

Basic Principles for Taking Extraoral Photographs

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Summary

Modern dentistry, as a part of the complete therapy plan, includes the whole of the patient's face. A photograph provides important visual reference for monitoring growth and developmental changes, providing the patient with a view of the changes and providing the therapist with credible visual material for teaching and research. The first component to consider is the technical aspect of photography. However, documentation of the treatment with pre-treatment and post-treatment photographs can be misleading if the features on one or both photographs are distorted. In this article the authors present the variables for frontal and profile facial photographs that should be understood and controlled if accurate reproduction is desired, such as: lens selection, camera position, subject distance and head position. Consequently numerous frontal and lateral photographs were taken with different head and camera positions in order to show their different contributions to the final picture. Using easily recognised facial landmarks, dental photographers can standardise frontal and lateral portraits for more consistent comparison, and by standardisation they could become valuable additions to clinical charts/records.

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Introduction

The majority of dentofacial changes are usually monitored by the method of cephalometry, where the structures of soft tissues are only registered in profile, and anteroposterior presentation is made impossible. As patients do not understand their own cephalogram, and neither do they know how to interpret the cephalometric analysis, the photograph represents a much more conventional documentation of the soft tissues and also a visual reference for monitoring the changes which occur during growth and development (1). It is a reliable source for qualita-

tive evaluation of postoperative results, as the patient is enabled a review of his own changes prior to and after certain operations, and the therapist can use it as visual material in teaching or as the basis for further research. There is an increasing need for such photo-documentation in orthodontics, as in many other dental disciplines (2).

In the literature many authors have described in detail the method of facial photography. Freehe (3), Gordon and Wander (4), and Bengel (5) give a survey of the basic principles of facial photography, and mention the need for standardisation. They give basic principles on the position of the head, position

of the camera and lighting. Williams (6) describes the position and lighting and gives specific anatomic references for the position of the head. Larabee et al (7) describe photogrametric method, while Farkas, Bryson and Klotz (8) use profile analysis.

The basis of all clinical photography includes the essential elements of clarity, consistency and technical skill. Consistency assumes the conception of standardisation of photographs, enabling their mutual comparison, particularly when they are taken in different time intervals, and technical skill assumes the knowledge and application of the technical aspects of photography (2).

The photographer should attempt to ensure that the patient is comfortable during the photographing, in view of better cooperation which results in a better quality photograph, particularly in the case of children, who rarely sit quietly. Thus, speed and skill are essential in order to obtain the right moment for photographing (2).

The aim of this study was the understanding of basic principles of frontal and lateral facial photography. The object was to concentrate on variations in distance and the position of the head and camera while photographing, and also to show the errors that can occur when standard protocol is ignored.

En face and profile photograph

In orthodontics three standard views of facial photography are used: en face, profile and en face with smile (2).

In the case of en face view the frame of the photograph in the upper part must encompass the crown, and in the lower part the whole neck to the collarbone must be visible. For orientation the level of the distance between the eyes and ears and flat facial surfaces, i.e. interpupilar line, must be parallel with the horizontal plane. The distance between the outer canthus of the eye and the hairline should be equal on both sides. The distance between the outer canthus of the eye and upper edge of the ear must also be parallel with the horizontal plane. This line, which is parallel with the Frankfurt horizontal, is a practical, consistent, clinical anatomic reference (8). Both lines are used to determine parallelism between the

eyes and the horizontal plane in order to prevent tilting of the head in the frontal and lateral view (9) (Figure 1).

For profile view the frame of the photograph in the upper part includes the crown and in the lower part the whole of the neck must also be visible. The distance between the outer canthus of the eye and upper edge of the ear should be parallel with the horizontal plane. The inner and outer edge of the eye and only one side of the face should be completely visible on the photograph (Figure 2). If any part of the opposite side of the face is visible (e.g. eyebrows) this would indicate that the camera is placed too close (3, 4).

A photograph of the face smiling is taken in the frontal position, and the patient must smile naturally (Figure 3).

Position of the head

One of the tested methods for orientation of the head is the "natural position of the head", which was defined by Broca in the 19th century as the standing position, when the visual os is in the horizontal position (10). The literature frequently asserts that the natural position of the head is in correlation with craniofacial morphology (11, 12), future growth trend (13) and respiratory requirement (14). Larabee et al used it for profile analysis (7), and Cooke and Wei combined the natural position of the head with horizontal position for cephalometric analyses, and concluded that it is a very reliable method for analysis of the craniofacial system (15). The concept of natural position of the head in orthodontics, which was introduced in the 1950s, was presented as a reproducible position, and considered to represent a better solution than intracranial referent lines because of less variability in relation to the actual horizontal or vertical (16-20). Natural position of the head is clinically achieved so that the subject during normal, natural posture looks into a mirror hung on the wall at eye level. For this reason it is impossible to photograph the patient in the dental chair, or in any position other than standing (21). During photographing subjects frequently acquire an unnatural position, flexion or extension, which gives different results in diagnostics. In order to avoid such prob-

lems Lundström et al (16, 18) recommend natural position of the head as a better solution. This is the position which they believe can be achieved if the subject looks at a distant point at eye level.

As consistent holding of the head during photographing is not reproducible, some distortion may occur. Namely, when the head during photographing is slightly raised (10% above FH), the forehead and nose can appear shorter; a straight nose can appear as if it has a kind of inclination of the nasal bone, and the chin, even when small, can appear slightly protruding. The upper and lower lips can appear longer and the vermilion of the upper lip smaller. Such an extremely protrusive position of the jaw with the head tilted backward, gives the impression of mandibular prognathism, which is best observed in the lateral photograph (Figure 4).

Similar distortion in the opposite direction can occur if the head is slightly lowered. The nose can then appear longer, the upper and lower lips shorter, and the vermilion of the upper lip enlarged. The width of the nose changes very little depending on the position of the head, due to the fact that the width of the nose is a horizontal measurement and thus less susceptible to distortion as a result of vertical shifting of the head. Such a retruded position of the lower jaw (mandible) with the head tilted towards the front emphasises the retrognathic appearance of the profile, which is dominant in the lateral photograph (Figure 5).

Rotation of the head in the frontal photograph also influences symmetry, giving the impression of facial asymmetry (Figure 6).

Camera

The human optic system measures distance by the ability of the brain to measure the angle between the eyes which focus on an object in the distance. The focal length of the human eye amounts to approximately 90 mm, and thus for facial photography a lens of around that length is used in order to avoid distortion, and focal length of the lens between 90 mm and 105 mm is acceptable while the focal length is consistent. Enlargement is adjusted on the lens casing, and final focussing is performed by shifting and moving the

camera while looking at the patient through the visor. The size of the picture on the film is one tenth of anything photographed (2). Perspective is determined by the distance between the subject and the level of the film. If lenses of different focal lengths are used the distance of the object to the camera will be determined by focal length of the lens. In general, 105-mm lens enables a good review of what we consider realistic perspective of the human face. When filming with objectives with a fixed focal length, after positioning the distance for photographing, for objective of 105 mm photographing should be at a distance of 3 m, and focus adjustment done by moving the camera closer or further from the subject.

Wide-angled 55-mm lens gives a distorted presentation of the face because they need to be focussed at a distance which is too close to the patient's face. Photographic 50-55 mm lenses are classified as "normal" because they have an identical perspective view, like the human eye. However, in perspectives for 1-10 enlargement, they show "barrel-shaped" distortion, where the chin and nose appear enlarged, with elongation in the anteroposterior dimension and laterally emphasised roundness. Extreme telephoto lenses (300 mm) create compressive type distortion, in which everything which is close appears smaller, creating flatness and reducing the anteroposterior dimension.

Ideally the camera should be situated on a stand, as the same distance is used each time for photographing. The ideal position for the camera is when the line of the central lens to the eyes is parallel with the horizontal plane and when the lens is centred between both eyes.

Mid-face is used as a vertical reference when placing the camera in the anteroposterior position. In the case of some facial deformities, determination of the mid-face can be very difficult. As already mentioned, when determining the mid-face the following can be of help: height of the eyebrows, ocular angles (or internal commissure, endocantion), nasal wing and horizontal line of the labial fissure (mouth), if they are symmetrically placed. For example, in the case of septum deviation, the point located on the tip of the nose (pronasal) and the point on the base of the nasal columella (subnasal) are not exactly in the middle (2, 21). Namely, a problem

arises if the camera is not placed in a specific position in relation to the patient, which is not noticed during the course of photographing, only when the photograph is finished. If the camera is placed too high the head will look as though it is tilted too much towards the front and the lower third of the face will appear smaller. If the camera is placed too low the head will look as though it is tilted towards the back and the lower third of the face will appear shorter (21) (Figure 7).

Lighting

Technically, good lighting is essential for the optimal final appearance of the photograph. It is important for the lighting system to be simple, in order to enable reproduction in the same manner at different time intervals, and for it to continue to retain its standard appearance. Furthermore, there are two frequent problems which can very easily occur from inadequate use of lighting. The first is

the use of poor lighting which can darken part of the patient's face, usually as a result of direct non-diffuse "flash" which has a tendency for the tone intensity to appear cloudy. Another problem occurs when the lighting is placed so that it distorts the patient's appearance. Two electronic "flashes" on a stand, placed at an angle of 45 degrees, so that they are slightly above the patient, ensure equal lighting on both sides of the face. The background is also important, and should be of white paper which ensures a neutral background.

The term standardisation of medical photography assumes that photographing is always from the same distance and from approximately the same position. Photographs in standard sizes in standard positions of the head, enable additional measurement of the craniofacial complex, and with standardisation of medical photography they become a valuable supplement to clinical charts/records.

It can be concluded that for dental diagnostics photographs en face, en face with smile and left and right profile are sufficient.