The Clinical Research Foundation
Presents

TREATMENT PLANNING GUIDELINES FOR RESTORATIVE AND PROSTHODONTIC PROBLEMS

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Clinical Research Foundation
(a non-profit Foundation for Research and Charitable endeavors)

Chula Vista, California
April 2011

"Treatment Planning Guidelines for Restorative and Prosthodontic Problems."

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"What we see is determined by what we know. "*Goethe"*
"What we treatment plan is determined by this same knowledge."

"What do we know and what is "Evidence-based" in 2011?"
* How much evidence do we have for the dental treatments that are being performed today?
* "7% to 8% of all dental treatments are evidence based, and that greater than 50% of general dentists in their study, turn to *friends and colleagues* for evidence rather than looking in peer-reviewed journals, textbooks and electronic databases." *Brian Fitzpatrick Int J Pros Vol.21,No.4;2008:358-363*
* Why don't practicing dentists look to the scientific literature for evidence?
"The "let's look it up in PubMed" was not emphasized enough in dental school."
"Accessing the scientific literature is difficult for anyone who is not computer literate," and...
"One is able to download *only abstracts* most of the time."

*"Cocooning" on the Internet? *(Prof. Cass Sustain Univ. Chicago)- David Brooks, NY Times*
"The new media allows you to personalize your newspapers so that you only see the stories that interest you."
"You can visit only those websites that confirm your prejudices."
*Dr. Sustain is concerned because this creates *"cognitive biases."*
**"We like hearing evidence that confirms our suppositions. We filter out evidence that challenges them."*

"The primary goal of *dental education* is the dissemination of knowledge."
"But the principal goal of "*experience"*is to teach you to recognize potential problems before they occur."
"They teach you to *"think."*

***"Welcome back to dental school"(AGD Graduate School)**
***What Treatment Planning Guidelines Do You Need For This Journey?**
1. New Guidelines for Masticatory Function
2. New Guidelines for Bite Forces Tooth Wear, TMD and Occlusion
3. New Guidelines in Growth & Development that affect esthetic restorative procedures
4. New Guidelines for Esthetics and Occlusion
5. New Guidelines for Splint Therapy: what works and why? *"New pitfalls in splint therapy."*

Summary of tooth contacts when chewing: (1) *Gibbs, Lundeen, Mahan etal; Woda A.*
- Chewing utilizes both (1) fine neuromuscular control and (2) tooth-guided controls
- The mandibular teeth close in a outside to inside motion.
- "When patients grind (brux), they usually grind from outside in."
- Teeth contact only in the last 1.3mm of closure
- "The "protrusive" and "working" movements of the mandible are not normal *functional* movements. They were taught only as articulator movements and are not used during chewing."

Are TMDs Related to Occlusion? (See website for TMD and Occlusion 30 Questions and answers?
In Tanaka Text 7th ed.
- What are TMDs, who do they affect and what causes TMDs?
- Is "clicking" bad and how often will it get worse?
- *How stable will the occlusion be in these patients?*

Common Dental Myths still taught in 2011: *TTT= Tanaka*

Dental Myth No.1: *"Balancing side tooth contacts are bad and must be removed."* *(false)*

(1) "Balancing side tooth contacts should not be removed in over 90% of patients."

(2) "Balancing side tooth contacts exist because there is inadequate canine guidance on the working side or the canine guidance is worn. *Tanaka(TTT) 1969 ADA,ACP 1985;* Other studies of working and non-working side contacts: *Ingervall; Woda A., Korioth*

(3) Therefore, the lingual of the canine on the working side should be restored to contact if necessary by restorative, orthodontic or other means. *TTT*

Exception; the lingual plunger cusp of the max. 2nd. molar on the balancing side occasionally requires adjustment. *TTT*

- "Balancing side tooth contacts occur in 40% to 67% of the population. *(Ingervall B; Helkimo E., Tanaka, Umeda 2011)*

-TMDs that require treatment, make up only 6-7% of the population."*Okeson 4th ed. Text; McNeill et al JADA; Griffith JADA*

-"The contacts on the balancing side exist because the canines on the (working side) are worn or because there is no contact between the U & L canines in CR or ICP."

-Do individuals with balancing side contacts have more muscle and joint pain than those without balancing side tooth contacts? *"No" (Seligman,Pullinger; Korioth)*

- Lack of canine guidance may lead to fracture of the buccal cusp of the new premolar laminate restoration during masticatory function.

-U/L Canine to canine contact may be restored with composite, a gold pin-ledge inlay or orthodontic movement. *(and a splint), TTT*

Dental Myth No. 2

2.*"The transverse occlusal plane (side to side), must be parallel to a line through the pupils of the eyes."* *(False)*

- "The Transverse Occlusal Plane should be parallel to the floor."- *GPT 5-8 Glossary of Prosthodontic Terms*
- Transverse disorders may be communicated to the laboratory via a wax up or a face-bow mounting with a transverse level, or a *Kois Facebow by Panadent*

*** Dental Myth No.3**

"The best way to determine if the disc is displaced is to place the little finger into the ears and "feel" the click as the patient opens the mouth." (false, the finger in the ear will cause the clicking in 50% of pts.)

**** Dental Myth No.4*** *"The interincisal mouth opening should be three fingers."* *(false)*

- Recommended mouth opening is 40-45mm *Orofacial Pain Guidelines AAOP*
- The width of two fingers is 39-44mm *TTT*
- The width of three fingers is 57-65 mm (may lead to a hypermobile joint) *TTT*

*** Dental Myth: No. 5** *"There is a slide from CR to CO" (False)*

Glossary of Prosthodontic Terms GPT 6, p.59 "Centric Occlusion: the occlusion of the opposing teeth when the mandible is in the Centric Relation position."

***Therefore CR and CO are the same position.*

Centric Occlusion is an occlusal contact position.

*** Dental Myth No**.6- *"Abfractions (wedge shaped cervical notches) are caused by tooth bending forces."*

***** 85% are caused by toothpaste: *(Tanaka); Estafan 2002; Tanaka 2004,,Estafan, 2005; Dzakovich 2008*

** 15% tooth bending forces).*

** Refs: Heyman, bending forces; Tanaka 2004;Estafan2005 not bending forces; Dzakovich2008 toothpaste*

** Tanaka,TT,Yoshioka L, Hancock D, Tanaka K. presented at AES Annual Meeting, Chicago, 2011*

"What Medical Disorders affect Dental Treatment Planning Decisions?" ***Tanaka text 6th ed.***

- Pain Diagnosis and Effectiveness of Dental Treatments

Vascular Pain, Neurogenic pain, Neuro-musculoskeletal pain

- Clenching & Bruxing: Musculoskeletal Effects of Sustained Contraction (ref. see Okeson text 7th ed.)

What's New In 2011?
- "New information has changed our understanding of muscle & joint pain and malocclusion."
- Sensory fibers in the dental pulp are 2X more sensitive than all of the periodontal ligament fibers surrounding the tooth. *(Levy J IADR,2002)*
"Many important restorative and prosthodontic concepts are interpreted differently." CR,CO and TMDs. *Tanaka AES 2011*

The Patient Interview: how to listen, and how to gather & process the required relevant information.
- Why is the patient here? Why did the patient make the appointment?
- Chief Complaints 1,2,3 - List the problems in the order the patient feels is the most important to him/her?
- Description of each of the pains or problems?
- Provisional Diagnosis for each Chief Complaint?
- Recommended treatment for each Chief Complaint?
- Prognosis for each Chief Complaint? (If the patient agrees to follow each recommended treatment?

Patient Rounds: management of required relevant information
*"The two principal keys to diagnosis are to: *"Listen"* carefully, and *"Observe"* carefully

*** Psychogenic Pain:**
* 95% are personality disorders
- 80% are stress related
- 80% are tension-type headaches
- 80% of day time disorders (HAs) are related to unfavorable social interactions at work, relations with other employees, boss, spouse, family, children, inadequate or poor coping skills. ("must learn")
** Meds that may induce bruxing in patients: (PPZs) Paxel, Prozac, Zoloft.

Medical Disorders that affect Occlusion:
"The Physical Examination"
"Observe" the patient for the physical signs and symptoms of their disease that may be affecting the occlusion and the maxillo-mandibular relationship. (eg. Hands, fingers, feet, flushed appearance of the face, temperature of the extremities, referred pain and neurologic deficits.
See chapter on "Temporomandibular Joint Disorders," Tanaka text 7th ed.
See "TMDs 30 Questions" on website

Neuro-musculoskeletal Disorders:
A. Muscle Disorders: TMDs are Muscle and joint disorders (Disc Disorders)
B. Joint Disorders may be the result of Trauma, inflammatory disorders that are local OA, systemic RA, or auto-immune-Psoriatic arthritis Localized Arthritis (OA) and Systemic Arthritis (RA)

*"Centric Relation position will change with increased time of loading (TDL), and parafunction due to TMJ remodeling. *Moffitt,B 1970; Celenza 1975 JPD; Tanaka 1976 UCSD, PCSP;*
- Systemic Arthritis: Rheumatoid Arthritis, RA bilateral TM joint disease 8-10%, affects both wrists, metacarpal bones of the hands and the metatarsal bones of the feet. *Pronounced anterior open bites are seen with RA.*
- How do localized Arthritis (OA) and systemic disease (RA) (Rheumatoid Arthritis) differ radiographically
- Anterior open bite? evaluate TMJs with radiographs first. Cone beam CT recommended in 2011.
-The origin of the more severe malocclusions, e.g. ant. open-bites are the result of developmental disorders(direction of growth of the mandible), or VME), or remodeling from localized arthritis (OA) or systemic disorders (RA).
- Cone beam imaging is recommended for TMJ images at this time, at 0.4mm3 or 0.25mm3 resolution.
- OA of the TMJ - remodeling should remain relatively stable if inflammation is controlled.

- RA of the TMJ - with remodeling will undergo exacerbations and remissions with continued changes in the occlusion and must be "managed" continuously, through age 70+.

Summary: Musculoskeletal Disorders

- The most commonly occuring headache is Tension Type Headache (TTH). (80-90% of HA *Wiederholt*)
- TTHs are described by the patient as "dull, achy, sore and tight.*Wyngarten et al*
- TTHs may occur both unilaterally and bilaterally
- TTHs respond favorably to analgesics and NSAIDs
- 55-65% of face pain is referred from the cervical structures. *Eggleton T,Langton D; Iglarsh A; Rocabado M*

* - (Musculoskeletal HA's may precede and or precipitate a vascular event such as migraines.

(Stabilizing splint is best, anterior splints may help TTHs, but not migraines)

Growth and Development and the Effects of Oral Habits on Inter-arch Occlusion: Static & Dynamic Occlusion

"What should the practicing dentist know about the structure and function of the temporomandibular joint and associated musculature?"

Masticatory Muscle Model *(Okeson 6th Ed.)*

Normal function

- 3 Causes can lead to Protective Co-Contraction which usually occurs with Myalgia *Okeson 6th ed.*
  - Altered sensory or proprioceptive input - changes in the occlusion significantly alters the input, such as a new crown that is too high crown.
  - Constant deep pain input- from sore muscles, the TMJ or even a chronic long term pain from an endodontically involved tooth.
  - Increased emotional stress has been shown to increase the muscle tension within the muscle resulting in a limited mouth opening,
  - Stress - oral habits - clenching, grinding(bruxing), joint loading, disc compression,
  * (Nocturnal clenching for 7.1sec. during sleep)
  * *(Musculoskeletal Disorders) (Okeson 6th Ed.)*

Temporomandibular Disorders

TMD: Temporomandibular Disorders *(TTT)*

"The important numbers to remember are that less than 10% of the population will have TMD signs and symptoms that they are aware of, and they may or may not choose to seek help for their problem." Okeson 6th ed p.151-152

* *Therefore, the actual figures of individuals seeking treatment for TMDs are closer to 6% to 8% of the population. MCNeill, Mohl, Tanaka JADA*

Okeson Studies:

- 57 Studies that investigated the relationship between the signs and symptoms of TMDs and occlusion were evaluated by Okeson:
- 35 of the studies reported that there was a relation between TMDs and occlusion and 22 studies reported that there was no relation between occlusal factors and TMDs.

Growth and Development of the Face:

Terry T. Tanaka, DDS

•"What should the general dentist know about growth and development of the face?"

•Skeletal Growth of the Jaws and Face:

•There is a growth spurt at age 8 and again at age 10 peaking at 12-13 and completing growth at age 15-16 in females. *Woodside DG - (14-15 in other studies)*

•Both height and condylar growth experience a growth spurt from 12-14 and then the rate of growth decreases and is completed by age 18-19 in males. *Woodside DG (15-16 in other studies)*

•*There are growth (remodeling) changes in adults after 30 years of age? Behrents, RG*

•"How can this information help us in treatment planning restorative problems?"

Facial Thirds:

- Upper 1/3 Hairline to Glabella

- Middle 1/3 Glabella to subnasale
- Lower 1/3 Subnasale to Menton
  -Lower 1/3 should be 1/3 to 2/3

• Transverse Occlusal Plane: side to side occlusal plane

* Use a Fox Occlusal Plane to determine the Transverse occlusal plane or a tongue blade with a level.

• Mandibular Plane:

• Occlusal Plane and Campers Plane

• **Skeletal contributions to malocclusions:** (1) *Proffitt/Fields/Sarver , Contemporary Orthodontics*

••**Facial convexity or concavity** may be the result of a disproportion in the size of the jaws:

•(a) Vertical: Class I

•(b) Convexity: more Class II

•© Concavity: more Class III

• **Ethnic differences** - variations in arch size and shape and tooth size and shape. *Tanaka T,Yoshioka L, Hancock D, Tanaka, K. 2010* What are the *Treatment Planning* considerations?

•Orthodontic Classification: Angle

•Class I (Molar relation)

•Class II (Dental, tooth -size discrepancies and other factors)

•Class II (Skeletal, arch -size discrepancies and other factors)

•Class III (Skeletal arch size, growth factors, genetic, local and systemic disease)

••Class II Dental, and Class II Skeletal Occlusions

• *Class II Dental Occlusions are the result of tooth-size discrepancies,* ectopic eruption of teeth and other growth and development causes. (Equilibration may result in coupling of the anterior teeth.)

• ***Class II Skeletal Occlusions*** *are the result of arch-size discrepancies,* and other growth and development causes.***"Equilibration of the teeth will not achieve coupling of the anterior teeth & is not indicated."***

•*A centric record and mounted casts are required.*

Mclaughlin Classification of Malocclusions: *McLaughlin, Angle Orthodontist 1988*

- **Vertical Disorders -** (open bites: anterior, posterior, unilateral; anterior deep-bite)
- **Horizontal Disorders** - (cross-bite, edge to edge occlusion, Class III occlusion, anterior skids from CR to ICP, retrusive forces on closure e.g. "constricted envelope")
- **Transverse Disorders** - side to side, canted occlusal plane.

•Treatment Planning Guidelines in Orthodontics and Restorative Dentistry

•The inclination of the incisors (90°-102°) Incisors should support the upper lip.

•"*Smiles are important, but they aren't everything."*

•*"The goal is to achieve function and lifetime health of the entire chewing system as well as the beautiful smiles." Andrew Girardot, Orthodontist, Denver, Colorado*

There are Ethnic differences in:

•Facial morphology - facial dimensions and growth patterns

•Arch size and shape

•Height of the palate

•Tooth size and shape

•Jaw size and shape (form)

•All of the above requires a different set of rules or guidelines for the treatment of Caucasians, Asians and Hispanics and Black African Americans

•*Ref. AES/CRF Multi-Center Studies in progress, TTT, Clinical Research Foundation*

"The Quarterback"
"When multiple health professionals are treating the same patient, there has to be a quarterback."
"All treatment protocols, medications and treatments must be passed through this individual in order to avoid redundancy or omissions."

Interdisciplinary Treatment Planning:
USC Graduate Prosthodontics Examination Form, Tanaka
1) Identify the problem(s)? Consult with the specialists.
2. Determine who is responsible for what?
3. Decide on the sequence of treatment. Who does what first, second and……
3. Identify the goals of the imaging and lab tests, they may alter the type and course of treatment.
4. Follow-up and accountability: someone, you or a staff member must be assigned to each patient when referrals are made .

Treatment Planning Guidelines in Restorative Dentistry & Orthodontics
•"A natural lampshade convergence of roots creates the inclination of the anterior teeth"
•"The inclination of the posterior teeth helps create the Curve of Wilson"
•Curve of Wilson: Teeth #s18 & 31 are tilted lingually 18°, leaving the buccal cusps of the second and first molars higher than the lingual cusps. *"If the lingual cusps are shorter than the buccal cusps, the OVD has decreased."*

Facial growth In Adults: *(1) Behrents 1984: 1984 U. Michigan Thesis*
in Contemporary Orthodontics 2007, Mosby Co, Elsevier
•"It was generally assumed that growth of the facial skeleton ceased in the early teens or early twenties. In the early 1980's Behrents succeeded in recalling over 100 individuals who had participated in the Bolton Growth Study in Cleveland in the 1930s and the late 1940s, more than 40 years previously.
•Most had never had orthodontic treatments; a few did. While they were participants in the study, the growth of these individuals had been carefully evaluated and recorded, by both measurements and cephalometric films."
•"As expected, *changes in the soft tissue profile were greater than the facial skeleton." Vig and Brundo, JPD*
•The changes were noted as:
•1. an elongation of the nose
•2. flattening of the lips
•3. an augmentation of the chin
•4. "The result is that more changes were noted in the mandible than the maxilla."

•Facial growth In Adults: *(8) Cont. Behrents 1984,*
Summary: (Planes of space affected differently)
•1. More changes in the mandible than the maxilla
•2. Growth in width drops to adult levels at puberty
•3. AP growth continues at a noticeable rate for a longer period, declining to basal levels only after puberty, with small but noticeable growth continuing throughout adult life."
•Vertical growth which had previously been observed to continue well after puberty in both males and females, continues at a modest level well into adult life."
•"A Treatise on the Continuum of Growth In the Aging Craniofacial Skeleton"
Rolf G. Behrents, DDS, PhD
•University of Michigan
Center for Human Growth and Development, 1984
Ann Arbor, Michigan
- "How stable is the anterior tooth position?"
"Will it change as the patient ages and why?"
- Incisor display at rest, a function of aging:
Vig RG, Brundo GC JPD 39:502-504, 1978; Sackstein M 2008 Int J Prostho

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Summary of clenching, effects of interproximal tooth wear, crowding, age & anterior guidance.
•Patients who clench and brux:

1. will have tight interproximal contacts that can be observed when flossing.
2. will experience a greater amount of interproximal wear resulting in flatter contact surface areas.
3. will experience a greater amount of crowding of the mandibular anterior teeth.
4. will have shorter dental arches as the result of the interproximal wear.
5. The crowding and greater anterior forces will result in more vertical mandibular incisors and less o overjet of the anterior teeth as the patient ages."

refs. Yamagawa et al ; Kasahara et al; Gibbs et al, Behrents; Vig and Brundo

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FACIAL GROWTH AND REMODELING FROM AGES 37 TO 77

"Will crowding of mandibular incisors occur in all patients?" "Yes and No"
•Aging and Oral Habits:
•1. The overjet will decrease from age 37-77
•2. The mandibular incisors will move lingually.
•3. The maxillary incisors will move downward (incisally)
•*Behrents R. 1984; in Contemporary Orthodontics, Proffit, Fields, Sarver*

•1. A constricted anterior envelope may develop with increasing age
•2. Wear will be seen at the lingual of the max.incisors. & labial of mand. incisors.
•3. Retrusive forces may lead to TMDs
•4. The incisal contact at full closure may be more lingual, resulting in retrusive forces on the mandible
•5. HAs and neckaches (TMDs are frequently seen.)
•6. Rec Tx: Orthodontic Tx., P.T., Chiropractic ("Active Release")

• Guidelines for Treatment Planning Anterior Tooth Wear Problems
• Guidelines for use of mounted and unmounted study casts
• Check the Chewing patterns and contact patterns on closure when chewing
• Check if Canine Guidance is present
• In a chewing stroke, the patient closes from outside,upward and into the final contact position in the intercuspal position (ICP).
• Check for Parafunctional Wear:
• "The real purpose of a canine protected occlusion is to protect the posterior teeth during lateral and anterior parafunctional movements."
• Deflective posterior contacts:
• Posterior interferences during closure may deflect the mandible forward resulting in the wear patterns seen at the lingual of the maxillary incisors and the incisal edges of the mandibular incisors
• U/L incisors will erupt to maintain contact. as the teeth wear.
• *Mounted casts required*
• Wear of Incisal Edges:
•If there is sufficient overjet, the patient is "doodle-ing."
•Incisors will erupt to maintain contact of the opposing incisors

• Summary of the effects of clenching, bruxing, aging and condylar remodeling:
•1. Clenching/bruxing increases occlusal and interproximal forces which contributes to crowding of mandibular incisors and interproximal wear with flattened contacts.
•2. Growth (remodeling)of the soft and hard tissues of the face continues from ages 37-77
•3. Condylar remodeling after age 37 contributes to crowding of mand. incisors.
•*4. These factors must be considered when determining anterior guidance at age 25-35.*

•6. A constricted anterior envelope may develop with increasing age
•7. Wear will be seen at the lingual of the max.incisors. & labial of mand. incisors.

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•8. Retrusive forces may lead to TMDs
•9.ref. Aging and Oral Habits:*Behrents R. 1989 ; Contemporary Orthodontics, Proffit, Fields, Sarver*

Periodontal and Restorative Guidelines
• Gingival Esthetics: the height of cervical margin is at the distal 1/3
• The tooth tapers from the interproximal contacts towards the cervical of the tooth. If crown lengthening is considered, there is a greater risk of creating a "black hole" at the interproximal/cervical.
• "Soft tissue levels may not reveal the level of the underlying supporting bone."
• Guidelines For Determining Anterior Tooth Length: How would you determine the incisal length?

THE WORN DENTITION GUIDELINES:
• When one encounters worn teeth, the first step in formulating a diagnosis is to understand what the tooth looked like,(shape and size/length), and what the original tooth position was before it wore down."
• Wear of the anterior teeth (incisors) must be related to the anterior-posterior Curve of Spee.
• The proper anterior tooth length cannot be determined solely by replacing the lost enamel.
DVD,VHS "The Worn Dentition"
DVD - "Treatment Planning"- Rule of Thirds: E-Line, etc.
• (1) E-Line - determines the degree of tooth display when the patient is speaking (very close to the habitual rest position).
• (2) Highest Smile Line - ask patient to smile as broadly as possible and to raise the upper lip as high as possible to determine how much gingiva will be seen. (gingival excess)
• (3) Retracted lower lip - to determine the degree of gingival display of the lower incisors

•Splint Therapy in Esthetic Dentistry:
• - Use of a Stabilizing Splint to determine anterior tooth length, to determine & maintain the OVD, determine the anterior guidance. (E-Line & Highest Smile Line)
- "Establish the OVD and anterior tooth length first, then fabricate the splint at this OVD and anterior length. Proceed to cut out a window in the incisal of the splint, add adhesive and composite."

Extra Notes on Occlusion and Occlusal Vertical Dimension:
•Centric Relation and Centric Occlusion definitions - *Glossary of Prosthodontic Terms 7-8*
•Centric Relation is a position of the condyles independent of tooth contact,
•Centric Occlusion is an interocclusal dental position of the maxillary teeth relative to the mandibular teeth.

•*"Even the Centric Relation Position will change throughout life as the TMJ structures remodel during the life of the patient." 1. Celenza,F; 2. TTT.*
•"And the face continues to remodel(1), and the soft and hard tissues of the face continue to sag down(2)
1. Behrents; 2. Vig and Brundo; 3. Sacketts

Extra Notes on Vertical Dimension:Muscle Physiology
• "All the muscles of the body are continually being remodeled to match the function that are required of them, their diameters, lengths, strengths and vascularity are altered throughout life and even the type of muscle fibers are altered at least to a slight extent; this remodeling process is often quite rapid, occurring during a few weeks(8)."
• "Reduced biting function in modern people has been documented in association with soft food, i.e. modern children need approximately several fold the strokes for eating a primitive meal in comparison with those for eating a modern soft diet," (10-11).
• "To compensate for this reduced biting function caused by the modern diet that could be critical in the vertical grower suggests that some exercise of the masticatory muscles might be necessary.

•Nanda
"The patterns of anterior vertical facial proportions are established at an early age and maintained during the progression of growth.
•Early initiation of orthodontic treatment might be beneficial in persons with relatively large lower face heights because these subjects appear to reach their adolescence at an early age. It is evident that deep bite subjects exhibit a prolonged period of facial growth in contrast to open bite subjects. (1).

•Isometric clenching exercises during orthodontic treatment:
•Lindsey and English recommended as the initial period of leveling began, the patients are instructed to squeeze their teeth together to aid to intrude the molars.(16).
•Tran et al (l9) evaluated high-pull headgear combine with masticatory exercise and found significant reductions in the ANB and gonial angles and reduced mandibular autorotation. (l9).
•*Isometric clenching exercises do not strengthen masticatory muscles, however, their effects on facial morphology might help to reduce aberrant vertical growth patterns. (17).*

Extra Notes on : Facial Morphology and Muscle Function:
•As the facial morphology depends on muscle function and this function is related to the muscle fiber and this fiber can be changed, so we could change the growth pattern or at least improve it. The changes that are achieved by clenching exercises could be achieved sooner and with better results with electro stimulation.
•Facial growth In Adults:*(2)Cont. Behrents 1984,*
p127, in Contemporary Orthodontics 2007, Mosby Co, Elsevier
•"The magnification in the radiographs was known precisely, and it was possible to obtain new radiographs more than 4 decades later with known magnification, so that precise measurements of facial dimensions could be made."
•"The results were surprising but unequivocal:
•"Facial growth had continued during during adult life." See (figure 4-31 next slide)
•"There was an increase in essentially all of the facial dimensions, but both size and shape of the craniofacial complex altered with time."
•Facial growth In Adults: *(3) Cont. Behrents 1984,*
p127, in Contemporary Orthodontics 2007, Mosby Co, Elsevier
•"Vertical changes in adult life were more prominent than antero-posteroior changes, where width changes were least evident, and so the alterations observed in the adult facial skeleton seem to be a continuation of the pattern seen during maturation."
•"In a point of particular interest, an apparent deceleration of growth in females in the late teens was followed by a resumption of growth during the twenties.
•"It appears that a woman's first pregnancy produces some growth of her jaws."
•Cont.

•Facial growth In Adults: *(4) Cont. Behrents 1984,*
p127, in Contemporary Orthodontics 2007, Mosby Co, Elsevier
•"Although the magnitude of the adult growth changes , assessed on a millimeters per year basis, was quite small, the cumulative effect over decades was surprisingly large."
•"The data also revealed that rotation of both jaws continued into adult life, in concert with the vertical changes and eruption of teeth."
•"Because implants were not used in these patients, it was not possible to precisely differentiate internal from external rotation, but it seems likely that both internal rotation and surface changes did continue." Cont.

•Facial growth In Adults: Males vs.Females
(5) Cont. Behrents 1984, p127, in Contemporary Orthodontics 2007, Mosby Co, Elsevier
•"In general, males showed a net rotation of the jaws in a forward direction, slightly decreasing the mandibular plane angle, whereas females had a tendency toward backward rotation with an increase in the mandibular plane angle."

•"In both groups, compensatory changes were noted in the dentition, so that occlusal relationships largely were maintained." (???)

•Facial growth In Adults: *(6) Cont. Behrents 1984,*
Effects of loss of teeth on facial morphology
•"Both a history of orthodontic treatment and loss of teeth had an impact on facial morphology in the adults and in the pattern of change."
•"In the smaller group of patients who had orthodontic treatment many years previously,, Behrents noted the pattern of growth associated with the original malocclusion continued to express itself in adult life.
•"This also indicates how a gradual worsening of occlusal relationships could occur in some patients long after orthodontic treatment."

SPLINT THERAPY 2011:
WHAT WORKS, WHAT DOESN'T AND WHY?
TERRY T. TANAKA, DDS
What should the dentist know about the splint therapy literature?
* 1. Dao TT, Lavigne G, Feine, Lund J, J Pain 56, 85-94; 1994,Comparison of splint types in the treatment of myofacial pain.
2. Gibbs, Lundeen, Mahan Differences in daytime and nocturnal bite forces JPD 1984,1986
Nocturnal bite forces are significantly higher than day forces 3-5X greater
3. Nishigawa, Day and Nocturnal bite forces; Nocturnal forces are 2.5-4x greater than day forces
4. Williamson E. et al JPD all patients were tested when awake only, results demonstrated that the EMG activity of the masseters was less when the patient was biting on a splint with contact on the anterior section. *"This does not mean that if a splint or deprogrammer is made to contact only the anteriors, that the patient will bite with less force* ***when he/she is sleeping."***

How effective are splints for the management of myofacial pain? (Classic Article)
Dao Study and results:
Note the significance of the effects of two different splint types:
Group A: stabilizing splints worn for 30 min.
Group B: palatal splint that covered only the palate with a Hawley labial wire, worn 24 hrs.
Group C: stabilizing splint worn 24 hrs./day
Results: no significant difference in pain relief between all three splint uses
Conclusions: by Tanaka
1. Maxillary splints that cover the palate provide relief from myofacial pain because of the sensory input Cr. V, from the tongue. The tongue feels a foreign object and the sensory input signals that there is a foreign object present and the muscles attempt to avoid forceful contact of the teeth. This results in a relaxation of the elevator muscles which reduces tooth contact and provides relief of the myofacial pain.
2.Therefore, it is the change in proprioception or sensory input that leads to relief of the myofacial pain with splints, orthodontic separators and orthodontic appliances and not the interarch occlusal position, e.g. CR or MIP.
3. The myofacial pain will be relieved regardless of whether the splint is made at the centric relation position or the MIP Maximum Intercuspation Position.

Should splints be made on the maxilla or mandible?
* Mandibular splints: are used for patients with an anterior open bite if they are experiencing myofacial pain and or TMJ pain or dysfunction. Attempt to provide occlusal coverage and occlusal contacts up to and including the mandibular premolars to stabilize the occlusion while managing the dysfunction and pain with medications and other modalities. Mandibular splints may be used if patient will be instructed to wear the splint during the day or night.

* Maxillary splints: I use maxillary splints for 97% of patients with myofacial pain and TMJ dysfunction because the full arch maxillary stabilizing appliance will provide (a) the pain relief at the same time that the patient is able to settle into their (b)comfortable occlusal position where I will restore them. This may be the centric relation position if complete restorations are required, or the ICP, MIP, if little or no restorations are required. (c) In patients with worn incisal edges, I will also be able to determine the desired incisal length (phonetics),by adding acrylic to the incisal edges of the maxillary splint, (d) the most important factor for me is the ability to shape the lingual of the anterior of the splint to provide the desired anterior guidance, both protrusive and lateral guidance. When restoring a complete rehabilitation, I use this splint to make a custom incisal guide for the final diagnostic wax up when the patient is comfortable.

When are hard acrylic splints recommended?
- I use hard acrylic splints for 99% of my splints, both upper and lower.
- There are some newer splints that use a softer material inside the splint against the teeth and a harder material that contacts the opposing teeth which are also just as effective. One drawback is that they have to be made thicker. If this splint is not made thick enough, the occlusal adjustment may grind through the hard material and the contact in the soft material may alter the occlusion as well as the occlusal proprioception.

When are soft splints recommended?
- I only use soft splints as a temporary replacement if the patient has lost their regular splint that is made to protect their restorations and that is worn at night.
- I also use the soft splint on the mandibular teeth for growing children who are severe grinders and have ground down their posterior and anterior teeth and exhibit severe wear. I limit the use of these appliances to 4 months and insist that the patient and the mother(parent) return with the appliance so that I may personally cut up and throw away the splint. Continued use of these soft rubber splints in growing children will affect the normal growth of the mandible and may affect the eruption pattern of the permanent teeth..
- The clinician should remember that these soft rubber splints are just as effective in relieving myofacial pain as the hard splints, however, they are difficult to adjust occlusally and may intrude the posterior teeth on one side more than the other side if inserted without adjusting them.
- I have noticed that many adults and children like to chew on these appliance and I feel that they are using the appliance as an exerciser to strengthen their elevator muscles, so I don't use them for adults.
-I recommend the 3mm mouth guard material from Great Lakes Co. I also use their Biostar vacuum machine which heats and makes a near perfect fit for the appliance.

When is night time use of stabilizing splints recommended?
** *Routine use of nocturnal, full coverage maxillary or mandibular splints are recommended for patients for whom you have performed restorative procedures because they had worn their teeth down and had exhibited tooth clenching and grinding habits.*
* Use for patients who clench and or grind their teeth when sleeping.
* Use for all patients with CNS disorders; use for patients who are aware of grinding their teeth during the day, dystonia, dyskinesia, cerebral palsey, and other diagnosed "movement disorders."

When is daytime use of stabilizing splints recommended?
* Daytime use of splints is not frequently recommended because of the very low forces produced during daytime clenching and bruxing (grinding).
* *Maximum clenching test averages 62-85lbs during the day* (when conscious) between the max/mand incisors
* *Maximum clenching test averages 130-340 lbs (during sleep, 2.2x to 4x greater*) between the max/mand incisors
* *Maximum clenching test averages 185lbs between the molars during the day*(when awake)
* *Maximum clenching test averages 740lbs between the molars during the night (when sleeping)*

** Daytime clenching and grinding is most often "job related," "related to stressful events," as in encounters with the "boss," other "employees," "spouses," or "other family members." The daytime use of splints is limited to use during encounters with these individuals.
** Clenching and bruxing during sleep may be related to airway disorders and "arousal mechanisms," but is generally not understood well at this time. refs. Lavigne G; and Rouse J.

Precautions with anterior deprogrammers and anterior splints:
Clinicians should exercise great care when recommending these appliances for patients who are known to clench and or brux because if the patient continues to clench or brux on these anterior appliances, the loading forces will be directed onto the TMJ disc, because there is no posterior vertical support in the molar region.
**** Always check the surfaces where the opposing teeth contact the anterior splint (deprogrammer. If scratches are seen on the anterior splint, this means that the patient is applying forces on the splint and to the TMJs as well. Minor adjustment of the contacting areas may reduce the anterior scratches, but a change back to a full arch stabilizing appliance is recommended before TMJ dysfunction results.*

Should medications be recommended along with the splint if muscle pain (myofacial pain) is present?
* Analgesics: If the patient is experiencing myofacial pain as the result of clenching and or bruxing, and a stabilizing splint is recommended, support with an analgesic such as Tylenol extra strength or Ibuprofen will reduce the discomfort faster than the sole use of an orthotic (splint). (2 to 4 tabs/day)
* NSAIDs: NSAIDs may be recommended for the above myofacial pain and also for most myalgic conditions, e.g. simple muscle overuse, local muscle soreness, protective muscle co-contraction and even Fibromyalgia. **The recommended dosage as an NSAID is 1800mg to 2400mg/day with food and should not be prescribed for patients who are allergic to aspirin.**

**** The material above is an abbreviated summary for Dr. Tanaka's full day lecture. More complete information is available in the DVDs and the Tanaka text(manual 6th ed.) in the *Tanaka Educational Library* on his website at www.TerryTanakaDDS.Com.**

**** The educational DVDs of Restorative and Occlusion Guidelines, Treatment Planning and TMJ Dissections that are used in over 80 dental schools and surgery programs are available on this website.**

**** NEW DVDs: in 2011**
(1)*"Problem Solving Guidelines for Restorative Dentists" DVD series* will be available in June, 2011
(2) *"Implant Surgery: Advances and Complications" will be available in October 2011*

****TANAKA, TEXT(MANUAL 7TH Ed):**
The 7th edition of the Tanaka Text is a working manual designed for graduate students in Graduate Prosthodontics, Endodontics, Periodontics and General Dentists. It is currently undergoing revision and will be available in September, 2011.

****A NEW schedule of interactive eCourses with Dr. Tanaka are being planned at this time. Watch the website, at www.TerryTanakaDDS.com**

"Best wishes for a happy and healthy 2011."

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