Historical evolution of aesthetic dentistry as a science and practice

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Abstract: The paper studies aesthetic dentistry as an independent field with its own history of development, theoretical basis, also presents the stages of development of aesthetic dentistry in historical aspect, describes odontological parameters, history of teeth whitening, qualitative characteristics of tooth color, stages of development of filling materials, aesthetic constructions.

Keywords: color formation, fillings, teeth whitening, aesthetic designs, aesthetic dentistry

The active development of technical means and materials science for dentistry has determined the rapid introduction of new clinical methods for the restoration of teeth and dentition defects. The high efficiency of aesthetic structures turned out to be attractive to patients, which stimulated most dentists to master and use modern materials in practice, primarily light-curing composites. In the current situation of mass use of photopolymers, as well as various auxiliary means, devices, devices, the shortage of basic theoretical and scientific knowledge in the field of shape formation and color science becomes noticeable. The separation of aesthetic dentistry into a separate branch of dental science and practice allows us to increase the level of theoretical training and practical skills of specialists working in the field of aesthetic restoration.

Historical aspects of the development of aesthetic dentistry. The development of aesthetic dentistry is closely related to the history of mankind. Anatomists, artists, sculptors and doctors sought to measure the human body and face and find their optimal proportions. Thanks to this, canons began to appear (literally “prescription”) - a set of artistic techniques or rules. Each canon was based on a module - the size of any part of the human body or face. In Egyptian art, the module was the distance from the sole to the ankle of the leg, in ancient Greek it was the height of the head, and the length of the body was an eightfold increase in the module. According to the canon of Polykleitos of Sikyon, corresponding to the modern term “physiognomic height of the face,” in a harmoniously developed body, the height of the face should be 10 times. In the statues created by Lysippos, the height of the face was placed 9

times, and the height of the body was equal to the distance between the ends of the fingers of outstretched hands. This ratio is called the “square of the ancients.”

In modern conditions, Nacagawa and Yamamoto have proposed ways to assess the color and transparency of tooth tissues. E.A.Hegenbart, Ch.Gran described the differences between tooth enamel and ceramic materials. Adrian et al. studied the correspondence of the color of materials to their standards. G. Ubassi, based on the theory of the optical properties of enamel, developed recommendations for dental technicians.

Throughout the history of society, pearly white teeth have been considered an integral part of human beauty.

In the literature there are tips on teeth whitening for certain types of pigmentation. Thus, I.G. Lukomsky (1960) recommended removing dense colored plaque by scraping with an excavator, machine cleaning with a brush with pumice and hydrogen peroxide. It was recommended to remove smoker’s plaque using iodine tincture, hydrogen peroxide, pumice, and also machine brushing of teeth. Pigmentation due to fluorosis was eliminated by applying decalcifying agents to the tooth crown. E.V.Borovsky (1973) described a whitening method by exposing the enamel to a saturated solution of organic acids (citric, tartaric) or a 10% solution of hydrochloric acid until pigmentation disappears. After this, the tooth is treated with soda paste and polished with a composition of pumice or phosphate cement powder mixed with glycerin. T.F.Vinogradova proposed a method for lightening “tetracycline stains” with hydrogen peroxide, hydroperite, and perhydrol. Nonspecific systemic hypoplasia was subjected to remineralization therapy followed by fluoride varnish coating. For hypoplasia of the incisal edge, gradual grinding of the enamel in small portions with remineralizing therapy after each preparation was recommended.

In the late 1980s, Haywood and Heyman introduced the technique of “dentist-prescribed, patient-administered overnight, intravital safe whitening.” The American Dental Association (ADA) in the 90s proposed a program for the development and use of materials containing hydrogen peroxide in the form of three types of dental products: commercial antiseptics; bleaches, usually containing 3% hydrogen peroxide (10% carbamide peroxide); toothpastes (powders) with low concentrations of hydrogen peroxide or calcium hydroxide.

The population’s demand for teeth whitening has increased significantly in recent years. At the same time, the number of doctors recommending vital whitening is increasing.

Shape formation and color science as a theoretical basis for aesthetic dentistry. One of the main concepts of modern dentistry is the aesthetic function of the tooth. It implies harmony of size, shape, relief, position of the tooth in the arch; optical

properties of tooth tissues, including a special range of color shades, fluorescence, opalescence and gloss of enamel.

Mathematical terms are used to describe the anatomical characteristics of a tooth. Surfaces are compared to flat geometric figures, and shapes and relief are compared to volumetric bodies. Flat figures are formed by points located on the same plane. A circle is defined as a set of points on a plane that are equidistant from the center. An oval is an elongated circle, and a regular oval is an ellipse.

Plane figures with angles are polygons: triangles, quadrangles, etc. A quadrilateral with two pairs of parallel sides is a parallelogram, which is considered a rectangle if all its angles are right angles. A square is a rectangle with all sides equal.

Even a minimum of knowledge in the field of mathematics allows us to describe the basic geometric shapes of tooth surfaces as flat figures. In rectangular teeth, the transverse dimensions of the vestibular surface in the gingival, equatorial region and at the cutting edge are close in value. The lateral surfaces are almost parallel, the length of contact with adjacent teeth is significant. With a triangular crown, the transverse dimensions of the vestibular surface increase from the neck to the cutting edge: the crown expands. The proximal surfaces diverge. Contacts between teeth are point-like. The oval shape of the crown is characterized by close values of the transverse dimensions of the vestibular surface in the cervical region and near the cutting edge. The largest diameter is in the equator region. The proximal surfaces appear in the form of convex arcs, with point contacts with adjacent teeth.

The visual perception of the geometric shape of a tooth can be influenced by its individual characteristics. The dome-shaped gingival margin, characteristic of 56% of incisors, resembles a wedge or triangle in shape. 39% of crowns have a rounded periodontal edge, 5% have a flattened, almost straight contour. The shape of the cutting edge can be smooth, convex, concave, embossed.

Teeth, being three-dimensional bodies, have spatial characteristics: height, thickness, width, relief. An example of geometric three-dimensional figures (the latter are studied by the branch of mathematics - stereometry) are polyhedra. In particular, a straight prism represents a body enclosed between parallel polygons. A triangular right prism has triangles as its bases. If the base is a rectangle, then it is a rectangular parallelepiped. If all sides are equal, it is a cube.

The pyramid also represents a three-dimensional body. At its base is a polygon, the vertices of which are connected to one point lying outside this plane.

A cylinder is obtained by rotating a rectangle around one of its sides. A cone is formed by rotating a right triangle around one of its legs. The ball can be obtained by rotating a semicircle around its diameter. A cross section of a ball with any plane will result in a circle.

Description of the shape of teeth is difficult due to the presence of protrusions, depressions, and roughness on its surface. However, upon careful analysis, one can detect sections that are close in shape to a cylinder (in the cervical region), a cone (in the area of masticatory teeth tubercles), and a flattened prism (in the area of the incisal edge). In accordance with this, all teeth are divided into groups that differ in the shape of the crown: spade-shaped (incisors), cone-shaped (fangs), cylindrical double-tubercular (small molars - premolars), cylindrical multi-tubercular (large molars - molars).

The relief also has three-dimensional characteristics. For example, the central incisors of the upper jaw of young people are characterized by a vestibular surface with vertical enamel ridges. In the lateral incisors, the median enamel ridge usually predominates in height, which in the canines turns into a more convex tubercle.

Description of the optical characteristics of a tooth also requires the use of special terms and concepts. An integral understanding of the laws of formation and perception of color is given by color science, which includes sections of physics (optics), physiology and psychology (vision), painting theory, and philosophy.

The patterns of refraction of light rays explain the appearance of color. Since the angle of refraction depends on the wavelength, or color, of the beam, when passing through a prism, white light undergoes decomposition into the colors of the rainbow (the phenomenon of dispersion).

In physics (optics), it is customary to place all colors on the same straight line in accordance with the wavelength (from red to violet). In color science, they are arranged in a circle: contrasting colors are located opposite each other. The sequence of tones in any color wheel is the same, the number is no more than 160 (the limit of discrimination by the eye).

The most trained observers are able to distinguish 150 shades by color tones, 25 by saturation, and up to 64 by lightness.

The qualitative characteristics of tooth color can also be tone, lightness, and saturation. Visually perceived tones, or shades, can be described as white, yellow, gray, blue, brown. By lightness they are characterized as follows: yellow - varies; gray, blue - come in light colors; brown - very light. The following gradations can be distinguished by saturation: yellow tones - vary; gray and blue are characterized by low saturation, brown shades are characterized by very low saturation.

The main shades of a tooth are explained by the characteristics of the structure and composition of the tooth. Thus, the maximum reflection of all colored rays by the surface, as well as the scattering abilities of the enamel, determine the white color. In addition, having a tendency to internally scatter light, enamel imparts blue shades to the color scheme, as well as the ability to opalescent.

The color of dentin is revealed due to the light transmission of enamel. The incisal area does not have dentin, so it appears more transparent. The middle part of the tooth often contains the bulk of yellowish dentin, which determines the color of the tooth as a whole. The cervical area of the tooth has a thinner layer of enamel, so the color of the underlying dentin is more clearly expressed.

Age-related differences in the optical properties of a tooth can be presented as follows. A young tooth with its surface reflects more light than a mature one, while having a high scattering ability. Its dentin contains less pigments. As a result, white color predominates in the reflection spectrum. A mature tooth is characterized by a reduced scattering ability of the enamel and an increase in the selective reflection of dentin, which forms the inherent shade of the tooth. The layer of dentin exposed as a result of physiological abrasion of teeth gives the cutting edge a dark yellowish, brownish tint. In addition, the color of sclerotic and secondary dentin is often yellow-brown. Darkening is enhanced by pigments that easily penetrate exposed dentin.

In ensuring the aesthetic function, the phenomenon of irradiation is important - the influence of color on the visual perception of the volumetric parameters of the tooth. Thus, warm colors (yellow - orange) seem to protrude, while cold colors (blue) recede into the depths.

Since dental structures must imitate living teeth in tone, saturation, and lightness, dentists must have knowledge in the field of shape formation and color science.

The rapid acquisition by specialists of manual skills in the field of aesthetic dentistry is ahead of their acquisition of theoretical knowledge and scientifically based recommendations, including due to the insufficient supply of special educational, scientific and methodological literature. At the same time, the accumulated world experience indicates that there is a need to develop and formulate basic concepts, provisions, and definitions of aesthetic dentistry as a science that ensures the widespread implementation of the proposed means and methods in practical healthcare.

Thus, an analysis of literary sources and work experience shows the urgent need to define aesthetic dentistry as an independent field that has its own history of development and theoretical basis. The improvement of materials, equipment, and accessories for dentistry had a significant impact on its development. The practical use of advanced methods of treating caries and non-carious lesions of teeth allows us to ensure high quality of modern work such as restoration, reconstruction, adhesive prosthetics, splinting using photopolymerizing materials.

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