KNMU

Department of Pediatric Dentistry, Pediatric Maxillofacial Surgery and Implantology

Topic of lecture : «Methods of investigation of orthodontic patient».

Plan of lecture:

1. Clinical method of examination patients with dentognatic anomalies.
2. Functions of the oral cavity in normal and malocclusion. Methods of investigation the functions of oral cavity.
3. Anthropometric methods of investigation patients with dentognatic anomalies.
4. Roentgenologic methods of investigation. Methods of the teleroentgenografy.

Treatment is secondary, the primary task for the clinician is to identify the problem and find its etiology. Once this is done, and only then can a treatment plan be formulated.

Diagnosis involves the development of a comprehensive and concise database of pertinent information, sufficient to understand the patient's problem as well as answer questions arising in the treating clinicians mind. The data is derived from essential and nonessential diagnostic aids or supplemental diagnostic aids.

Essential diagnostic aids, as the name suggests are considered essential for the diagnosis of an orthodontic case. Ideally before starting a case, a treating clinician must possess these aids. These include the following.

1. Case history
2. Clinical examination
3. Study models
4. Certain radiographs:
   -Lateral cephalograms
   -Orthopantomograms
5. Facial photographs.

These diagnostic aids are simple and easy to obtain, except for specialized radiographs like orthopantomograms and lateral cephalograms where a specialized radiographic setup might be required.

NONESSENTIAL OR SUPPLEMENTAL DIAGNOSTIC AIDS

These diagnostic aids may be required only in certain cases and may require specialized equipment, which might not be available in every dental clinic. The supplemental diagnostic aids include:

1. Specialized radiographs; like

a. Occlusal views of maxilla and/or mandible.

b. Selected lateral jaw views, etc.

2. Electromyographic examination of muscle activity

3. Hand-wrist radiographs

4. Computed axial tomography (CT scan)

5. Magnetic Resonance Imaging (MRI)

6. Endocrine tests and/or other blood tests

7. Estimation of the basal metabolic rate

8. Sensitivity (vitality) tests

9. Biopsy.

CASE HISTORY

Case history is the information gathered from the patient and/or parent and/or guardian to aid in the overall diagnosis of the case. It includes certain personal details:

- chief complaint
- past and present dental and medical history
- any associated family history.

The aim is to establish a rapport with the patient and to obtain an accurate account of the individual's complaints, which, following examination will enable, a diagnosis to be made.

PERSONAL DETAILS

These include very basic data, for communication and access. It includes:

Name

The patients name should be recorded not only for the purpose of communication and identification but because it gives a personal touch to the following conversation. It makes the patients more comfortable when he is addressed by his first name and arouses a feeling of familiarity, which has a positive psychological effect on the patient.

Age and Date of Birth

The chronologic age of the patient helps in diagnosis, treatment planning and growth prediction.

Certain transient conditions, which might be perceived as malocclusion by the patient and parents, can be identified and the concerned are counseled accordingly.

The age of the patient also dictates the use of certain treatment protocols. For example, surgical correction might be advocated following cessation of growth whereas the same malocclusion might be treated using functional appliances if the patient has a potential to grow.

Sex

Sex of the patient also helps in treatment planning.

Girls mature earlier than boys, i.e. the timing of growth related events including growth spurts, eruption of teeth and onset of puberty are different in males and females.

Psychologically also the reaction of males and females may be different to similar malocclusion. Females are generally more concerned about facial aesthetics.

Address and Occupation

These are important for communication, assessing the socioeconomic status as well as for records.

The socioeconomic status might dictate the kind of appliance required.

Also, patients coming from far may require a different appliance therapy as they might not be able to visit the clinician more frequently.

CHIEF COMPLAINT

The patient's chief complaint should be recorded in his or her own words.

It should mention the conditions the patient feels he / she is suffering from. This helps in identifying the priorities and desires of the patients.

The parents' perception of the malocclusion should also be noted.

This will help in setting the treatment objectives and satisfying the family in general.

MEDICAL HISTORY

Knowledge of a patient's general health is essential and should be obtained prior to examination.

It is best obtained by a questionnaire.

In most cases orthodontic treatment can be undertaken but precautions may be required prior to extractions.

Antibiotic coverage may be required in patients with rheumatic fever or cardiac anomalies even for molar band placement/removal, if the adjacent gums are inflamed or bleeding is anticipated.

Mentally or physically challenged patients may require special management.

DENTAL HISTORY

The patient's dental history should include information on the age of eruption and exfoliation of deciduous and permanent teeth.

Reason for exfoliation will also hint at the oral hygiene maintenance capabilities of the patient.

The past dental history will also help in assessing the patients and parents attitude towards dental health.

PRENATAL HISTORY

Prenatal history should concentrate on the condition of the mother during pregnancy and the type of delivery. Her nutritional state and any infections that she might have will affect the developing teeth of the child. The use of certain drugs or even excess use of certain vitamins can result in congenital deformities of the child.

Forceps deliveries have been associated with injuries to the temporomandibular joint (TMJ). Excess forceps pressure in the TMJ region can cause ankylosis of the joint and associated mandibular growth retardation.

POSTNATAL HISTORY

The postnatal history should concentrate on the type of feeding, presence of habits especially digit/thumb sucking and the milestones of normal development. Tongue thrust and digit sucking habits are associated with malocclusions. These will be discussed later in detail.

FAMILY HISTORY

Skeletal malocclusions especially skeletal Class III malocclusions and congenital conditions such as cleft lip and palate are inherited. Detailed records of such malocclusions might aid in any future studies on the subject.

CLINICAL EXAMINATION

GENERAL EXAMINATION

General examination should begin as soon as the patient first comes to the clinic. A general appraisal of the patient is done. The clinician should observe the gait, posture and physique of the patient. Height and weight are recorded to assess for the physical growth and development of the patient. Abnormal gait may be present due to an underlying neuromuscular disorder. Abnormal posture also may lead to malocclusions.

Body Build

Sheldon classified body build into:

a. Ectomorphic: Tall and thin physique

b. Mesomorphic: Average physique

c. Endomorphic: Short and obese physique.

Cephalic and Facial Examination

The shape of the head can be evaluated based on the cephalic index of the head which was formulated by Martin and Saller (1957) as:

$$1 = \frac{\text{Maximum skull width}}{\text{Maximum skull length}}$$

Index values

- Mesocephalic (average) 76.0-80.9
- Brachycephalic (short, broad skull) 81.0- 85.4
- Dolicocephalic (long, narrow skull) < -75.9
- Hyperbrachycephalic -> 85.5

The index is based on the anthropometries determination of the maximum width of the head and the maximum length.

The shape of the face is assessed by the morphologic facial index which was given by Martin and Saller (1957) as:

$$T = \frac{\text{Morphologic facial height (distance between nasion and gnathion)}}{\text{Bizygomatic width (distance between the zygoma points)}}$$

Index values

- Hypereuryprosopic} low facial x - 78.9
- Euryprosopic } skeleton 79.0 - 83.
- Mesoprosopic }average facial skeleton 84.0 - 87.9
- Leptoprosopic }high facial 88.0 - 92.9
- Hyperleptoprosopic } skeleton 93.0 - x

The type of facial morphology has a certain relationship to the shape of the dental arch, e.g. euryprosopic face types have broad, square arches; border line crowding in such cases should be treated by expansion. On the other hand, leptoprosopic face types often have narrow apical basel arches. Therefore, extraction is preferred over expansion.

Assessment of facial symmetry

A certain degree of asymmetry between the right and left sides of the face is seen in most individuals. The face should be examined in the transverse and vertical planes to determine a greater degree of asymmetry than is considered normal.

Proportions of the face

Latera view of the face. Types of profile: straight, convex, concave.

Intraoral examination

H.Y. Pakalns divides frenula of thr lip into:

- firm frenula with attachment place on the apex of interdental small papilla; at pulling the lip with such a frenulum the interdental small papilla moves too;
- average — attachment at the distance of 1 to 5 mm from the apex of interdental small papilla;
- weak, which attach in the region of transitional fold.

F.Y. Khoroshilkina differentiates 5 types of the frenulum of tongue.

- *The 1st type* includes thin, almost transparent frenula, attached normally, but which limit tongue movements because of small length.
- *The 2nd type* includes thin, semitransparent frenula, which attach close to the apex of tongue and have small length. During tongue lifting a sulcus forms in the centre.
- *The 3d type* includes the frenula, which are a solid, short band, attached close to the apex of tongue. During tongue protruding the apex rolls down, and the back bursts because of tension. The lick of the upper lip is complicated, and sometimes impossible. Palpation of such a frenulum shows that tongue mobility limitation is conditioned by the fixation of its apex with a connective tissue band. Under the band, which has a form of a cord, thin mucous tunic duplication is located.
- *The 4th type* includes the frenula, whose band, even though standing out, is inter grown with the tongue muscles. Such frenula are often observed in children with congenital fissures of lip, alveolar process, and palate.
- *The 5th type* includes frenula with a hardly noticeable band, but its fibers are located in the thickness of tongue, interwoven with its muscles and limit movements.

According to Y.L. Obraztsov's (1992) classification, vestibule depth can be of 4 types:

- the Ist — up to 3 mm (very shallow);
- the 2nd — up to 5 mm (shallow);
- the 3rd — 5-10 mm (of medium depth);
- the 4th — more than 10 mm (deep).

Smiling

- Smile line
- Incisor display
- Broadness of smile (buccal corridors)
- Maxillary midline to face
- Chin to facial midline
- Occlusal cant

Intraoral (front)

- Dentition type (mixed, adult, etc)

- Angle’s Classification
- Overjet, Overbite
- Cross bites
- Anterior teeth Present / Absent
- Maxillary to Mandibular midline
- Oral hygiene
- Incisor morphology (short, chipped, etc)
- Gingival health / defects

Dental (right)

- Molar relationship
- Canine relationship
- Cross bites present
- Posterior teeth Present / Absent
- Lateral open bites present
- Gingival health / defects
- Upper/Lower Curve of Spee

Dental (left)

- Molar relationship
- Canine relationship
- Cross bites present
- Posterior teeth Present / Absent
- Lateral open bites present
- Gingival health / defects

Maxillary occlusal

- Maxillary Crowding / Spacing
- Present / Absent /Erupting teeth
- Rotated teeth
- Displaced teeth
- Arch shape

- Bolton Discrepancies
- Buccolingual axial inclination of posterior teeth
- Caries / Restorations present

Mandibular occlusal

- Mandibular Crowding / Spacing
- Present / Absent /Erupting teeth
- Rotated teeth
- Displaced teeth
- Arch shape
- Bolton Discrepancies
- Buccolingual axial inclination of posterior teeth
- Caries / Restorations present

Functions of the oral cavity.

BREATHING

Naso-respiratory function and its relation to craniofacial growth is of great interest today, not only as an example of the basic biologic relationship of form and function, but also is of great concern for orthodontists, pedodontist, pediatricians, otorhinolaryngologists, allergists and speech pathologists for varying reasons.

Infants are obligatory nasal breathers. Everyone breathes partially through the mouth under physiological conditions, the most important being the need for increased air, i.e. physical exertion during strenuous activity and exercise.

During normal mechanism of respiration, the efforts to breathe through the nose is greater. The mouth does not normally participate in respiration.

The tortuous nasal passages introduce an element of resistance to airflow as they perform their function of warming and humidifying the inspired air. This modest resistance present in the system makes respiration more efficient.

Mouth breathing. Facial type.

Seen more in ectomorphs, long-faced, tall, slender persons with long narrow pharyngeal space.

RESPIRATORY PATTERN.

Respiratory needs are the primary determinant of the posture of the jaws and tongue. Thus, an altered respiratory pattern, e.g. in mouth breathing could alter the posture of the head, jaw and tongue. This, in turn, could alter the equilibrium of pressure on the jaws and teeth thus, affect, jaw growth and tooth position. To breathe through the mouth, it is necessary to extend lower the mandible and tongue and the head. If these postural changes were maintained:

• Face height would increase.

• Posterior teeth would supra-erupt

• Mandible would rotate down and back

•Open-bite develops anteriorly, increased overjet

• Narrower maxillary arch-increased pressure from stretched cheeks

• 'Adenoid Facies' appearance .

EFFECTS OF MOUTH BREATHING

1. *Associated structures and nose When air is inspired* through the mouth, it is not cleaned, warmed and moistened, secretion of mucus is stopped gradually. The irritants accumulate resulting in local inflammation discomfort and pain.

2. *General health and growth The child is usually restless* and is affected by repeated cold, cough, glandular fever etc., loss of general body resistance to other diseases.

3. Growth and development of the face and jaws

On Face

1. Lips slack and stay open

2. Short upper lip

3. Moulding action of upper lip on incisors is lost thereby resulting in proclination and spacing.

4. Lower lip: heavy and everted.

5. Tongue is suspended between upper and lower arches resulting in constriction of buccal segment (V shape arch).

EFFECT ON OCCLUSION OF TEETH

• *Proclination of anteriors*

• Distal relation of mandible to maxilla

• Lower anteriors elongate and touch the palatal tissues.

• *Upon gingivol tissues constant wetting and drying* of the gingiva causes irritation, saliva about the exposed gingiva tends to accumulate debris resulting in an increase in bacterial population.

Hypertrophic Mouth Breathing Gingivitis. Gingival hypertrophy is seen as mouth breathing line/ gum ridge at the junction of edematous and normal tissues. This line marks the limit of the area exposed to air

Non-hypertrophic Mouth Breathing Gingivitis. Non-hypertrophic mouth breathing gingivitis is a marginal gingivitis without edema which develops on the palatal tissues of upper anterior region in mouth breathers even in the presence of good oral hygiene.

Methods of Examination

1. Study the patient's breathing unobserved: Nasal breather's lips touch lightly during relaxed breathing whereas mouth breathers keep the lips parted.

2. Ask the patient to take a deep breath: Most mouth breathers respond to this request by inspiring through the mouth. The nose, does not change the size or shape of external nares occasionally contracts the nasal orifices while inspiring.

Other Tests

a. *Mirror test A double sided mirror is held between* the nose and mouth. Fogging on the nasal side of the mirror indicates nasal breathing while fogging on oral side - mouth breathing.

b. *Cotton test/Massler's butterfly test. Butterfly shaped* cotton strands is placed over the upper lip below nostrils. If the cotton flutters down it is a sign of nasal breathing. This test can be used to determine unilateral nasal blockage.

c. *Water test. The patient is asked to fill the mouth with* water and retain it for a period of time. Mouth breathers find this task difficult.

SWAIIOW

Humans show 2 types of swallow patterns:

1. Infantile and neonates swallow

2. Mature/adult swallow.

Infantile swallow is characterized by:

• Active contractions of the lip muscles.

• Tongue is placed between the gum pads and tongue tip is brought forward into contact with the lower lip.

• Little posterior tongue activity / pharyngeal muscle activity.

• Tongue-to-lower lip posture adopted by infants at rest.

• Contraction of lips and facial muscles helps to stabilize the mandible.

• Vigorous mandibular thrust.

Physiologic transition of swallow begins daring the 1st year of life and continues for several years. Mature swallow is seen usually by 2.5-3 years. Maturation of swallow pattern occurs with the addition of semisolid and solid food to the diet. Increasing activation of the elevator muscles of mandible is seen. When sucking activity stops, a continued transition of swallow leads to acquisition of ***adult pattern of swallow***.

This swallow is characterized by:

• Cessation of lip activity, i.e, lips relaxed.

• Placement of tongue tip against the palate and behind upper incisor

• Posterior teeth into occlusion during swallow.

• Downward and forward mandibular growth

increases intraoral volume and vertical growth of the alveolar process changes tongue posture.

• Mandible stabilized by contraction of muscles of mastication.

RETAINED INFANTILE SWALLOW

Retained infantile swallow is defined as predominant persistence of the infantile swallowing reflex after the eruption of permanent teeth.

CLINICAL FEATURES

• Strong contractions of lips and facial musculature especially buccinator.

• Massive grimace

• Anterior and lateral thrusting

Inexpressive face due to use of facial muscles for swallowing.

• Difficulty in mastication since they normally occlude on only one molar in each quadrant.

• Low gag threshold

• Poor prognosis

Usually associated with skeletal craniofacial developmental syndromes and neural deficits.

Anthropometric methods of investigation patients with dentognatic anomalies

Orthodontic study models are essential diagnostic records, which help to study the occlusion and dentition from all three dimensions. They are accurate plaster reproductions of the teeth and their surrounding soft tissues.

IDEAL REQUIREMENTS OF ORTHODONTIC STUDY MODELS

1. Models should accurately reproduce the teeth and their surrounding soft tissues.
2. Models are to be trimmed so that they are symmetrical and pleasing to the eye and so that an asymmetrical arch form can be readily recognized.
3. Models are to be trimmed in such a way that the dental occlusion shows by setting the models on their backs.
4. Models are to be trimmed such that they replicate the measurements and angles proposed for trimming them.
5. Models are to have clean, smooth, bubble-free surfaces with sharp angles where the cuts meet.
6. The finished models should have a glossy marproof finish.

WHY WE MAKE STUDY MODELS?

1. They are invaluable in planning treatment, as they are the only three dimensional records of the patient's dentition.
2. Occlusion can be visualized from the lingual aspect.
3. They provide a permanent record of the intermaxillary relationships and the occlusion at the start of therapy; this is necessary for medicolegal considerations.

4. They are a visual aid for the dentist as he monitors changes taking place during tooth movement.

5. Help motivate the patient, as the patient can visualize the treatment progress.

6. They are needed for comparison at the end of treatment and act as a reference for posttreatment changes.

7. They serve as a reminder for the parent and the patient of the condition present at the start of treatment.

8. In case the patient has to be transferred to another clinician, study models are an important record.

USES OF STUDY MODELS

1. Assess and record dental anatomy
2. Assess and record intercuspation
3. Assess and record arch form
4. Assess and record the curves of occlusion
5. Evaluate occlusion with the aid of articulators
6. Measure progress during treatment
7. Detect abnormality, e.g. localized enlargements, distortion of arch form, etc.
8. Calculate total space requirements/discrepancies
9. Provide record before, immediately, after and several years following treatment for the purpose of studying treatment procedures and stability.

MODEL ANALVSIS

PANT'S ANALVSIS

In 1909 Pant presented to the profession a system whereby the mere measurement of 4 maxillary incisors automatically established the width of the arch in the premolar and molar region.

The greatest width of the incisors is measured with calipers recorded on a line, and their sums then recorded in millimeters. This is termed as *Sum of Incisors (SI).*

The distance between the upper right first premolar and upper left first premolar (i.e. the distal end of the occlusal groove) is recorded and called as *Measured Premolar Value (MPV).*

The distance between the upper right first molar and upper left first molar (i.e. the mesial pits on the occlusal surface) is recorded and is termed as *Measured Molar Value (MMV) whereas on the* mandibular teeth the points used are the distobuccal cusps of the first permanent molar . *Calculated premolar value (CPV) The expected arch* width in the premolar region is calculated by the formula: SI x 100/80

Calculated molar value (CMV) The expected arch width in the molar region is calculated by the formula: SI x 100/64

The difference between the measured and calculated values determines the need for expansion. If measured value is less, expansion is required.

Pont's index gives an approximate indication of the degree of narrowness of the dental arches in a case of malocclusion and also the amount of lateral expansion required for the arch to be of sufficient size to accommodate the teeth in perfect alignment.

Drawback of Pant's Analysis

1. Maxillary laterals are the teeth most commonly missing from the oral cavity.
2. Maxillary laterals may undergo morphogenetic alteration like 'peg' shaped lateral.
3. This analysis is derived solely from the casts of the French population.
4. It does not take skeletal malrelationships into consideration.
5. It may be useful to know the desired maxillary dimension for a case, but it is more difficult to achieve the corresponding mandibular dimensions that are necessary to maintain a balanced occlusal relationship.
6. Pont's index does not account for the relationship of the teeth to the supporting bone, or the difficulties in increasing the mandibular dimensions.

It *should always be remembered that the patient's original mandibular and maxillary arch form should be considered as the ultimate guide for arch width rather than the values arrived at by using the Pont's index.*

LINDER HARTH INDEX

Linder Harth proposed an analysis, which is very similar to Pont's analysis. However he made a variation in the formula to determine the calculated premolar and molar value.

The calculated premolar value is determined using the formula: SI x 100/85

The calculated molar value is determined using the formula: SI x 100/64

where SI = sum of mesiodistal width of incisors.

KORKHAUS ANALYSIS

This analysis makes use of the Linder Harth's formula to determine the ideal arch width in the premolar and molar region. An additional measurement is made from the midpoint of the inter-premolar line to a point in between the two maxillary incisors. According to Korkhaus, for a given width of upper incisors a specific value of the distance between the midpoint of interpremolar line to the point between the two maxillary incisors should exist. In case of proclined upper anteriors, an increase in this measurement is seen while a decrease in this value denotes retroclined upper anteriors.

For the values noted the mandibular value (U) should be equal to the maxillary value (Lu) in millimeters minus 2 mm.

Roentgenologic methods of investigation. Methods of the teleroentgenografy.

Radiologic investigation is necessary for diagnosis clarification, defining the plan and prognosis of treatment, studying changes that take place in the process of child's growth under the influence of medical procedures. It is important, depending on the aim, to choose the most effective method of radiologic investigation correctly. These methods fall into intraoral and extraoral.

Intraoral Roentgenography

Intraoral roentgenography is carried out with the help of dental devices of different construction. Intraoral roentgenogram allows studying the state of hard tooth tissues, periodontal tissues, alveolar processes and jawbones with destructive changes, cysts, new formations, congenital and acquired defects, and also the clarification of teeth germs position anomalies, the degree of their crowns and roots formation, teeth retention, their form anomalies, correlation of milk teeth roots and permanent teeth crowns.

Intraoral roentgenogram of the median palatine suture is needed to study its structure, the degree of ossification, changes that take place at slow or rapid suture opening in the process of upper jaw dilation, specifying indications to surgical plasty of the frenulum of the upper lip, if its fibers interweave into the median palatine suture and promote diastem formation.

Extraoral Roentgenography Methods

Extraoral roentgenography methods include panoramic radiography, orthopantomography, TMJ tomography, and teleroentgenography.

Panoramic Radiography of Jaws. In a panoramic radiograph of the upper jaw the images of its dental, alveolar, and basal arches, the vomer, nasal cavity, maxillary sinuses, zygomatic bones are obtained; in a panoramic radiograph of the lower jaw — the images of its dental, alveolar and basal arches, lower jaw margin, angles and wings.

In comparison with intraoral roentgenograms, at obtaining a panoramic radiograph the distance object-film increases. Due to this at the expense of a big area of investigation and image magnification by 1.8—2 times valuable diagnostic data can be obtained.

Orthopantomography. Orthopantomography, or panoramic tomography, provides obtaining a flat image of the arched surfaces of volumetric areas. Orthopantomograms are obtained with the help of this method; they make possible studying the degree of teeth roots and crowns mineralization, the degree of milk teeth roots resorption and their correlation with permanent teeth germs, inclination of erupted teeth and the teeth retained relative to the neighboring teeth and the median plane, dentoabeolar height in the frontal and lateral parts of jaws, overbite, the symmetry of the right and left parts of face, of the middle and lower parts of the facial skeleton.

- Dental Age
- Erupting teeth
- Tipped / axially inclined teeth
- Impacted teeth
- Supernumerary / Missing teeth
- Lesions associated with teeth (including caries)
- Third molar position / development
- Other notable pathology
- TMJ / Condylar morphology

Methods of the teleroentgenografy (cephalometric radiography) is a standardized method of production of skull radiographs, which are useful in making measurements of the cranium and the orofacial complex. The radiograph thus obtained is called a cephalogram.

Cephalometrics had its beginning in craniometry. For many years anatomists and anthropologists were confined to measuring the craniofacial dimensions of skulls of dead individuals. This was not possible in case of living individuals, where the varying thickness of soft tissues interfered with the accuracy of these measurements. With the advent of radiography, an alternative method was provided which enabled the researchers to obtain indirectly but with sufficient accuracy, and convenience the skeletal measurements of the human skull. The reproducibility of these radiographs allowed for a longitudinal serial study of growth of living individuals.

Cephalometrics can be a useful diagnostic and evaluative tool for the Pedodontist, the Prosthodontist, the Oral Surgeon and the General Practitioner of Dentistry. Yet, it has primarily remained within the province of the Orthodontist and still remains a mystery to clinicians in other areas of dentistry. There is a general lack of knowledge of cephalometrics at the undergraduate level. This lecture will try to clear the basic fundamentals of cephalometrics and present in brief the commonly used analysis

USES OF CEPHALOMETRICS

1. Study of craniofacial growth Serial cephalogram studies *have helped in providing information* regarding

• The various growth patterns.

• The formation of standards, against which other cephalograms can be compared.

• Prediction of future growth.

• Predicting the consequences of a particular treatment plan.

2. Diagnosis of craniofacial deformity. Cephalograms help in identifying, locating and quantifying the nature of the problem, the most important result being a differentiation between skeletal and dental malrelationships.

3. Treatment planning. By helping in diagnosis and prediction of craniofacial morphology and future growth, cephalometrics help in developing a clear treatment plan. Even prior to starting orthodontic treatment an orthodontist can predict the final position of each tooth within a given patient's craniofacial skeleton to *achieve aesthetic and more* stable results.

It helps in distinguishing cases which can be treated with growth modification appliances or whith may require orthognathic surgery in future.

4. Evaluation of treated cases. Serial cephalograms permit the orthodontist to *evaluate and assess the* progress of treatment and also helps in guiding any desired change.

5. Study of relapse in orthodontics. Cephalometrics also helps in identifying causes of orthodontic relapse and stability of treated malocclusions. It helps in establishing positions of individual teeth within the maxilla or the mandible, which can be considered to be relatively stable. By convention, the distance from the X-ray source to the subjects' midsagittal plane is kept at *five feet.* The distance from the midsagittal plane to the cassette can vary in different machines, but must be the same for each patient everytime.

Now more than 200 methods of analyzing lateral teleroentgenograms of head and numerous supplements to them are well-known. Various methods differ from one another by measurement types, points for linear and angle measurements, planes of references, which change slightly in the process of facial skeleton growth and development.

The methods of analyzing lateral teleroentgenograms by measurement types are the following:

- Detecting linear dimensions between certain points and their correlation (methods of De Coster, Korkhaus, Moorrees, Wylie);
- angles measurement (methods of Bjork, Downs, Graber);
- detecting the proportionality of the dimensions of the facial skeleton bones (methods of Maj, Luzy);
- combined — detecting linear and angle dimensions and the proportionality of the facial skeleton structure (methods of Sassouni, Schwarz, A.A. El-Nofeli, Frankel, A.P. Kolotkov and others).

The most widespread method of interpreting lateral teleroentgenograms of head in Ukraine is the technique offered by Schwarz with supplements of other authors.

During the analysis of teleroentgenograms Schwarz divides linear and angle measurements into craniometric, gnathometric, and profilometric.

- *Craniometric* investigations aim at detecting the position of jaws relative to the plane of the anterior part of the cranium base — detecting the type of face and finding out the deviations from average dimensions, characteristic of neutrocclusion

at the same type of face. The purpose is to get the natural patient's profile without any pathology. The difference between the "right" and real profiles is caused by pathology.

- *Gnathometric* investigations aim at detecting the morphological peculiarities of different types of occlusion anomalies and deformations. At that, measurements concern the dentognathic complex, located between *SpP* — the spinal plane, or the plane of the upper jaw base, and *MP* — the mandibular plane, or the plane of the lower jaw base. On the basis of gnathometry anomalies caused by jaws dimensions inadequacy, teeth position anomalies, and by alveolar process shape anomalies are detected; the influence of jaws dimensions and position, and also of teeth position anomalies on the form of face profile is found out; the degree of the inclination of *OcP* — occlusal plane — to *NSe* is evaluated, which is important for the prognosis of treatment from the esthetic point of view.
- *Profilometric* investigations aim at studying the form of face profile and clarifying the influence of craniometric ratios on the profile form. Schwarz recommends estimating the form of jaw profile by the position of lips, by the relation of the mouth tangent *T* to *Pn* and *Po*, by the proportionality of face parts, and by the profile angle *T*.

Cephalometric analysis

- *Measurement of skeletal relations*
    - Antero-posterior relations
    - Vertical relations
- *Measurement of dento-skeletal relations*
    - Upper teeth and the maxilla
    - Lower teeth and the mandible
- *Measurement of soft tissues*

Antero-posterior skeletal relations

SNA angle (82 + 3)

Indicates prognathism of maxillary apical base

in relation to the cranial base:

Large angle = Prognathic maxilla

Normal angle = Orthognathic maxilla

Small angle = Retrognathic maxilla

SNB angle (79 + 3)

Indicates prognathism of manibbular apical base

in relation to the cranial base:

Large angle = Prognathic mandible

Normal angle = Orthognathic mandible

Small angle = Retrognathic mandible

ANB angle (3 + 1)

Indicates the skeletal relationship between maxilla and mandible:

Large angle = postnormal relation (skeletal class II)

Normal angle = Normal relation (skeletal class I)

Small angle = Prenormal relation (skeletal calss III)

Vertical skeletal relations

MM angle (27 + 5)

Large angle = Skeletal open bite

Normal angle = Normal

Small angle = Skeletal deep bite

Gonial angle (126 + 5)

Increased angle indicates long face

Decreased angle indicates short face

Dentoskeletal relations

UI / Mx plane angle (108 $\pm$ 5)

LI / Mn plane angle (92 $\pm$ 5)

Interincisal angle (133 $\pm$ 10)

LI / A-Pog distance (0 $\pm$ 2 mm)

Soft tissue relations

Esthetic line (Rickett's line)

Upper and Lower lips to E line

Growth Evaluation

Superimposition on cranial base structures:

To examine overall changes in the facial pattern including changes in maxilla and mandible in relation to the cranial base

It is made on:

1- De Coster line

2- *SN line*

Superimposition on maxilla

To record changes in:

1- Maxilla

2- Maxillary teeth in the maxilla

It is made on :

1- Anterior surface of zygomatic process

2- *Maxillary plane*

Superimposition on mandible:

To record changes in:

1- Mandibular teeth in the mandible

2- Remodeling in the mandible

It is made on :

1- Contour of the mandibular canal

2- Inner contour of the cortex of the mandibular symphysis

3- Tooth bud of the 3rd molar