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A Painting Technique Using Ceramic Pigments for the Artificial Iris of an Ocular Prosthesis Guided by Applying Newton's Color Wheel

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Keywords
Esthetics; Newton's color; ocular prostheses.

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The authors deny any conflicts of interest related to this study.

Accepted March 27, 2018

doi: 10.1111/jopr.12919

Abstract

This article describes a simple method for painting an artificial iris for the manufacturing of an ocular prosthesis with dark and light tones, both with excellent esthetic results. The challenge of choosing colors around the pupil and medium zone during painting is aided by the application of Newton's color wheel theory. This technique provides a safer choice of color during the painting procedure by using a mixture of ceramic pigments.

An ocular prosthesis is an alloplastic rehabilitation procedure whose main goal is to rescue the identity of a human being and his return to society.[1-3] Painting the artificial iris is the most delicate step, and requires a proper method and rigorous discipline for satisfactory results. The observation of the distribution of pigment layers of the human iris and the knowledge of Newton's color theory and its application are fundamental to achieve esthetic and facial harmony in painting the artificial iris.[4,5] The technique for the application of Newton's color theory is based on the mixture of complementary colors in uneven parts for the perfect visualization of the artificial iris, similar to a heairis, similar to a healthy eye in color and naturalness.

Many authors have suggested various painting techniques for the artificial iris, with the use of watercolor, gouache, oil, automotive or acrylic paint over card paper discs, and/or pure pigments in a monomer and polymer medium over acetate discs or prefabricated ocular buttons.[6-10] Previous studies have reported that pure pigments and those with a base of metal oxides appear to be more appropriate for obtaining ocular prostheses of superior quality.[6] The method proposed here is an alternative to the painting of the artificial iris button using an in-depth understanding of Newton's color theory, a color triangle, and ceramic pigments dissolved in monomer/polymer syrup. The method used is simple and low cost, permitting quick drying and providing excellent esthetic results.

Technique

1. From primary colors such as yellow, blue, and red, it is possible to obtain secondary, tertiary, or intermediate as well as complementary colors. The mixture of a primary color with a secondary one generates a tertiary color. Tertiary colors are called intermediate colors because they are located between a primary and a secondary color on a color wheel. In the color clock wheel, the colors of even numbers are the primary and secondary ones, while the

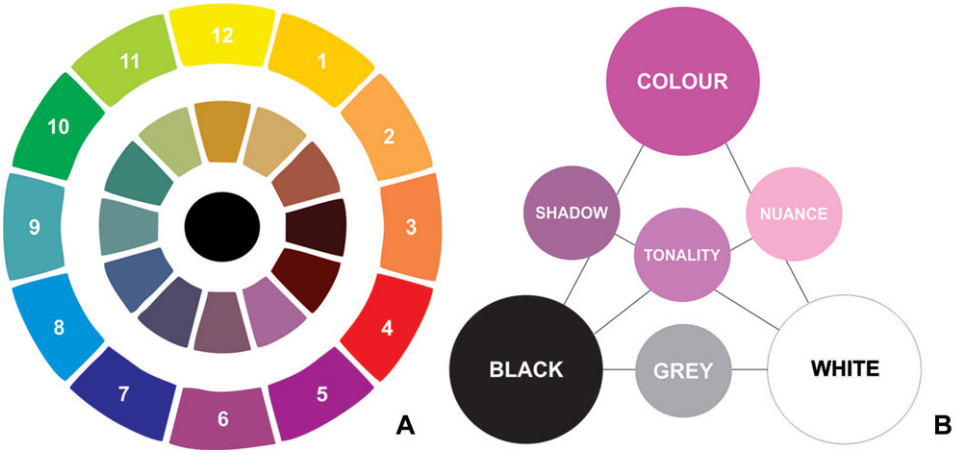

Figure 1 (A) Newton's color wheel and (B) color triangle.

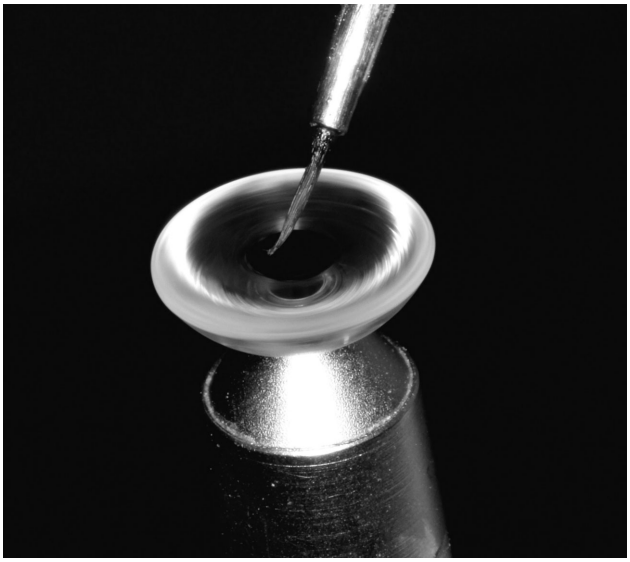

Figure 2 Painting of pupil at the base of the ocular button.

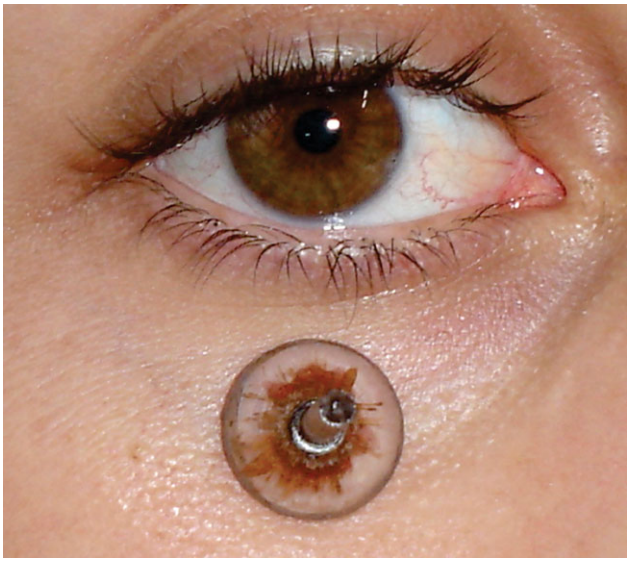

Figure 3 Location of the painting around the pupil.

colors of odd numbers are the tertiary ones. Complementary colors are those in diametrically opposite positions in the color wheel (Fig 1A).

2. Complementary colors mixed in equal proportions result in black or dark gray located in the center of the inner circle. Using the color triangle, it can be noted that white and black complement the spectrum (Fig 1B). White makes the colors brighter and black diminishes the luminosity of the color. White and black are extreme points of any color scale. The mixture of black and white or the mixture of equal parts of complementary colors can result in gray.
3. The mixture of complementary colors in uneven proportions will be located in the inner circle of Newton's color wheel which, according to our theory, corresponds to the colors of the human iris located around the pupil and medium zone (Fig 1A). Black will always be a part of the mixtures for the painting of the iris, since black removes the transparency of the color. The inner circle of the color wheel represents darker colors.
4. The inverted painting of the artificial iris is done over the base (flat surface) of a colorless ocular button of acrylic resin (Ocular cap with pin; Artigos Odontológicos Clássico, Campo Limpo Paulista, Brazil). The base of the selected ocular button can be slightly sanded to promote better adherence of color pigments. Select an ocular button with a reduction of 0.5 mm for the iris painting as the ideal diameter, considering the future effect of magnifying lenses.
5. In the patient's presence, paint the artificial iris. Use thin and delicate brushes (Pêlo de Marta no. 2/0 or 00; Tigre, Joinville, Brazil). Paint with ceramic pigments (Corantes minerais; Triart Produtos, São Paulo, Brazil) and a mixture of colorless monomers and polymers (Thermo

Polymerizing Acrylic - Slow - for denture base; Artigos Odontológicos Clássico), which serve as a means to dissolve the pigments. The syrup consists of a mixture of monomers and polymers corresponding to 10 parts of a thermopolymerizable monomer to one part of thermopolymerizable polymers. The mixture of monomers and polymers (manufactured syrup) must be placed in a glass bottle in a water bath to conserve its constant proportions. Once the mixture, initially whitish, becomes colorless, and with a viscosity similar to that of olive oil or denser, it is then ideal for use. Next, the solution must be taken from the water bath, placed in an amber jar, and protected from light.

6. Start the painting process with the pupil. Initially the ocular button is assembled on a low rotation motor (Micro Motor Lb 2000; Beltec, Belton, TX). Turning the motor slowly, with the help of a thin brush, dispense one drop of the pure black pigment (Corante Preto; Triart Produtos) previously mixed with the syrup of monomers/polymers on the center of the base exactly where the ocular button pin is visualized by transparency. The paint must be spread forming a small black circle, giving a foundation to the painted pupil (Fig 2). The pupil should be of the approximate size of the pupil of the remaining eye.
7. The reference zones of the human iris to be pigmented are: (1) from the center to the periphery where the black pupil is found; (2) around the pupil, which varies in color in different individuals and has radial streaks that should be reproduced in the painting of the iris (Fig 3); (3) at the periphery there is the external zone, or halo. The external zone is usually characterized by the darkening of the medium zone and is obtained from the mixture of black and the basic color of the iris, or the color of the medium zone (Fig 4). The medium zone has radial streaks, dots, and stains that should be equally reproduced in the painting of the iris. The basic color of the eye is characterized in the medium zone, and can be brown, green, blue, or an adjacent color to be chosen in the painting around the pupil, located in Newton's color wheel (Fig 5). Thus, when an iris is painted, it should reproduce the colors and the elements around the pupil, medium zone, and halo, or external zone.
8. Next, paint the zone around the pupil in the shape of thin traces from the center back or vice versa, in an irradiated fashion (Fig 3). It is recommended to add black to the mixture of colors used in order to remove transparency of the iris color in all painting stages.
9. Finally, the external halo is painted. This halo may or may not exist; if present, it might be either darker or lighter than the base color. Painting is usually carried out with blue or gray or may also consist of darkening the base color chosen for painting the medium zone (Fig 4).
10. The medium zone should be the last layer to be painted (Fig 5). The ceramic color suspension with syrup promotes sealing of the ocular button, since both are dental acrylic resin compounds. The ocular button is included in a metal flask using plaster (Durone IV; Dentsply Sirona, York, PA) and attached to the scleral acrylic resin by thermopolymerizing to manufacture the ocular prosthesis. The esthetic aspect of the artificial iris of the ocular prosthesis is visualized by the transparency of the ocular button (Fig 6).

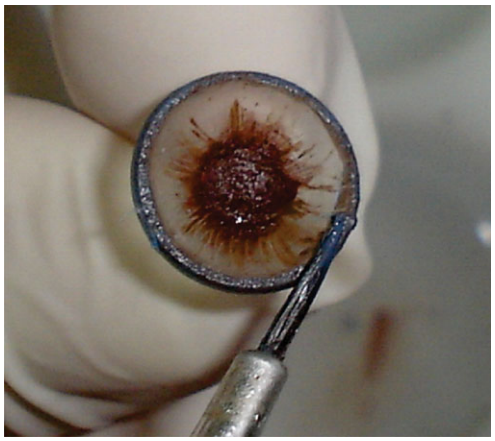

Figure 4 Location of the painting of the external zone.

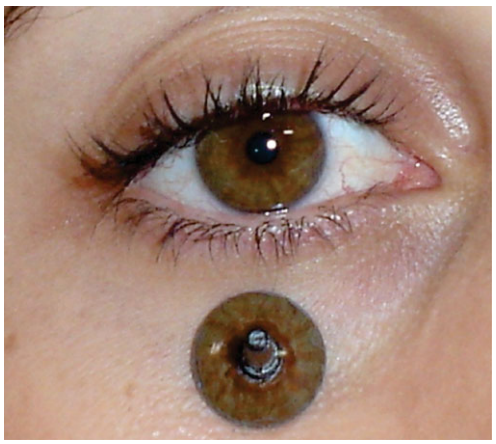

Figure 5 Human iris and base of the painted ocular button.

Figure 6 Final esthetic aspect of the artificial iris on the ocular button.

Discussion

This article details an alternative technique for the painting of the artificial iris button using ceramic pigments dissolved in a syrup of monomers/polymers, and provides instructions for painting based on the application of the theory of Newton's color wheel and color triangle. One of the critical steps in the painting of the artificial iris is the adequate reproduction of the colors of the human iris.[4,6] The orientation of applicability of complementary colors in Newton's color wheel in the painting of the artificial iris permits a better visualization of the scope of the tones of color of the remaining iris. One of the interesting points in painting with ceramic pigments directly over the colorless acrylic base is the use of black on several hues employed in the procedure to avoid transparency of the iris color. Also, the quick drying of acrylic paint permits the almost immediate removal of part of the already dry paint. Additionally, repainting, which provides an artistic effect regarding the reproduction of streaks and stains, is an excellent positive side of the technique. It is important to study Newton's wheel color theory in depth, as well as the color triangle, to develop a color chart for easier painting of the colors around the eye pupil and medium zone.

Painting with ceramic pigments dissolved in syrup permits better adhesion to the acrylic surface, with the consequent maintenance of coloring obtained in the artificial iris. It is also known that inorganic pigments generally contain molecules that are more stable in their ion bonds and tend to change less compared to organic pigments.[9,11] In the technique presented here, both the acrylic resin of the ocular button and the acrylic resin of the sclera as well as the final colorless layer seem not to degrade the painting after thermal polymerization of the acrylic resin. More studies are necessary to evaluate the final color stability and the aging of the eye prosthesis manufactured by the painting technique presented in this article.

Summary

Painting the iris is a meticulous task that requires attention, patience, and a bit of ability. The application of color theory to the painting of the iris represents, in a very simple fashion, the development of Newton's wheel color technique. The painting of the artificial iris over the ocular button using this understanding helps the visualization of how the paints relate to each other and contributes to a safe color choice during painting. The use of ceramic pigments dissolved in syrup is an easy and low-cost method for the painting of the artificial iris, providing excellent esthetic results regardless of the hue of the patient's natural iris color.

Acknowledgments

The authors thank Dr. Renato Ferreira for helping with the ocular prosthesis photographs used in this study. Mrs. E. Greene provided English editing of the manuscript.

References

1. Goiato MC, Santos DM, Bannwart LC, et al: Psychosocial impact on anophthalmic patients wearing ocular prosthesis. Int J Oral Maxillofac Surg 2013;42:113-119
2. Beumer III J, Marunick MT, Esposito SJ: Maxillofacial Rehabilitation: Prosthodontic and Surgical Management of Cancer-Related, Acquired, and Congenital Defects of the Head and Neck (ed 3). Wiley, São Paulo, Quintessence, 2011, pp. 255-314
3. Cain JR: Custom ocular prosthesis. J Prosthet Dent 1982;48:690-694
4. Melgosa M, Rivas MJ, Mez LG, et al: Towards a colorimetric characterization of the human iris. Ophtal Physiol Opt 2000;20:252-260
5. Celani A, Salemme MA, Stroppiana L: The experience of the knowledge in Newton's and Goethe's works. Med Secoli 1989;1:185-197
6. ERPF SF: Comparative features of plastic and/or glass in artificial eye construction. AMA Arch Ophthalmol 1953;50:737-744
7. Moreno A, Goiato MC, Oliveira KF, et al: Color stability of the artificial iris button in an ocular prosthesis before and after acrylic resin polymerization. Cont Lens Anterior Eye 2015;38:414-418
8. Reitemeier B, Notni G, Heinze M, et al: Optical modeling of extraoral defects. J Prosthet Dent 2004;91:80-84
9. Goiato MC, Fernandes AÚ, dos Santos DM, et al: Alteration of blue pigment in artificial iris in ocular prosthesis: effect of paint, drying method and artificial aging. Cont Lens Anterior Eye 2011;34:22-25
10. Guttal SS, Joshi SM, Pillai LK, et al: Ocular prosthesis for a geriatric patient with customised iris: a report of two cases. Gerodontology 2011;28:152-156.
11. dos Santos DM, Goiato MC, Moreno A, et al: Influence of pigments and opacifiers on color stability of an artificially aged facial silicone. J Prosthodont 2011;20:205-208