg LA, Krueger B, Intl. J. Pros. Oct. 1955; Vol. 8:5).*

VDO

"The reduction in face height…study", Tallgren A Acta Odontal Scand 1966;24 (2):195-239.

- Rest position unreliable reference for assessment of VDO.
- "Incisive papilla line as a guide…display", Oh WS et al, J Prosth Dent 2009;102(3):194-6.

- Incisive papilla remains relatively constant in both vertical and horizontal position, except in cases of severe alveolar bone resorption.
- The mean vertical distance between the incisive papilla and the incisal edges of maxillary central incisors was 6.7 mm with a range of 5.5 to 8.9 mm.

Occlusal Influences on Esthetics

1. Anterior guidance
2. X-over
3. Phonetics.