

BOOK OF ABSTRACTS



Lebanese Dental Association 13th Annual Convention

Problem Solving *in* Dentistry

August 27 to 30, 2003
Beirut, Lebanon



World Dental Federation



Under the High Patronage of His Excellency
The President of the Lebanese Republic
General Emile LAHOUD

SESSIONS' SCHEDULE

Lebanese Dental Association
13th Annual Convention
Problem Solving
in
Dentistry

August 27 to 30, 2003
Beirut, Lebanon

Problem solving in Dentistry:

*Applying color theory
in clinical practice*

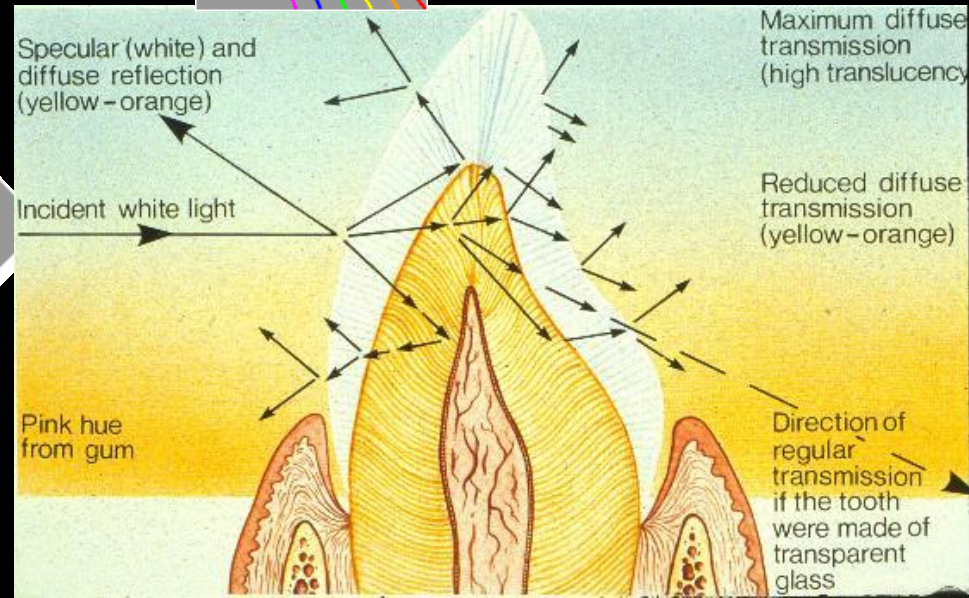
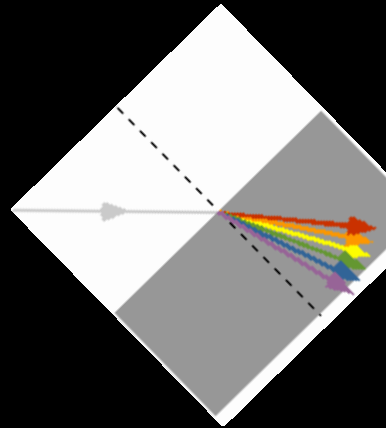
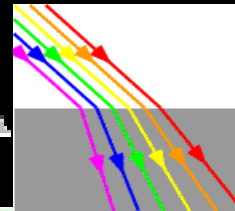
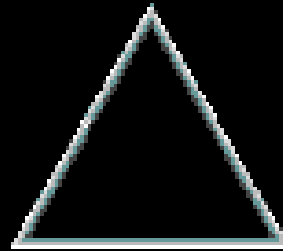
*Asbjørn Jokstad
Institute of Clinical Dentistry, University of Oslo, NORWAY*

Topics to cover



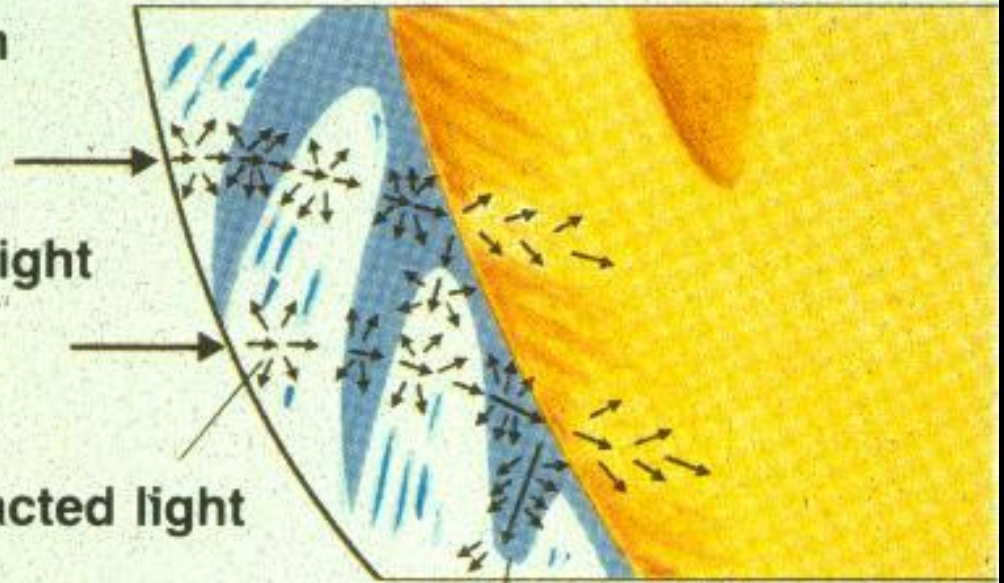
1. Discolored teeth - etiology
2. Materials
 - Esthetic Restorative Materials
 - Shade guides characteristics
3. Shade matching
 - Digital systems
 - Procedure for matching & communication

The color of teeth?





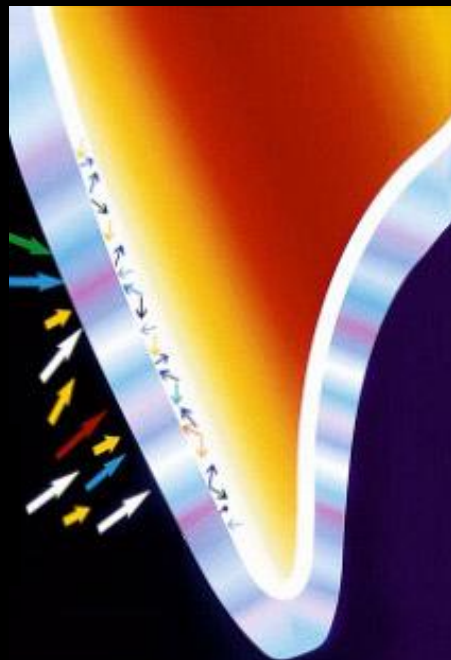
Natural tooth



Light

Refracted light

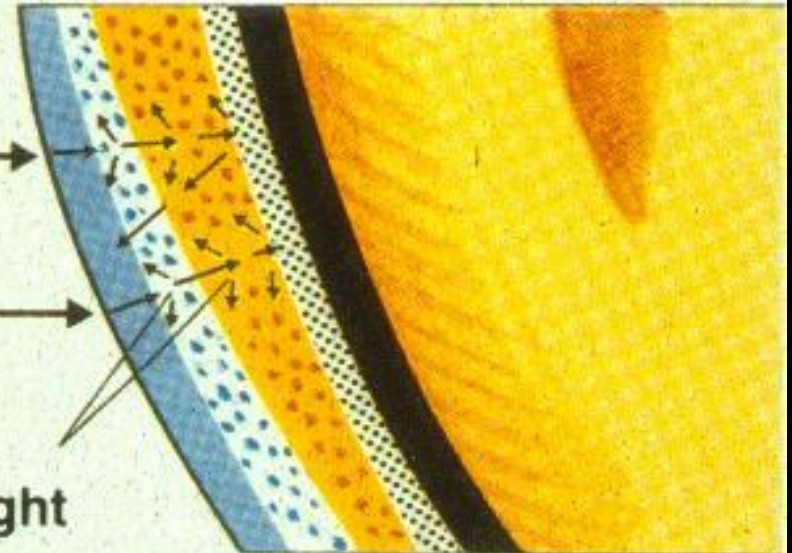
Scattered light



Conventional porcelain crown

Light

Refracted light

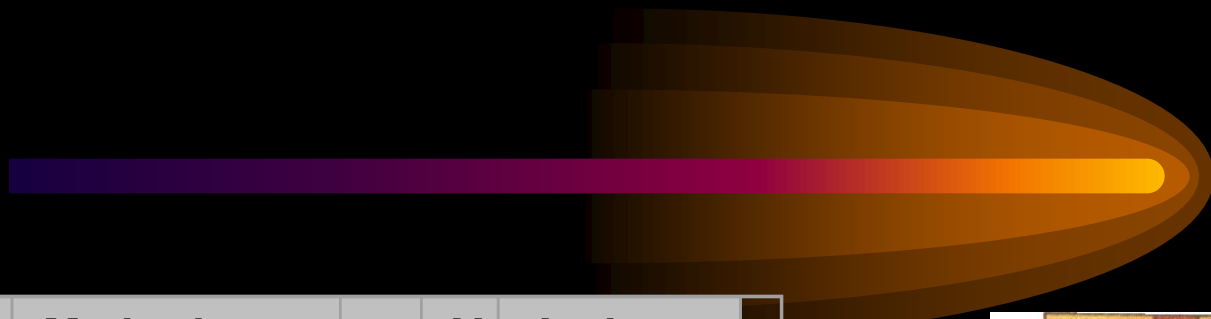
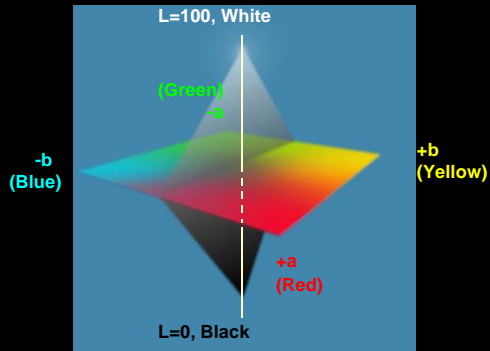


Tooth Color

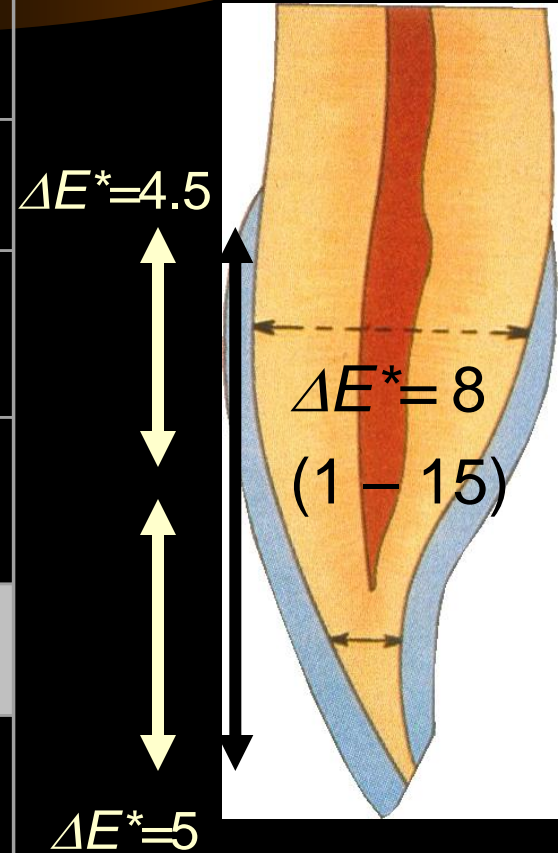
- *Munsell values*
- *CIE 1976 L^*a^*b*
- *Tristimulus values X, Y, Z*
- *CIE chromaticity values $Y(\%), x, y$*

??!

Tooth Color, CIE 1976 L*a*b



Average	L	a	B	Method	n	Yr	Author
Vitro							
72-1-16	56-83	-.7-4.6	4.4-26.	Spectrophotometer	95	95	O'Brien et al.
	48-61			Spectrophotometer	20	98	Horn et al.
Vivo							
	63-73	2-9	12-20	Colorimeter	87	00	Hasegawa et al.





Proportional contributions to tooth color 1/2

- 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



Proportional contributions to tooth color

- In addition to ground color, other internal structures will produce optical phenomena:
 - Enamel: Perikymata, Infractures, Retzius-lines, Hunter-Schreger lines, enamel lamellas, hypoplasia, thickness and composition
 - Dentin: Dentin canal obliteration, enamel-dentin-transition, thickness and composition
 - Pulp: Secondary dentin and size
- Contact points, size and location and embrasure form and size
- Location of the enamel-cement transition buccally and proximally

**Definitely
not
Realistic!**

Realistic white shades for special cosmetic needs



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

Only SYNERGY® offers three different bright white shades—selected by dentists.

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

With SYNERGY® Super White shades, tooth whitening can be accomplished with one office visit or laboratory produced veneers.

Let SYNERGY® Super White assist you with your cosmetic needs.



Before veneer



After SYNERGY® Super White veneer

Tooth color

There is lack of longitudinal studies on how much teeth discolor with age

The evidence that teeth may be related to ethnic group is weak

A reliable and valid measurement system of tooth color remains to be developed

Nobody have attempted to correlate tooth color with any demographic data

Age related increased opacity and perceived darkening is due to following deposition of calcium-phosphates in enamel and in peritubular dentin, loss of enamel surface due to wear, and increased secondary dentin and gradual obliteration of the pulp.

Discolored teeth – extrinsic, etiology

Nathoo 1997

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.

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.



Discolored teeth – intrinsic, etiology

1. Hereditary defects

Dentinogenesis imperfecta. Teeth are relatively normal at eruption. With time, they become more and more translucent, and yellow, pink, brownish or grey-brown. The enamel may chip off with subsequent heavy discoloration of the exposed dentin.

Amelogenesis imperfecta. Two categories have been described:

Hypoplastic: Teeth are smooth and glossy. The color is orange, reddish or brown

Hypomineralised. The color can vary between bone white, yellow, red and black. The enamel may chip off later



Discolored teeth - etiology

2. Toxic effects during tooth development

Fluorosis: Due to high intake of fluorides. The surface may range between small opaque white spots to extensive yellow-brown areas



Discolored teeth - etiology

2. Toxic effects during tooth development

Fluorosis: Due to high intake of fluorides. The surface may range between small opaque white spots to extensive yellow-brown areas

Tetracycline: Due to a chemical complex between the medicament and ameloenamel proteins. Even a short one-week cure can cause marked discoloration. The Color can vary between light to dark yellow, and give a characteristic fluorescence in UV light. The teeth are usually very dark cervically due to the thin enamel



Discolored teeth - etiology



1. Hereditary defects: Dentinogenesis imperfecta. - Amelogenesis imperfecta
2. Toxic effects during tooth development: Fluorosis - Tetracycline
3. Trauma: In the early phase following a trauma, a discoloration can sometimes be observed due to internal bleeding in the pulp, with retention of porphyrines and iron in the dentine. 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
5. Other reasons: Can be degradation products from metallic restoratives, seldom bleeders' diseases, surface erosions and unknown reasons, possibly related to some childhood illness. One such known relationship is hepatitis over a long period.

Bleaching, methods

TYPE OF PRODUCT OR METHOD	ACTIVE AGENTS	INDICATIONS FOR USE
Internal Bleaching—In-Office or Walking	Na perborate or 35 % hydrogen peroxide	Endodontically treated teeth
External Bleaching—In-Office One to Three Visits	30 - 38 % hydrogen peroxide, alone or with heat or light	Single or multiple disColored teeth
Custom Bleaching Trays Worn by Patient Daily for Two to Six Weeks	10 % carbamide peroxide	Multiple teeth and entire arches, most effective for yellow or brown discoloration; may be effective for tetracycline staining with longer use
Brushing With Whitening Toothpaste	Abrasives	Surface staining
Microabrasion Followed by Neutral Sodium Fluoride Applications	Abrasives and HCl up to 36 %	Isolated brown or white discolorations of shallow depth in enamel
Microabrasion Followed by Custom Tray Bleaching	Abrasives and acid; 10 % carbamide peroxide	White discoloration on yellowish teeth

*Esthetic
Restorative
Materials*



Dental Materials

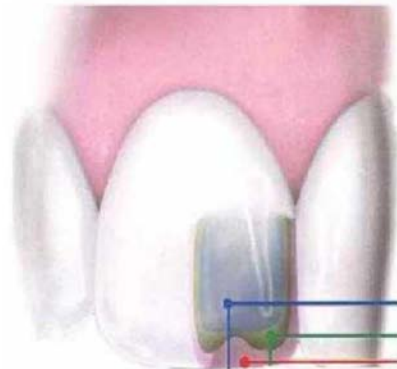
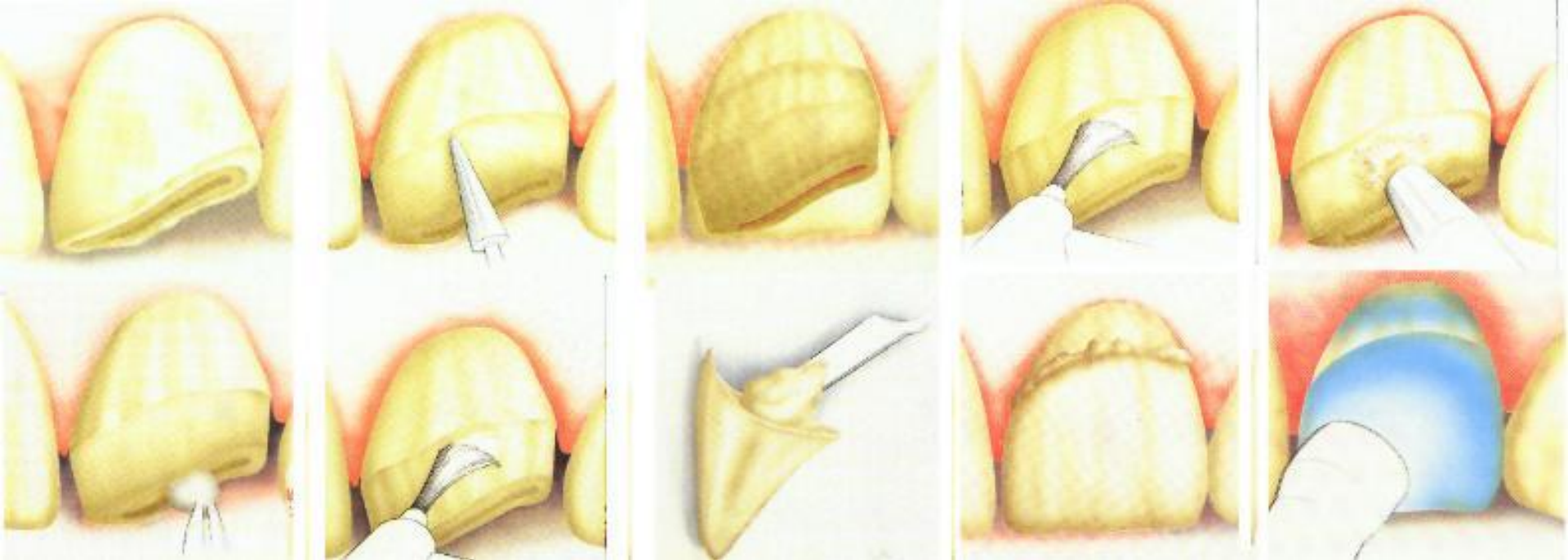
Presently, there are no spectrophotometric quality control of materials with minimum criteria of performance

Among the direct plastic materials composite resins possess the best optical-physical properties regarding esthetics



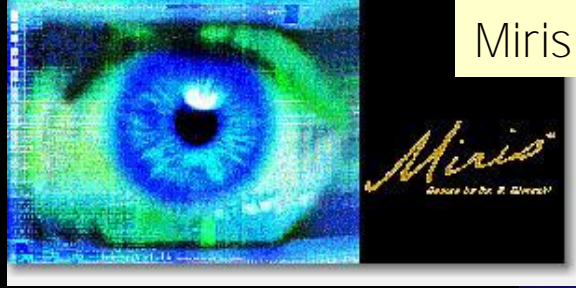


Procedure -brochure from 1980



Opaque Dentin Shades
Regular Body Shades
Translucent Enamel Shades

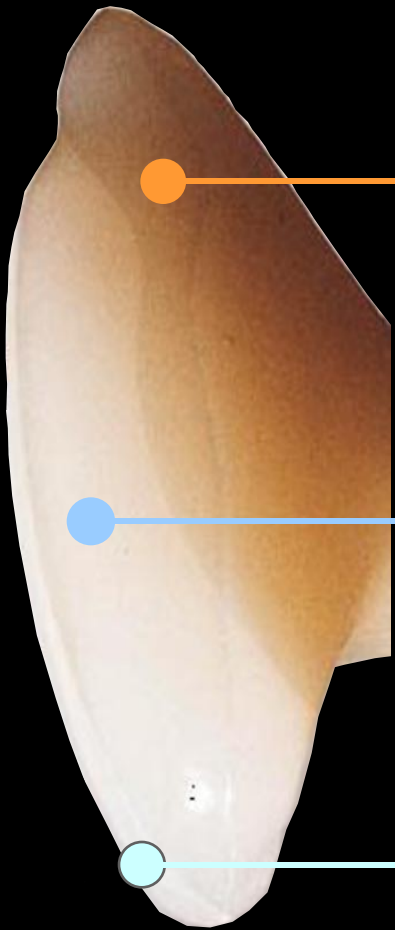
New products



Miris



Esthet-X



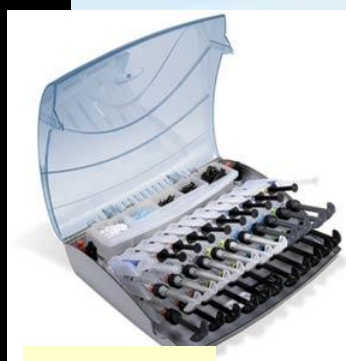
Opaque Dentin

Regular Body

Translucent Enamel



Enamel plus HFO



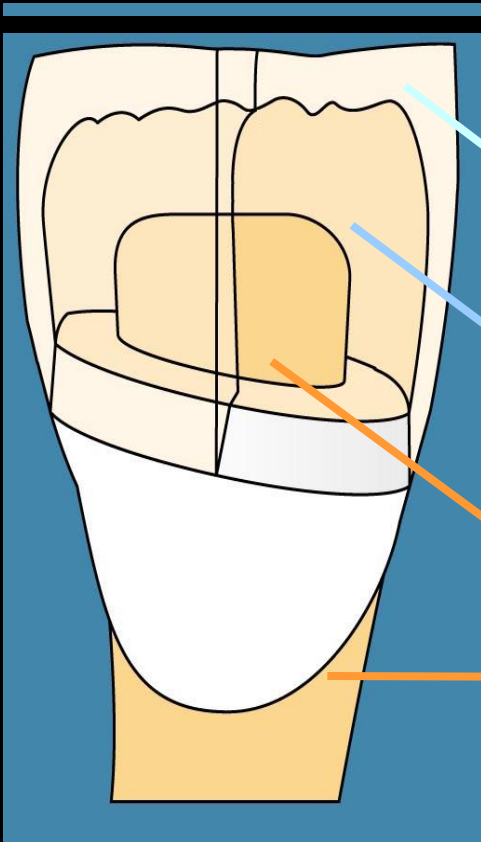
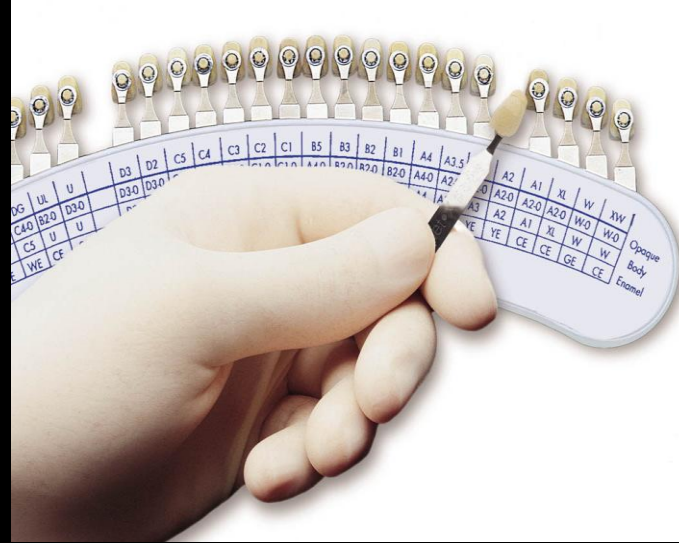
Matrixx



= Vit-I-escence



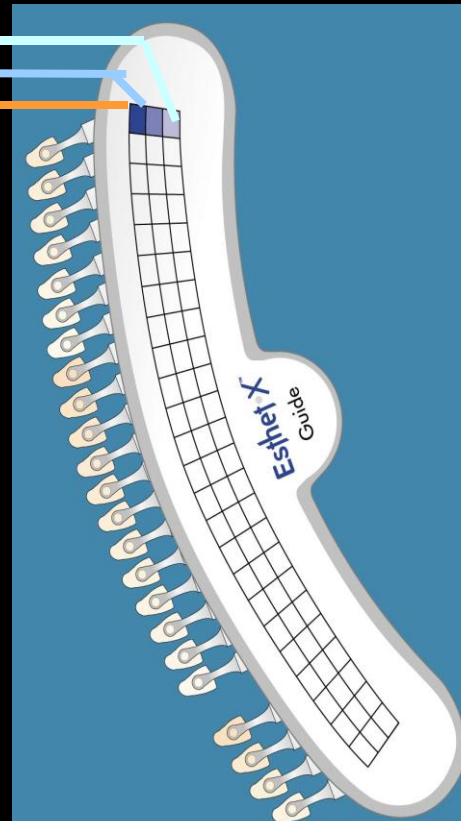
Shade Selection



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
- 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.



Dental Materials- composites, laboratory observations

Compare the stain resistance of ADAPTIC II vs. other composites.



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

Principles - preparation

- 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.



Principles – composite materials properties

- Light polymerised composites become less colorful after polymerisation, with microhybrids becoming darker and microfills becoming lighter after polymerization.
- Light-curing cause an increase in translucency of microhybrids and a reduced translucency in microfills

Principles – composite materials, effects

- When placing a microfill composite the shade of unpolymerised material should be slightly more yellow/chromatic than the tooth before placement
- The surface structure influences the appearance of shade. A highly polished surface appears lighter than a rough surface with a similar color
- Special optical effects in composite restorations created by using intensive colors must always be veneered by a translucent composite

Shade guides

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



Shade guides

- Shade guides from the different producers may often differ markedly from the original VITA-shade

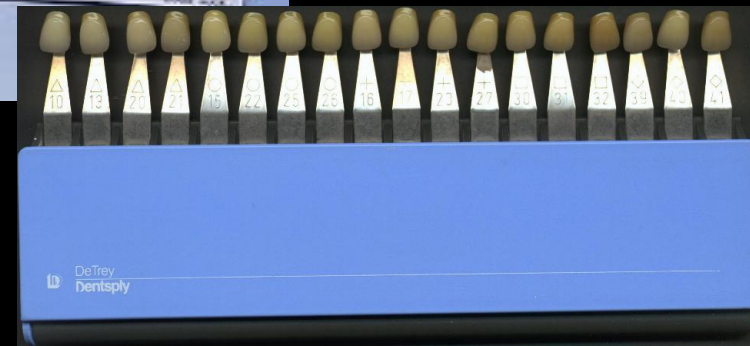
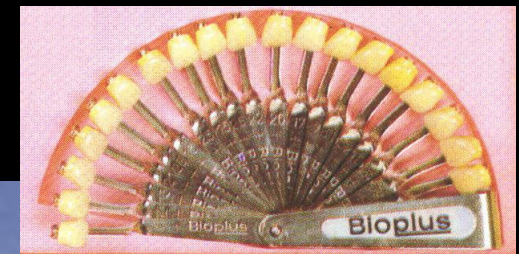
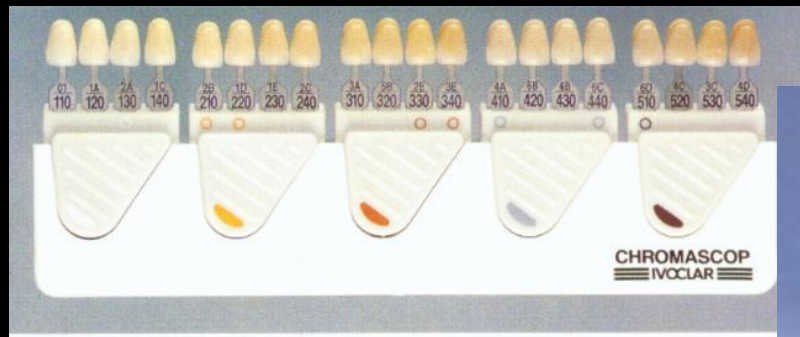


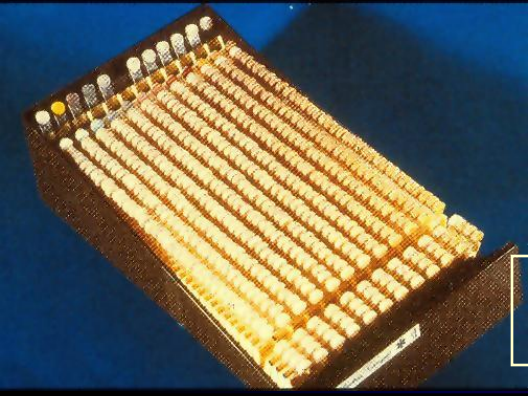
Shade guides



- Shade guides from the different producers may often differ markedly from the original VITA-shade
- 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
- Some tooth shades changes following immersion in disinfectants. Keep away from chlorine-containing solutions.

Shade guides

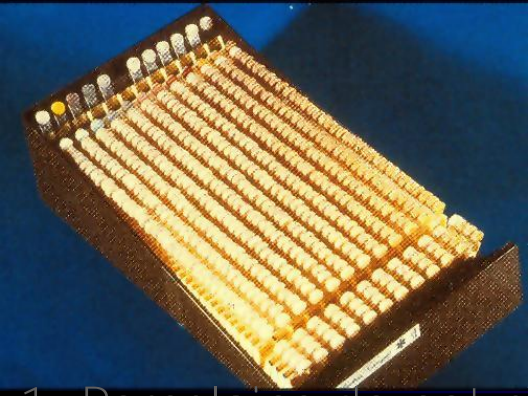




Clark 1933
703 Colors

Shade selection guides 1/2

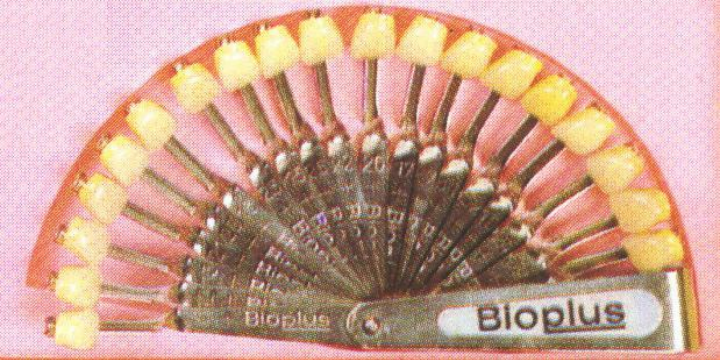
1. Porcelains do not match the shade guides that they are being compared to
2. Shade variations occur between different die lots of porcelain from the same manufacturer and between shade guides ($\Delta E^* = 2$)
3. Shade guide tabs are 4-5 mm thick compared to the thin 1.5 mm piece of porcelain used for the restoration
4. Shade guides are not always made with fluorescent porcelain, which causes inconsistencies in color matching



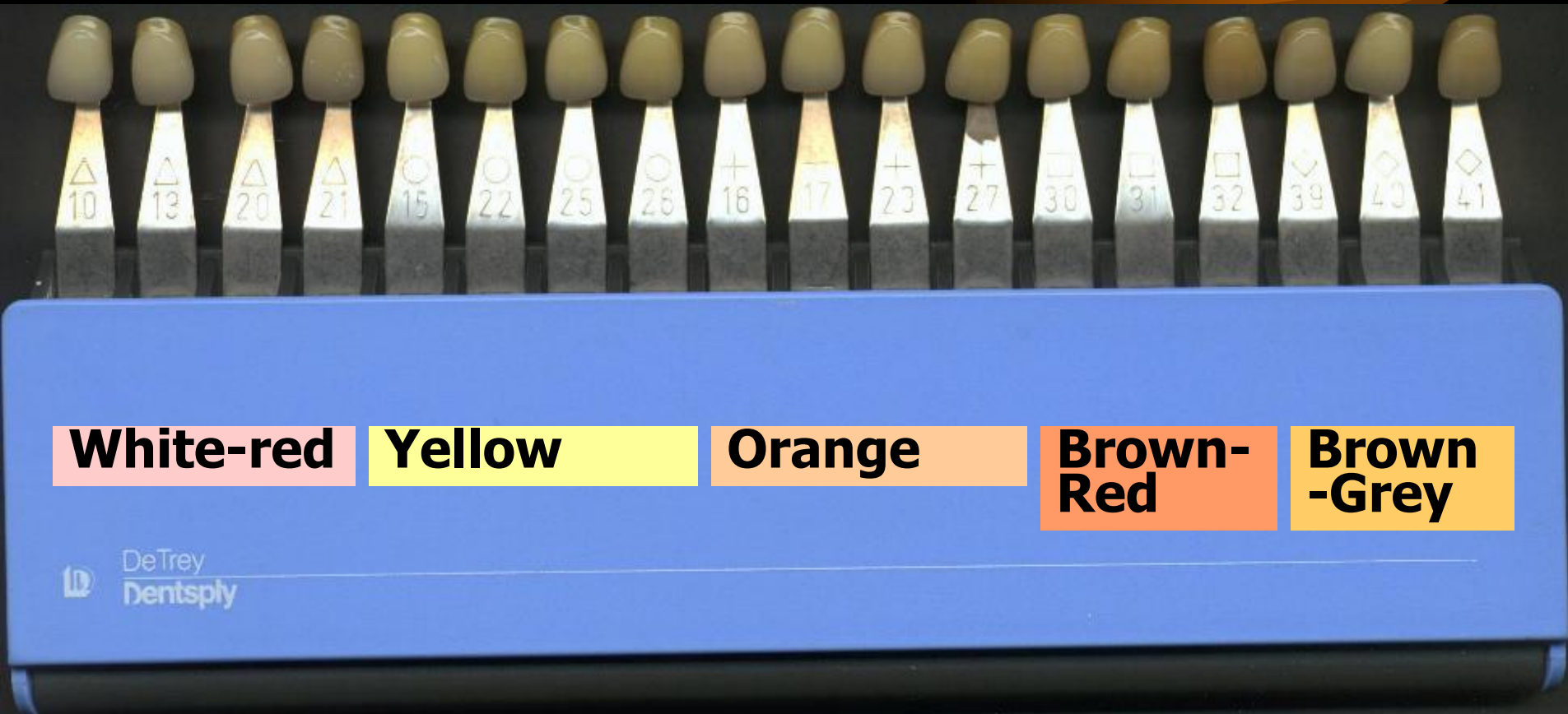
Clark 1933
703 Colors

Shade selection guides 2/2

1. Porcelains do not match the shade guides that they are being compared to
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3. Shade guide tabs are 4-5 mm thick compared to the thin 1.5 mm piece of porcelain used for the restoration
4. Shade guides are not always made with fluorescent porcelain, which causes inconsistencies in color matching
5. It is difficult to predict the final shade after the layering of opaque, dentin and enamel
6. Guide tabs lack a metal backing when using porcelain-fused to-metal restorations
7. Shade tabs are condensed differently than porcelain used for final restorations



Bioform -> Biotone -> Trubyte
Bioblend -> Portrait IPN



White-red

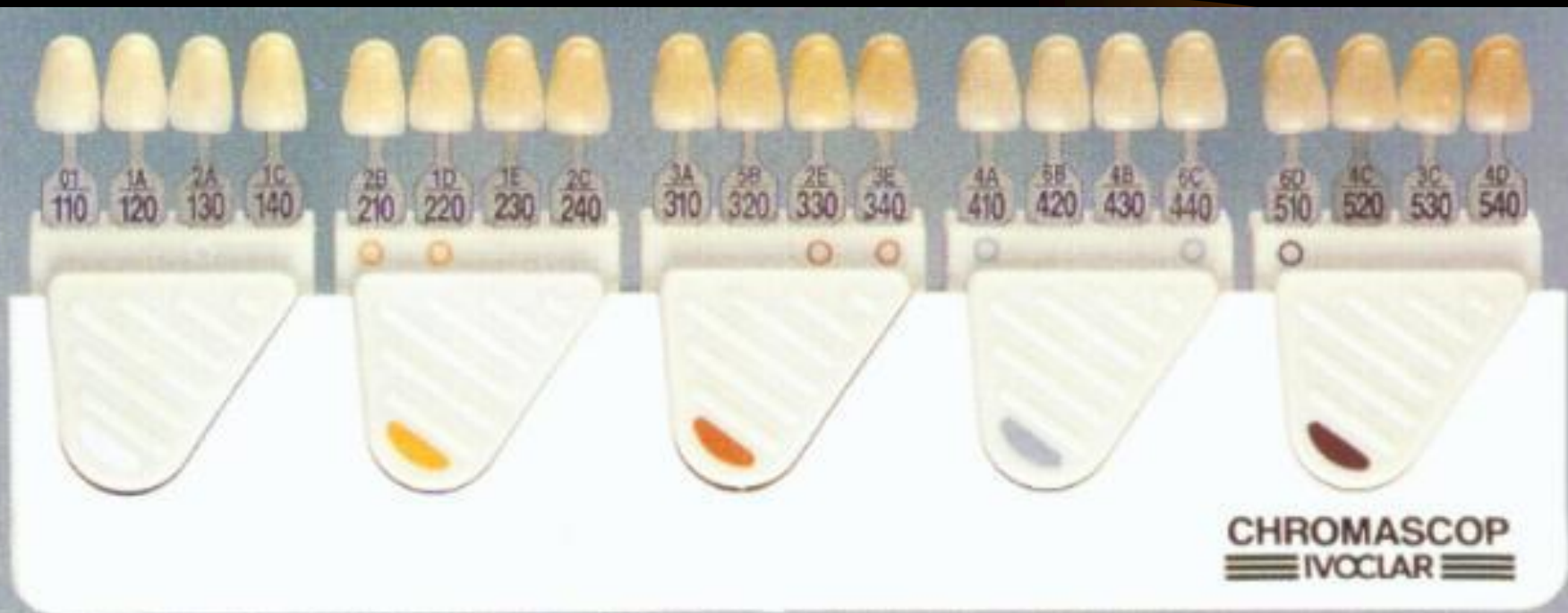
Yellow

Orange

Brown-Red

Brown-Grey

DeTrey
Dentsply



1990; Vivadent -> Kerascop

Reddish-
brown

Reddish-
Yellow

Grey
shades

Reddish
-Grey

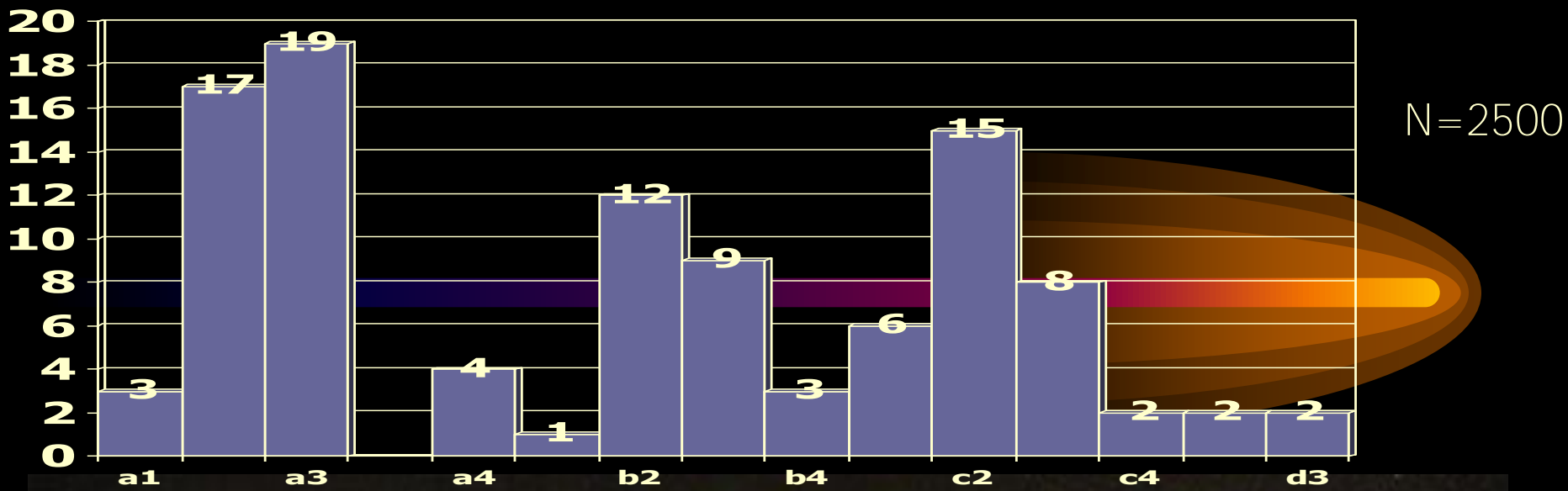


+/- neck?

Changed in the mid-seventies

A3.5 & D4 added in 1980

B1 & D1 sometimes excluded



B1
Nur für Keramik
Ceramics only
Céramique seulement
Solamente cerámica

Lumin-VACUUM

VITAPAN
Zahn-Teeth-Dent
K. B.

Reddish-brown

Reddish-Yellow

Grey shades

Reddish-Grey



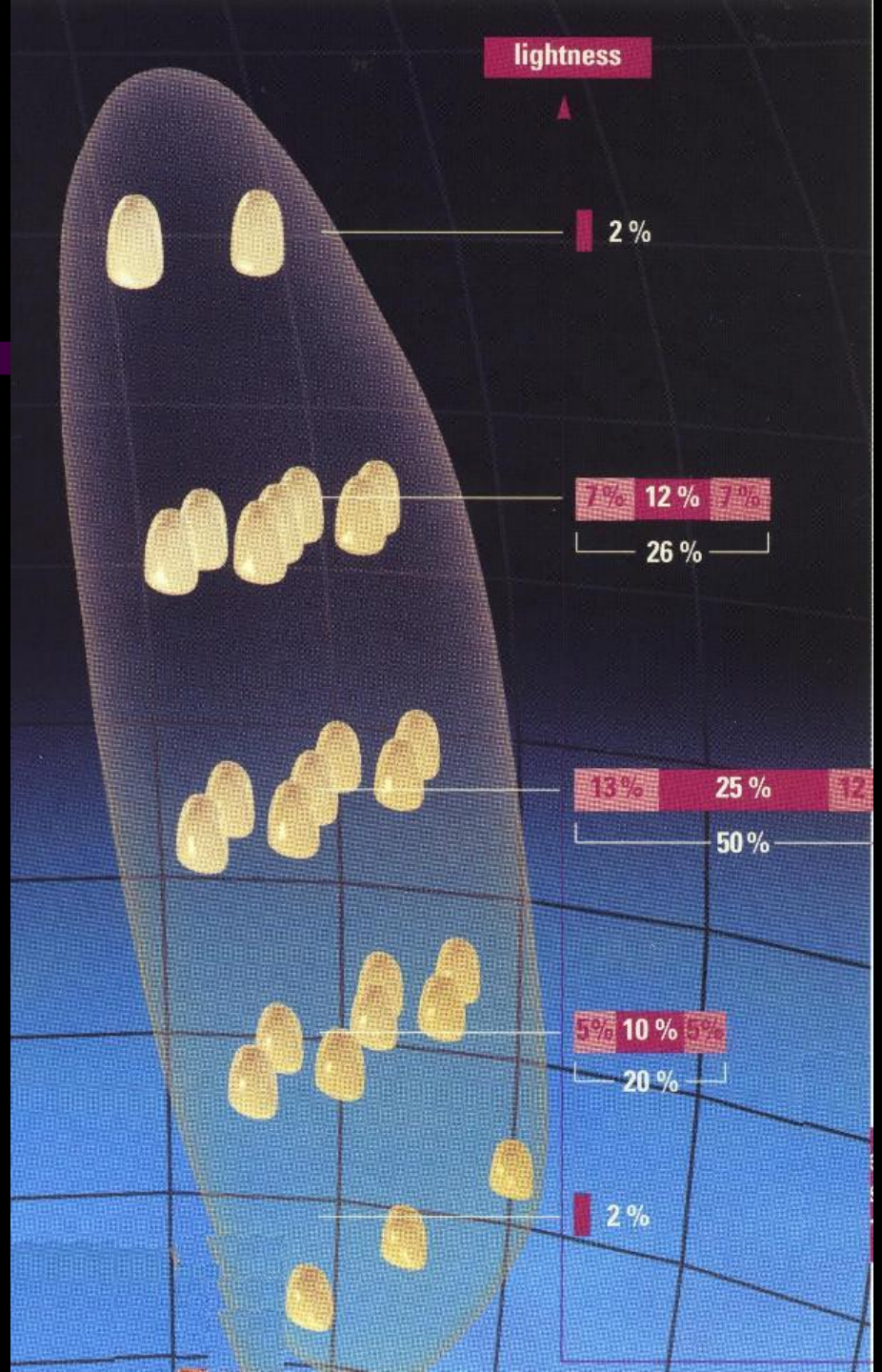
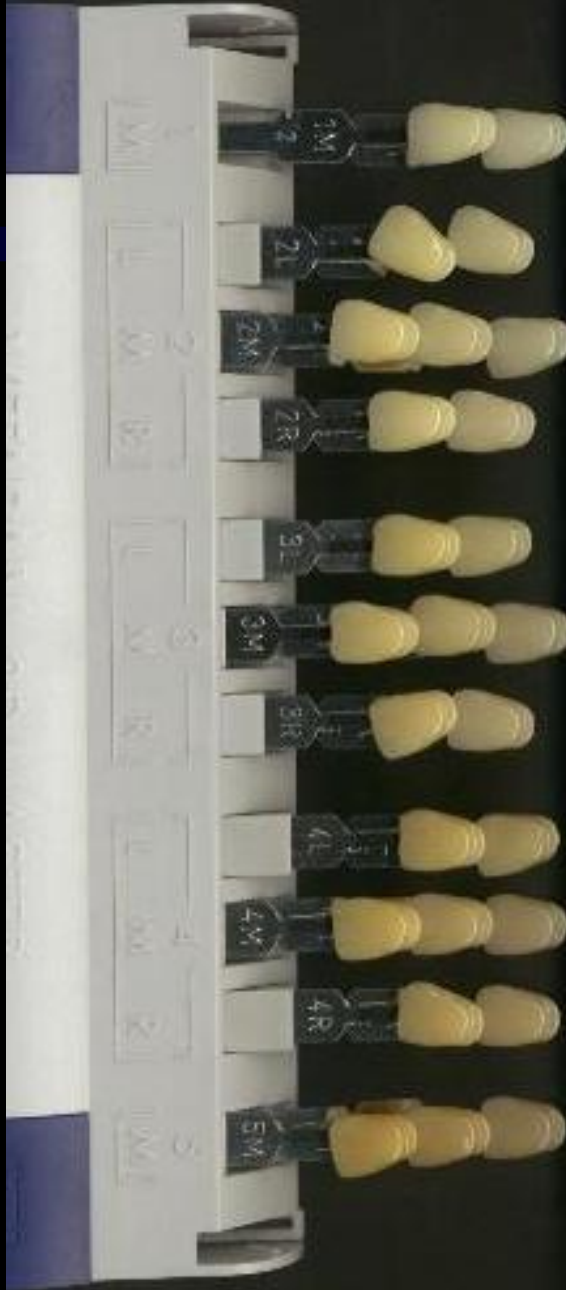
VITA
3D-
MASTER

With

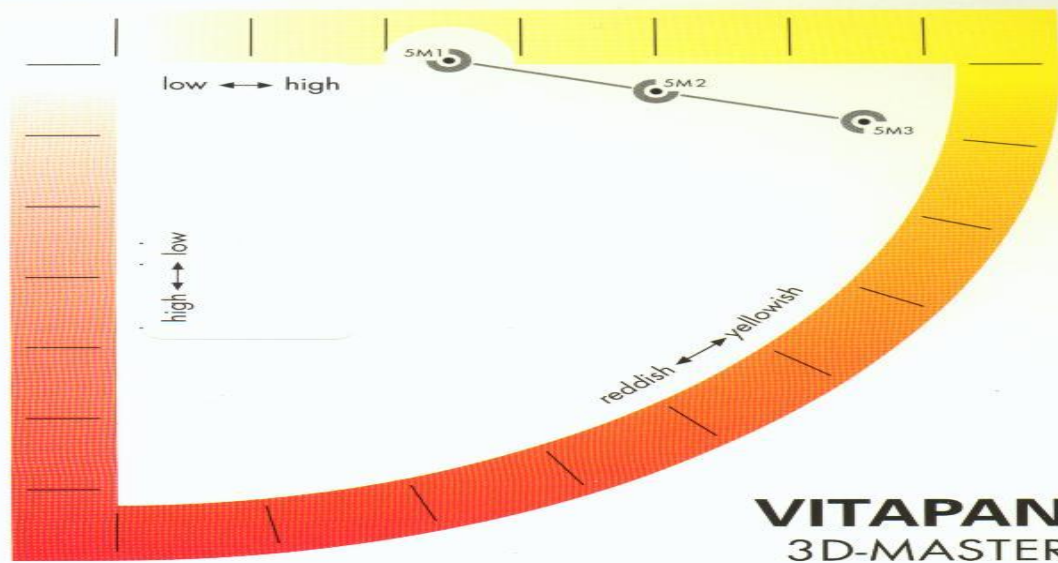
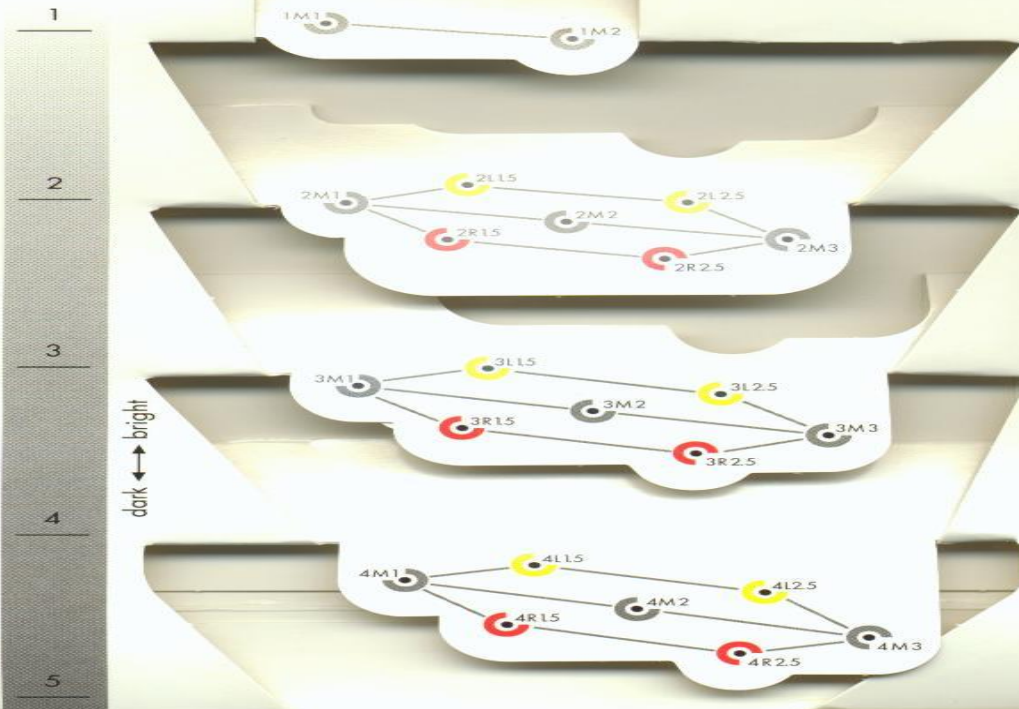
&

Without
neck
Colors

Hue
Chroma
Value

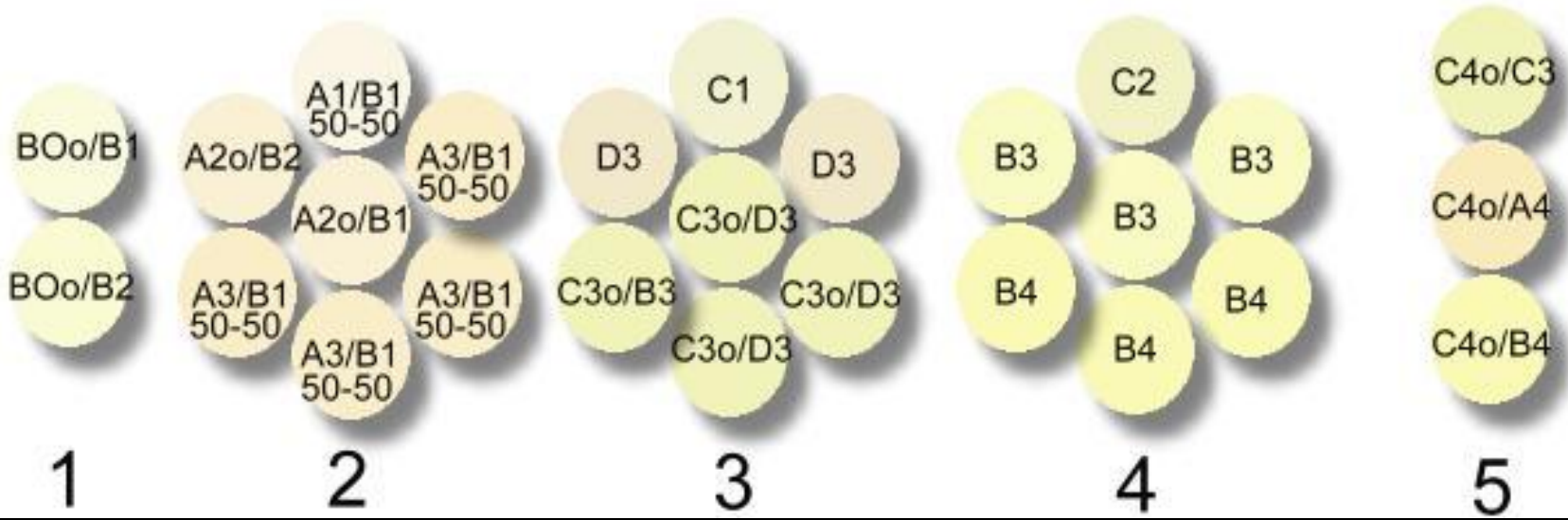


VITA



VITAPAN 3D-MASTER

A1 A2 A3 A4 B1 B2 B3 B4 C1 C2 C3 C4 D2 D3 D4



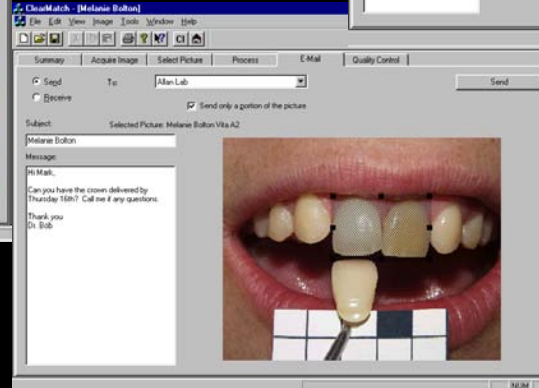
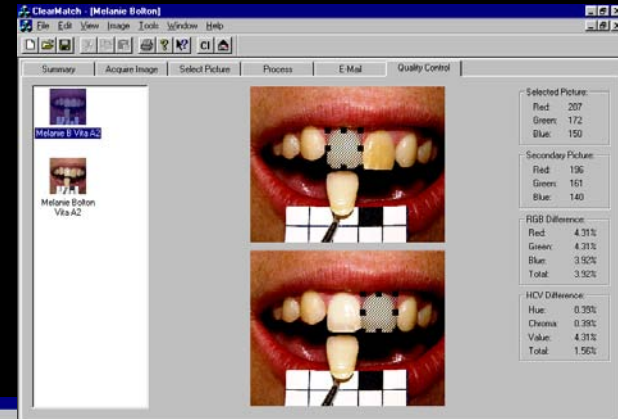
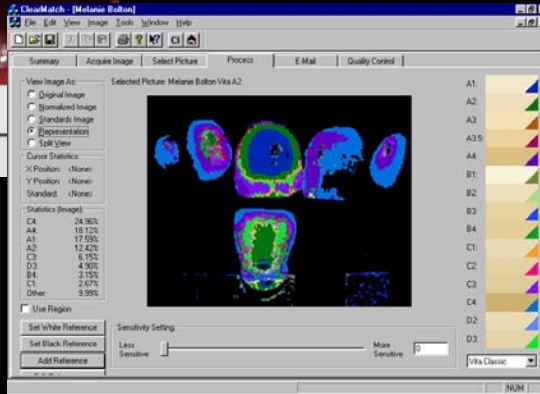
Shade Matching

Digital
Analogue



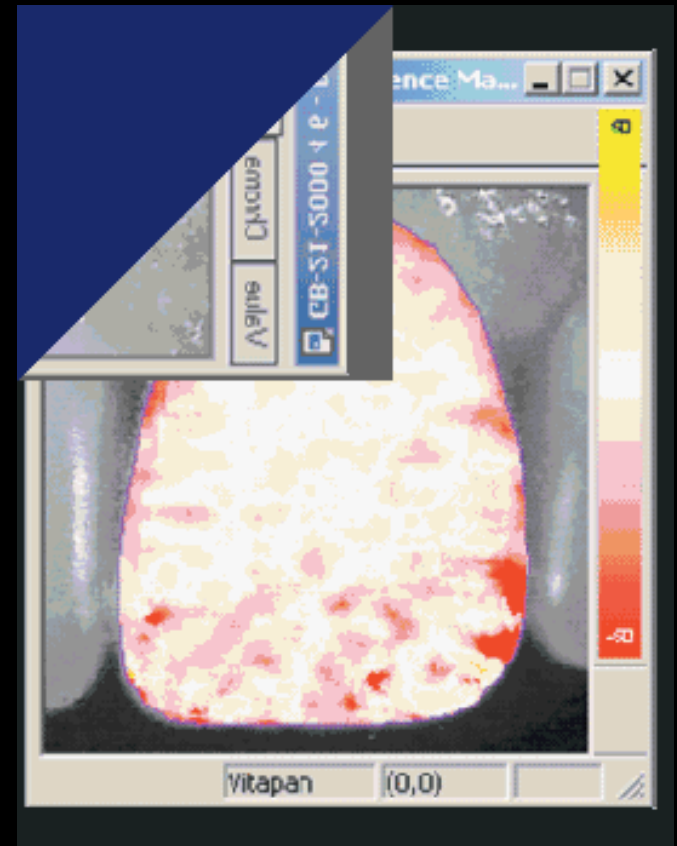
Digital Shade Matching Systems

Alternative 1. Objectively match shades from natural dentition with standard shade guides and incisal shades. Record with a digital or video camera and analyse or send to technician



Digital Shade Matching Systems

Alternative 2. A hand held optic device with dual light source connected through fiber optics to a spectrophotometer



Digital Shade Systems

- 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



Cosmetic Imaging Systems

1. **Vipersoft 3.1**
Integra Medical
2. **Digital Dentist**
Digident
3. **Image FX 4.0**
SciCan
4. **Smile-Vision Cosmetic Imaging System**
Smile-Vision

Realistic white shades for special cosmetic needs




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

Only SYNERGY® offers these different bright white shades, selected by dentists.


- Super White N (Neutral)
- Super White O (Opalescent)
- Super White P (Pearl)

With SYNERGY® Super White shades, tooth whitening can be accomplished with one-off covers or laboratory produced veneers.

Let SYNERGY® Super White assist you with your cosmetic needs.



Before veneer



After SYNERGY® Super White veneer

Digital Shade Systems -Problems

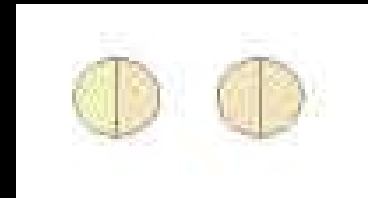
Prize

Systems may be subject to external variables

- Filters and bulbs breakdown
 - Heat
 - Length of time in use
- Algorithms
 - Attempt to fill in the gaps
- Single light source
 - Can create reflection and glare spots

Analogue Shade Matching Systems

A handheld optic device viewed in split image with a light source projected through variable filters



Fixed Prosthetic Dentistry- shade selection



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

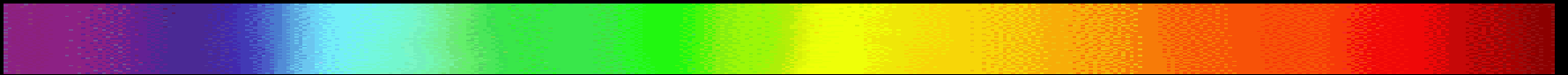


... right environment

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 operator 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
- 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 a good for selecting shade as they have the highest chroma of the dominate 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

Communication with lab



Communication is often
impaired because
handwritten Rx's are often
poorly specified

Communication with lab

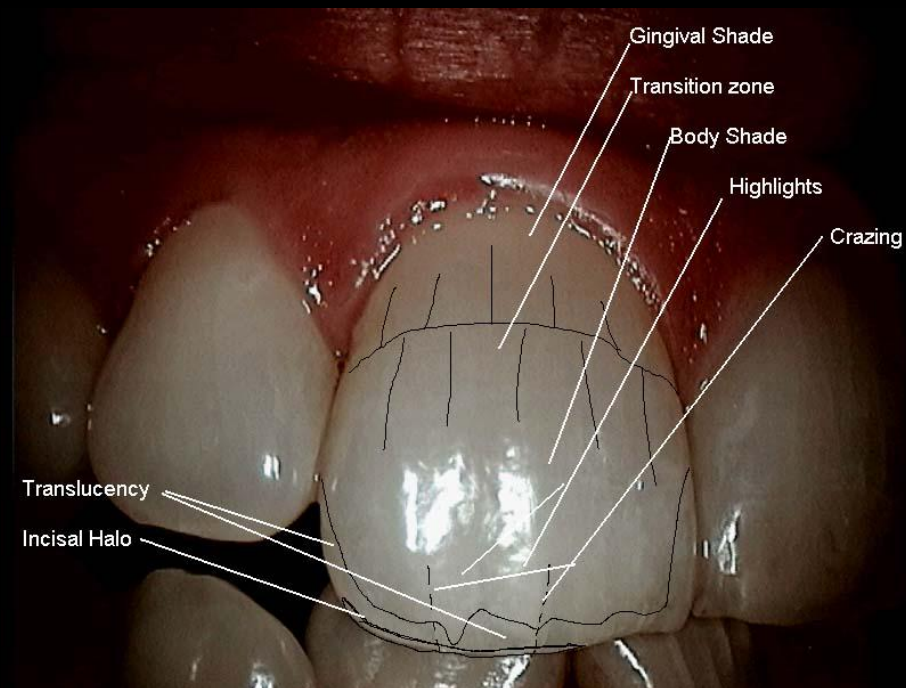
- Color characteristics:
 - conventional thirds,
 - no apparent thirds,
 - only the cervical or central 1/3 differ
- Translucency:
 - Diffuse translucency over the whole surface
 - incisally
 - translucent both incisally and proximally

Communication with lab

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



Topics covered



1. Discolored teeth - etiology
2. Materials
 - Esthetic Restorative Materials
 - Shade guides characteristics
3. Shade matching
 - Digital systems
 - Procedure for matching & communication



*Thank you
for your
kind
attention*