FDI  CSA
世界牙科联盟 中华口腔医学会
临床牙科进展报告会
Continuing Dental Education Programme
UPDATE IN CLINICAL DENTISTRY

25-27 October, 2004
Hangzhou China
Programme

报告会日程

2004年10月26日（星期二）

地址:
8:30 - 9:00  Opening ceremony 开幕式
9:00 - 10:20  Color theory and Application in Dentistry 颜色的理论及在牙科中的应用
10:20 - 10:40  Break 休息
10:40 - 12:00  Tooth wear 牙齿磨损
12:00  Lunch 午餐
1:30 - 2:50  Chemotherapeutics in the management of Periodontal Diseases 牙周疾病治疗中的药物治疗
2:50 - 3:10  Break 休息
3:10 - 4:30  Relationship between Periodontal Health and Systemic Health 牙周健康与全身健康的关系

2004年10月27日（星期三）

地址:
8:30 - 11:30  Current Trends in Aesthetic and Restorative Dentistry 美容修复口腔医学的目前发展情况
12:00  Lunch 午餐
1:30 - 2:50  How to Fabricate Complete Denture for Edentulous Patients with Low and Flat Alveolar Ridge 如何为牙槽嵴低平患者制作全口义齿
2:50 - 3:10  Break 休息
3:10 - 4:30  The Preliminary Research on the Basis and Clinical Apply of Reverse Neck Dissection 逆行性颈淋巴清扫术的基础和临床应用初步探讨

2004年10月25日（星期一）

Orthodontic Course 口腔正畸专题

地址:
8:30 - 12:30  Contemporary Orthodontic Practice——Biomechanics and Smart Wires 现代正畸实践：生物力学与SMART弓丝
12:30  Lunch 午餐
1:30 - 2:30  Differential Diagnosis and Treatment of Class II and Class III Malocclusions Angle II类和III类错位的鉴别诊断与治疗
2:30 - 3:30  Orthodontic management of periodontal Patients with Periodontal disease 牙周病患者的正畸治疗
3:30 - 4:30  Adult orthodontic treatment—a great chance and challenge for orthodontist 成年人正畸治疗——机遇与挑战同在
Applying color theory in clinical practice to improve patient treatment

Asbjørn Jokstad
Science Manager, FDI World Dental Federation
Professor, University of Oslo, Norway
Learning objectives

Be familiar with the physical mechanisms of tooth coloring and its measurement
Recognize possible etiology for discoloration
Realize the potentials and limitations of esthetic restorative materials
Be acquainted with different shade guides and their characteristics
Know of commercially available digital systems for shade matching
Know procedures for optimizing correct shade matching & communication
Light-tooth interaction

Specular (white) and diffuse reflection (yellow-orange)

Maximum diffuse transmission (high translucency)

Reduced diffuse transmission (yellow-orange)

Direction of regular transmission if the tooth were made of transparent glass

Pink hue from gum
Colors for teeth and dental materials are reported in the literature as:

- **Munsell values** \((Hue, Chroma, Value)\)
- **Tristimulus values** \(X, Y, Z\)
- **CIE chromaticity values** \(Y(\%), x, y\)
- **CIE \(L^*a^*b^*\)**
CIE $L^*a^*b^*$ color system

$\Delta E^* = \text{Change of } L^*a^*b^*$ values
Proportional contributors to tooth color

- The proportional contribution of enamel, dentin, pulp, gingiva and mucosa to the spectral reflection from the tooth in isolation remain uncertain
The proportional contribution of enamel, dentin, pulp, gingiva and mucosa to the spectral reflection from the tooth in isolation remain uncertain.

In general, dentin contributes the most as it is more chromatic than enamel.
The proportional contribution of enamel, dentin, pulp, gingiva and mucosa to the spectral reflection from the tooth in isolation remain uncertain.

In general, dentin contributes the most as it is more chromatic than enamel.

Enamel is very translucent and more grey-blue than dentin.
Definitely not realistic!

SYNERGY® Super White shades are ideal for restoring whitened teeth and deciduous teeth.

Only SYNERGY® offers three different bright white shades, selected by dentists:

- Super White N (neutral)
- Super White O (opaque)
- Super White P (pear)

With SYNERGY® Super White shades, tooth whitening can be accomplished with one-off co-visits or laboratory-produced veneers. Let SYNERGY® Super White assist you with your cosmetic needs.

Before veneer

After SYNERGY® Super White veneer
Learning objectives

1. Be familiar with the physical mechanisms of tooth coloring and its measurement

2. Recognize possible etiology for discoloration and best treatment
   - Extrinsic
   - Intrinsic
Extrinsic discolored teeth – etiology

N1-type colored material (chromogen) binds to the tooth surface. The color of the chromogen is similar to that of dental stains caused by tea, coffee, wine, chromogenic bacteria, and metals.
Extrinsic discolored teeth – etiology

**N1-type** colored material (chromogen) binds to the tooth surface. The color of the chromogen is similar to that of dental stains caused by tea, coffee, wine, chromogenic bacteria, and metals.

**N2-type** colored material changes color after binding to the tooth. The stains actually are N1-type food stains that darken with time.
Extrinsic discolored teeth – etiology

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N2-type colored material changes color after binding to the tooth. The stains actually are N1-type food stains that darken with time.

N3-type colorless material or prechromogen binds to the tooth and undergoes a chemical reaction to cause a stain. N3-type stains are caused by carbohydrate-rich foods (eg, apples, potatoes), stannous fluoride, and chlorhexidine.

(Nathoo 1997)
## Discolored teeth – best treatments

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Appropriate method</th>
<th>Active agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface staining</td>
<td>AirScaling / Brushing with (whitening) toothpaste + Patient counseling</td>
<td>Abrasives</td>
</tr>
<tr>
<td>Hereditary defects</td>
<td>Restorative treatment</td>
<td></td>
</tr>
<tr>
<td>Tetracycline staining</td>
<td>Custom bleaching trays worn by patient daily for six to 12 weeks</td>
<td>10% carbamide peroxide</td>
</tr>
<tr>
<td>Single or multiple discolored teeth</td>
<td>External bleaching — in-office one to three visits</td>
<td>30-38% H₂O₂, alone or with heat or light</td>
</tr>
<tr>
<td>Multiple teeth and entire arches</td>
<td>Most effective for yellow or brown discoloration</td>
<td>10% carbamide peroxide</td>
</tr>
<tr>
<td>Isolated brown or white discolored teeth</td>
<td>Microabrasion followed by neutral NaF applications</td>
<td>Abrasives + HCl up to 36%</td>
</tr>
<tr>
<td>White discoloration on yellowish teeth</td>
<td>Microabrasion followed by custom tray bleaching</td>
<td>Abrasives and acid; 10% carbamide peroxide</td>
</tr>
<tr>
<td>Endodontically treated teeth</td>
<td>Internal bleaching — in-office or walking Na perborate or 35% H₂O₂</td>
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</table>
Intrinsic discolored teeth – etiology

1. Hereditary defects

Dentinogenesis imperfecta.

- Teeth relatively normal at eruption
- Discolor increases with time
- More and more translucent, pink yellow, brownish or grey-brown
- Enamel may chip off with subsequent heavy dentin discoloration
Intrinsic discolored teeth - etiology

1. Hereditary defects

**Dentinogenesis imperfecta.** Normal at eruption. Translucent, yellow, pink, brownish or grey-brown. The enamel may chip off with subsequent heavy discoloration of dentin.

**Amelogenesis imperfecta.** 2 categories:

1. **Hypoplastic:**
   - Teeth smooth and glossy
   - Color is orange, reddish or brown

2. **Hypomineralised:**
   - Color can vary between bone white, yellow, red and black
   - The enamel may chip off later
Intrinsic discolored teeth - etiology

2. Toxic effects during tooth development

Fluorosis: Surface may range between small opaque white spots to extensive yellow-brown bands and/or areas
Intrinsic discolored teeth - etiology

2. Toxic effects during tooth development

Fluorosis: The surface may range between small opaque white spots to extensive yellow-brown areas

Tetracycline:
Chemical complex to ameloenamel proteins
Color can vary between light to dark yellow
Characteristic fluorescence in UV light
Cervically usually darker due to thin enamel
Intrinsic discolored teeth - etiology

1. **Hereditary defects**: Dentinogenesis imperfecta. - Amelogenesis imperfecta

2. **Toxic effects during tooth development**: Fluorosis - Tetracycline

3. **Trauma**: Sometimes in the early phase following a trauma, due to internal bleeding in the pulp, with retention of porphyrines and iron in the dentin. The discoloration may be reversible or remain, even if the pulpa remains vital

4. **Pulp necrosis**: Results usually in a tooth discoloration, but not always
Intrinsic discolored teeth - etiology

1. **Hereditary:** Dentinogenesis & Amelogenesis imperfecta
2. **During tooth development:** Fluorosis - Tetracycline
3. **Trauma:** Internal bleeding in the pulp, with retention of porphyrines and iron in the dentine
4. **Pulp necrosis:** Usually tooth discoloration, but not always
5. **Other reasons:**
   - Degradation products from metallic restoratives
   - Seldom bleeders’ diseases
   - Surface erosions
   - Unknown reasons, possibly related to some childhood illness. E.g. hepatitis over a period
## Discolored teeth – best treatments

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Dental Materials

Presently, there are no spectrophotometric quality control of materials with minimum criteria of performance.

Among the direct materials, composite resins possess the best optical-physical properties regarding esthetics.
Technique in 1980
New products in 2004

Opaque Dentin

Regular Body

Translucent Enamel

=Miris

Enamel plus HFO

=Vit-l-escence

Matrixx

Esthet-X
Shade Selection

- Enamel
- Body
- Dentin
Dental Materials- composites, clinical observations

- Most materials become more opaque and lighter after a while intraorally, due to water uptake
  - This varies markedly among different materials
Dental Materials- composites, clinical observations

- Most materials become more opaque and lighter after a while intraorally, due to water uptake

- Chemically polymerised composites discolor more into yellow than the light polymerised due to the polymerisation chemicals in the resin
Dental Materials- composites, clinical observations

- Most materials become more opaque and lighter after a while intraorally, due to water uptake.
- Chemically polymerised composites discolor more into yellow than the light polymerised due to the polymerisation chemicals in the resin.
- Chemically polymerised composites with microfillers discolor more compared to those with macrofillers.
Composites are tested in laboratory for discoloration potential. E.g.

1. Color Stability, in 60/80°C Water
2. Color Stability, Xenon light
3. Stain Resistance, in 37/80°C Coffee
4. Stain Resistance, in 37/80°C Tea
An absolute requirement is adequate preparation depth!

- The thickness of a restoration / veneer is critical to obtain a correct reflection spectrum and thus acceptable shade.
- Not removing enough tooth substance will either result in poor esthetics or to overcontouring with risk for subsequent gingival recession. This is especially critical cervically.
Learning objectives

1. Be familiar with the physical mechanisms of tooth coloring and its measurement
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3. Realize the potentials and limitations of esthetic restorative materials
4. Be acquainted with different shade guides and their characteristics
# Shade guides

<table>
<thead>
<tr>
<th>Producer</th>
<th>Materials</th>
<th>Shade</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M ESPE</td>
<td>Composite / Hybrid</td>
<td>VITA/ Biodent / Own</td>
</tr>
<tr>
<td>Bisco</td>
<td>Composite / Hybrid</td>
<td>VITA</td>
</tr>
<tr>
<td>Coltène</td>
<td>Composite</td>
<td>VITA</td>
</tr>
<tr>
<td>Dentsply</td>
<td>Composite / GIC / Hybrid / Ceram / Prefabricated teeth</td>
<td>Biodent/ VITA/ Own</td>
</tr>
<tr>
<td>Discus</td>
<td>Composite</td>
<td>Own</td>
</tr>
<tr>
<td>DMG</td>
<td>Composite / Hybrid / GIC</td>
<td>VITA</td>
</tr>
<tr>
<td>Ducera</td>
<td>Ceram</td>
<td>Biodent / VITA</td>
</tr>
<tr>
<td>GC</td>
<td>Hybrid / GIC / Ceram</td>
<td>VITA</td>
</tr>
<tr>
<td>H Kulzer</td>
<td>Composite / Hybrid / Prefab teeth</td>
<td>Biodent/VITA</td>
</tr>
<tr>
<td>Jeneric</td>
<td>Composite / Ceram</td>
<td>Bioform/VITA</td>
</tr>
<tr>
<td>Kerr</td>
<td>Composite</td>
<td>VITA</td>
</tr>
<tr>
<td>Shofu</td>
<td>Ceram</td>
<td>VITA / Vintage Halo</td>
</tr>
<tr>
<td>Ultradent</td>
<td>Composite</td>
<td>VITA</td>
</tr>
<tr>
<td>VITA</td>
<td>Ceram / Prefabricated teeth</td>
<td>VITA VITA3D</td>
</tr>
<tr>
<td>Vivadent</td>
<td>Composite / Ceram</td>
<td>Chromascop/VITA/ Own</td>
</tr>
</tbody>
</table>
Shade guides

Large deviations between supposedly similar tooth shades from the same producer is not uncommon
Shade guides

- Large deviations between supposedly similar tooth shades from the same producer is not uncommon
- Custom-made color shades using the actual restorative material is claimed to be better than using a standard color shade
Shade guides

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- Custom-made color shades using the actual restorative material is claimed to be better than using a standard color shade

Some tooth shades changes following immersion in disinfectants. Keep away from chlorine-containing solutions!
The 5 most common shade guides in use internationally
Bioform -> Biotone -> Trubyte
Bioblend -> Portrait IPN

White-red  Yellow  Orange  Brown-Red  Brown-Grey
1990; Vivadent -> Kerascop
<table>
<thead>
<tr>
<th>Reddish-brown</th>
<th>Reddish-Yellow</th>
<th>Grey shades</th>
<th>Reddish-Grey</th>
</tr>
</thead>
</table>

 +/- neck?

Changed in the mid-seventies
A3.5 & D4 added in 1980
B1 & D1 sometimes excluded
“VITA-Shade” guides from different producers may often differ markedly from the original.
A more modern principle for a shade guide
"old" VITA shades

VITA 3D
VITA 3D-MASTER

With

&

Without

Colors
Learning objectives

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5. Know of commercially available digital systems for shade matching
Digital Shade Matching Systems

A hand held optic device with dual light source connected through fiber optics to a spectrophotometer
• Dental Color Analyser (clearlight.com/~aei)
• Metalor-ikam system (metalor-ikam.com)
• Pocketspec (Pocketspec.com)
• ShadeVision /ShadeRite (X-Rite.com)
• Shadescan (Cynovad.com)
• Spectroshade (mhtint.com)
• ShadeEye NCC (Shofu.com)
Digital Shade Systems - Benefits

• Improved communication between dentist and lab
• Can integrate with
  – Intra-oral camera
  – Digital Camera
  – Image enhancing software
  – Mouth Simulator
  – Printer
Learning objectives

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6. Know procedures for optimizing correct shade matching & communication
Before you start...

1. Have the patient remove lipstick or bright makeup
2. If patient is wearing bright clothing, drape him or her with a neutral colored cover, i.e. light blue or light gray
3. Keep a surface with a neutral color nearby
4. Clean the teeth if doubt of extrinsic discoloration
5. Don't recline your patient – keep at eye level
6. Do not wear glasses that changes with light
Fixed Prosthetic Dentistry- shade selection

... right environment

1. Do not use direct lights. Lighting should be in the most natural light possible. Incoming light may be altered if the window in your operatory has a lot of greenery around it
Fixed Prosthetic Dentistry- shade selection

... right environment

1. Do not use direct lights. Lighting should be in the most natural light possible. Incoming light may be altered if the window in your operatory has a lot of greenery around it.

2. Compare your shade selection under varying conditions such as with lip retraction versus lip down and when the patient moves their head in different directions or lighting angles.
Fixed Prosthetic Dentistry- shade selection

... right environment

1. Do not use direct lights. Lighting should be in the most natural light possible. Incoming light may be altered by greenery around the window

2. Compare your shade selection under varying conditions such as with lip retraction versus lip down and when the patient moves their head in different directions or lighting angles

3. Have also your patient press their tongue against the lingual surface, when doing an anterior tooth restoration
Light sources

Fluorescent  Natural daylight  Incandescent

The same teeth look different under different light sources
Fixed Prosthetic Dentistry -
shade selection

... right time

1. Select the shade at the beginning of the session before the tooth becomes dehydrated and your eyes fatigued

2. An impression and the use of rubber dam will cause lighter teeth. Retraction cord may influence the tooth color both ways. Anaesthetics too?

3. The canines are good for selecting shade as they have the highest chroma of the dominant color of the teeth

4. Once the tooth is fully prepared, use your guide to select the shade of the dentin in the tooth’s body
Important:

1. The first impression is usually the most accurate in shade selection

2. It is important avoid fatiguing the eyes. Do not stare for >3-10 secs. Gazing at a neutral color, e.g. blue or grey for approx. 30 seconds will help to cleanse and refocus the eyes
Fixed Prosthetic Dentistry - shade selection

... the process ...

1. Place the shade tab parallel to the facial surface of the teeth, not in front or behind
2. Arrange each tab on the guide so that the incisal edge is facing out or away from the tab holder. Since incisal shading has the greatest influence on value, it is helpful to position the incisal area of the tabs closest to the teeth you are shading. This will also help avoiding color choice being influenced by the hue area of the tab
3. Always select the **value** reading first. It may help to squint
4. Now that the value reading has been taken, use your hue guide to select the **color** reading
Fixed Prosthetic Dentistry - shade selection

... finalising

1. Make your final shade selection after comparing your selections with those of a staff member and/or ask the patient's opinion on your choice

2. Make a mental note of morphological details

3. If unable to match, choose a lower chroma and higher value

4. Take photo with shade tab if possible
Communicate this to laboratory

Get as detailed as possible with characterization
Every piece of information helps:
- Surface texture
- Glaze
- Translucency
- Wear
- Proximal view with incisal/thickness of enamel
- Any unique color characterizations of the dentine
Thank you for your kind attention