Meng Dentistry

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Achieving Maximum Esthetic Results through Proper Laboratory Communication

The value of the team approach to achieving predictable and successful results with implant restorations, particularly in the esthetic zone is well recognized. One of the often overlooked members of the dental team is the dental laboratory technician. The product of the dental laboratory is only as good as a well designed and communicated esthetic plan. Anterior esthetic restorations are often the least profitable prosthetic procedure, even when all the steps go smoothly. An error causing a return to the dental laboratory further reduces this productivity.

Keys to communicating the esthetic plan include:

- Transitional restorations that fit the esthetic plan
- Records and guides to communicate all critical aspects of the case
- Color corrected photographs in Power Point to explain all aspects of commonly accepted esthetic principles to include: tooth position and proportion, tissue level, arrangement, shape and texture, contour, and color

In order to communicate these principles, a brief discussion of commonly accepted esthetic principles is appropriate. Numerous articles have been written, particularly in orthodontic and prosthodontic literature describing esthetic principles in the esthetic zone[1].

A common technique, as described by Spear and others, includes first determining resting lip position. (Figure 1) is is the amount of tooth display of the central incisors with the mouth open and the lips at rest. This generally varies from 1 to 3 mm depending on age, sex, and lip mobility. Once this is established the other parameters can systematically be determined starting with dental midline, tooth position, tooth proportion, tissue level, arrangement, shape and color. As described by Kokich[2], the dental midline can vary by 3 to 4 mm and still appear clinically acceptable to lay people if the long axis of the teeth is parallel to the long axis of the face. Figure 2 shows a 2mm midline shift to the right that would still meet acceptability. When evaluating tooth position, positioning the labial surface of central incisors perpendicular to the posterior maxillary occlusal plane, will result in light reflecting the surface characteristics in a pleasing fashion. (Figure 3)

The proportion of teeth has been defined in many forms, such as the Golden proportion, but this is found to be accurate for the natural dentition only eighteen percent of the time[3]. More recent descriptions by Steven Chu[4] and others, based on measurements of the natural dentition of many ethnic groups, more accurately describe a proportion common to all these groups. If the central incisor width is (X) mm, the lateral incisor width is X-2mm and canine width is X-1 mm. The width to height ration is approximately eighty percent.

This proportion then gives a logical position for the tissue level by measuring up from the predetermined incisal edge[5].The arrangement of the teeth then must appropriately fill the available space. Small space deficiencies can be managed with minor rotations, but larger deficiencies or space excess may require consideration of additional restorative dentistry, orthodontics or both. Also described by Kokich[6], deviations from the normal are still often acceptable to the lay person as long as the deviations are symmetrical. Figure 3 also shows a lower tissue level (and width/height ratio) that would still be considered acceptable.

If one's dental laboratory is made aware of these esthetic parameters, they will more consistently value the information provided them. Addressing all of the above esthetic issues, even in single tooth situations, is still very valuable, as some additional restorative dentistry or minor bonding procedures will frequently yield a more acceptable end result. When patients are provided the same information prior to treatment, they will usually make better choices about their treatment plan than if esthetic problems are encountered in the transitional fabrication phase. Figures 4 and 5 demonstrate the value of additional restorative dentistry than if only the tissue level single implant crown on tooth #8 were restored. Using an Etkon milled zirconium core on #8 and Etkon zirconium based crown on #9 provided nice harmony with veneers on #'s 7 and 10. Increased incisal length would not have been possible with a single tooth restoration.

The next important step is capturing the

Figure 1. *The resting lip is important to help determine the other esthetic parameters.*

Figure 2. *A midline shift is often non-discernable when parallel to the facial plane.*

Figure 3. *A disproportional tissue level is frequently acceptable when it is symmertical*

Figures 4, 5 *Additional restorative dentistry more appropriately addresses esthetic demands than if only the tissue level single implant crown on tooth #8 was restored.*

Figure 6. *When replacing multiple missing teeth, denture teeth will frequently simplify the diagnostic wax up.*

Figure 7 *A putty index of the transitional model will verify incisal edge positions of the final restorations.*

Figure 8 *The tissue mask on the working model allows the technicial to duplicate subgingival contours and margins of a potential coping*

Figure 8 *The additional polyvinyl index of the transitional an also be used to form a custom impression coping and fabrication of wax-up for cad-cam scanning and production of a custom milled core*

above goals in the diagnostic wax up. Whether the laboratory technician or the restorative dentist performs the procedure, a PowerPoint with photographs of the close up smile of front and lateral views and full face photographs are helpful to know how the teeth fit with the lips and face. Figure 6 demonstrates that replacement of multiple missing maxillary bicuspids, canines and lateral incisors utilizing denture teeth frequently simplifies the laboratory procedure, as contouring of the dentiform and/or wax addition can be performed to achieve ideal contours. Verification of occlusal compatibility in all excursive movements is essential on the articulated casts. Using a copy of this model for the surgical stent, the surgeon is also committed to a well designed plan that he can verify using appropriate scans.

The clinical achievement of ideal transitional restorations in both the supragingival and subgingival areas is essential to give the laboratory a working blueprint for the final restoration. Supragingival contours are captured with a solid model (Figure 7) and photographs. A putty index of the model will verify incisal edge position of the final restorations. Subgingival contours are often communicated using two indices. Figure 8, using a tissue mask in the peri-implant tissue area of the model, allows for duplication of this critical contour.

A separate guide fabricated chairside (figures 9,10) by placing a laboratory analog on the temporary and inserting it into a polyvinyl bite putty gives the laboratory technician an easy guide to wax up for either a cast subgingival component or for scanning to incorporate a milled metal or zirconium understructure, such as when utilizing the Etkon System. The separate analog can also be utilized to customize the impression coping, so the final working model with the tissue mask exactly mimics the tissue height and contour. Hence, the wax up will place the margin in an appropriate position. Improper margin placement of the coping would

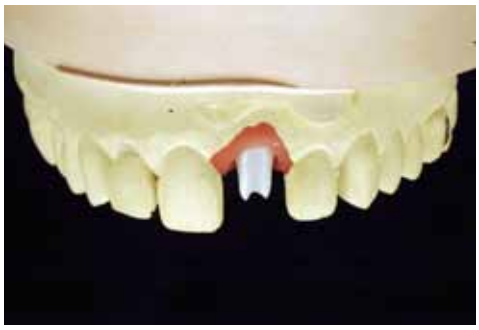

Figure 13 *The custom incisal guide table assures duplication of established lingual contours and incisal guidance.*

Figure 14 *Perpendicular and off angle photographs help the technicition interpret surface texture and luster.*

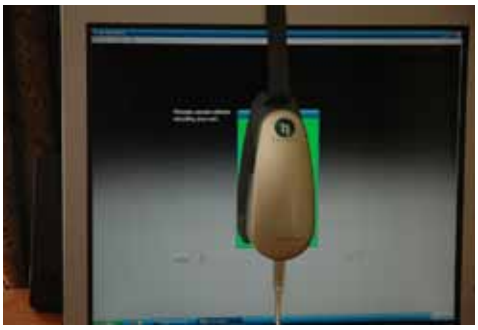

Figure 15 *Calibrating both the labratory and clician's monitors with a spectrometer is critical for all subsequent color correction.*

Figure 16, 17 *Color and brightness are corrected using a batch file in Adobe Photoshop.*

Figure 18 *The laboratory technician has used the index to make a slight alteration of buccal countour of the final restoration.*

result in either a cement margin being too deep, or, as in the case of zirconium, if placed too shallow or over contoured, a weakened core from grinding (Figure 12).

A mounted solid model of the transitional restoration provides a guide for lingual contours and occlusal form utilizing a custom incisal guide table. This is simple to fabricate on the articulator by moving the articulator pin through all of the excursive movements in Triad putty (Figure 13).

The next step is to provide photographs of all the critical views of the transitional restorations. Frontal and lateral views of the close up smile in addition to a full face frontal photograph will help detect subtle contour discrepancies that can be corrected in the final restorations. Perpendicular and off angle photographs help the technician interpret surface texture and luster, Figure 14.

Essential to this step, and one that made the biggest difference in this author's laboratory experience, is color correction of the digital photographs and color accurate viewing. The first step is color correction of the computer monitor of both the dentist and the dental laboratory. The videos cards powering monitors vary for each manufacturer. This is comparable to seeing a different color and intensity on TV screens, as one would see in a TV store. Using a color spectrometer, such as Eye-1 by Greytag McBeth, monitors are calibrated so no matter where viewed, the colors and brightness will be nearly the same (Figure 15).

The next step is calibrating the information from the camera as interpreted by the computer. The majority of cameras shoot in an RGB formats. These formats are narrower than the true visible light spectrum. Each camera's computer will vary in how the sensors interpret the color out of the range of the RGB spectrum. By shooting photographs of the shade tab in the clinical situation against a neutral grey card, the color can be standardized using a color aware program, such as Adobe Photoshop, to produce a color accurate image for the dental laboratory (Figures 16, 17). Once the color information from the camera has been standardized, the information is stored in a batch file in Adobe Photoshop. The clinical photographs from the day or week can be easily corrected (with a few mouse clicks) from this initial calibration process to convert the images for the dental labratory.

Many variables can affect the quality of the image, such as ambient light, battery power, subject distance, etc., but when the photographs are recorded in the dental operatory, these variations are tolerable for the accuracy of this process. The details of the above color correction process are too complex to cover in an article of this length, but taking courses but taking courses in digital photography and using dental educational DVDs[7 8 9 10] on color management will make this a valuable investment in practice improvement. Other techniques are slightly more sensitive, but would require color correcting each individual image and/or manually capturing each image[11]. Commercial computerized color matching processes are available that studies have shown increased accuracy in selecting base shade[12] . Digital images are still key to allowing the technician to use one's artistic ability in matching the nuances of shade and translucency. As always, if the laboratory is good at one process or technique, use the one in which they are the most proficient.

Another useful aid that may be preferred by the laboratory is printed color corrected photographs that can be very helpful for critical anterior incisor regions. This also requires calibration of the printer and an additional time commitment to get each case ready for the labratory.

The last important step is putting all the images into a PowerPoint presentation. In the process of making the PowerPoint presentation and reviewing the photographs, the dentist will frequently see minor contour

discrepancies in the transitional restorations that can be pointed out to the laboratory for improvement of the final restoration. Specific explanations on how to use the indexes and guides avoid any of these carefully recorded steps being overlooked. Figure 18 demonstrates the similarity of the transitional and final restoration, with a minor requested alteration in buccal contour, after the author evaluated the transitional photographs.

Figures 19-25 show the results of close duplication of transitional restorations and guides in this complex case. This 19 year old female was congenitally missing permanent maxillary laterals, canines, and first and second bicuspids bilaterally. Orthodontics retained a primary molar tooth size in the second bicuspid site. The case is restored using tissue level implants and treated with single cementable restorations in the primary molar and first bicuspid sites and a cantilever from the canines to restore the lateral incisors. Guides provided or fabricated by the laboratory included separate tissue analogues, gingival mask in the solid model, a putty matrix of the transitional model verifying incisal length, and photos of transitional restorations. Detailed explanations in the PowerPoint are key to following all of the guides. After lengthy verification of fit, contours, shade, etc., adjustment of one contact was all that was required to seat this case.







Figures 12-25 *In this complex case the laboratory closely followed provided indexes and guides to produce a final result requiring minimal alterations and adjustments*

Most of the above techniques are quite simple to implement into one's daily routine. Color correction is more of a commitment to the digital process. In today's economic world, there is no better time to make these commitments and elevate your practice's level of care.

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