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Etiology of Non-Syndromic Facial Asymmetry: experimental study

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Abstract

The identification of skeletal problems in a growing patient need a carefully treatment planning. Skeletal asymmetry in a growing patient should be treated in a conservative way, unlike the same dismorphosis in a patient that have completed his growth therapy is exclusively surgical.

The etiopathogenesis of facial asymmetry is multifactorial and is the result of a non-balanced growth. Factors that alter this balance can be genetic and environmental. The purpose of this research is to analyze the environmental factors through a careful history to know all the details of the growth of the subject under consideration, from the fetal period when they are presented to our observation (pregnancy, mode of delivery, type of feeding, birth trauma or damage to the fetal posture ..) and a functional examination (breathing, swallowing, chewing, speech and bad habits).

The analysis of genetic factors was analyzed by family history and aesthetic examination of photographs taken of the patient and the parents. In particular, assess the presence of a "stretch" asymmetric in parents, and correspondence in the laterality of the asymmetry between parent and child.

Introduction

The term symmetry (from the greek συμμετρ?α, comp. Of σ?ν "with" and μ?τρον "measure") is a property that stands for an orderly distribution of the parts of a body or a geometric figure that you can locate a geometric element (a point , a line, a surface) so that at each point of the object to place a part of it corresponds, at equal distance, a point on the other part1.

For facial asymmetry we mean the lack of correspondence between them in shape, size and position of components of the two halves of the face than the mediana2 line.

Facial symmetry has been studied by researchers and is an important concept in biology related to breeding strategies, health and survival of the species.

Some studies suggest that symmetrical face is more attractive than an asymmetrical one 3.

The reasons for this phenomenon are not yet completely understood. We can find two types of interpretations in the literature: the "Evolutionary Advantage View" and "Perceptual Bias view". "Evolutionary Advantage view" proposed that symmetrical faces are attractive because stands for the individual's healthy. Our genes are programmed to give rise to a structural symmetrical development; diseases and infections can produce anatomical irregularities (such as facial asymmetry). Subject with symmetrical face is demonstrated how he have also a good immune system, good health and his capacity to transfer these qualities to their offspring. Animal studies confirmed relationship between body symmetry and fisical health.

Lars Penke has conducted a series of studies in humans and concluded that greater facial symmetry, the greater the likelihood of maintaining mental health in old age. According to the "Perceptual Bias view", our system is programmed in a way in which symmetrical input are simpler to process. This greater processing simplicity would be transformed not only into a preference for symmetrical faces, but for all objects that show a higher symmetry.

That said, however, it faces with symmetries middle grade are still attractive, or even still more attractive compared to individuals with a face with an almost perfect symmetry.

It appears in numerous studies to be a correlation between health and symmetry, but not between the latter and the attractiveness of the individual 3,4. Therefore symmetry is a genetic health indicator which together with other features (such as in male subject the expression of secondary sex characteristics induced by testosterone: jaw, chin and cheekbones, facial hair) is interpreted as a factor of attractions 5. For this reason, not always symmetrical faces are perceived more beautiful than the faces that have a degree of asymmetry mild or medium.

The symmetry of body and face is mostly a theoretical concept that rarely exists in the

living organisms. Right-left differences occur worldwide in nature where there are two bilateral present congruent parts into a single entity. Humans have physiologically functional and morphological

asymmetries, such as the preference of using the lower limb or the right hand with respect to the left to take a specific action. Some of these asymmetries are embryonic or genetically determined and encoded central 8 nervous system.

According to R. Bourdiol, anthropologist, anatomist and French neurophysiologist, the human embryo is perfectly symmetrical only during the first four weeks of life.

By day 21 the formation of the heart and aorta, the carotid vasculature, requires anatomical and functional asymmetry as hemodynamic laws favor spraying of the left brain. It follows its functional and structural dominance with a differentiation to somatic level, which always favors the preferenziale9 side.

In "The Brain: The Last Frontier", R. Restak refers to anatomical studies at Harvard University, and published in February 1978 about the structural differences of the two cerebral hemispheres, with particular reference to language production: in most subjects of the area of ??residence of the function of language is more extensive left cerebral hemisphere.

The left brain controls the function of the right side of the body that becomes predominant and structurally funzionalmente10. In fact, as is widely documented in the literature, usually the right emivolto is slightly wider than the left, while the reverse is a rare condition.

Since a slight asymmetry seems to be the rule rather than the exception, we must quantify how much is the measures to decide that is present a facial asymmetry.

For this purpose there is a study of Fernandes 2011 study by Silva et al., In a publication on the Dental Press Journal of Orthodontics, that analyzes the perceptions of facial asymmetry caused by mandibular deviations, by orthodontists and ordinary people. In the experiment the faces of the two patients one man and one woman, were photographed in the natural position of the head, and were released additional photos with progressive mandibular shifts of 2, 4 and 6 mm from intercuspal usual. Orthodontists perceived displacements greater than 4 mm from the position of maximum habitual intercuspation in both sexes. Ordinary people showed similar results when analyzing photographs of the woman while rilevavano the asymmetry in the male body when the mandible was 6 mm. So the asymmetry perception is different between orthodontists and ordinary people not only with regard to the asymmetry severity but also for the sex of the patient11.

Clinician during examination has the task of detecting if a patient has facial asymmetries, a proper diagnostic process and decide if the patient have to do a therapy or monitor the evolution of the asymmetry of the patient with periodic checks.

The patient's age is a very important factor both from the diagnostic point of view that therapeutic.

We can distinguish two types of populations: pediatric and adult.

The adult is already a stable and well-structured body, where there are growth phenomena, but the capacity to adapt to environmental responses are smaller compared to what happens in the pediatric population. So in an adult patient correcting a structural asymmetry is surgical-orthodontic.

The pediatric population is more adaptable, editable where environmental input takes place simultaneously to the physiological changes that the body is just going from one form to the final one, adult. Where there are growth's phenomenal, it's possible do a conservative therapies, as functional therapies.

The purpose of the research is to analyze the environmental factors through a careful history to know all the details of the growth of the subject under consideration, from the fetal period when they are presented to our observation (pregnancy, mode of delivery, type of feeding, birth trauma or damage to the fetal posture ..) and a functional examination (breathing, swallowing, chewing, speech and bad habits).

The analysis of genetic factors was analyzed by family history and aesthetic examination of photographs taken of the patient and the parents. In particular, assess the presence of a "stretch" asymmetric in parents, and correspondence in the laterality of the asymmetry between parent and child.

Materials and Methods

It was carried out, for a period of 15 months, the observation of patients at first visit (2 days/week, 7 f visits/day). During the clinical examination often they were found different degrees of asymmetry localized in the cranio-facial region, in patients without syndromes due to asymmetry. Especially, the middle third and lower of the face were found to be most affected by the presence of some degree of asymmetry. In addition, careful observation of parents, brought to our attention, often presenting an asymmetric stretch even in these subjects. From this observation it was born on our study, aimed at investigating the following aspects:

further researches medical history, clinical, photographic and radiographic.

Evaluation of the presence of facial asymmetry in the

parents, and the correspondence in the laterality of the asymmetry between parent and child.

Evaluate also, if the integration of the medical history, clinical, radiographic and photographic data can direct toward a diagnosis of asymmetry due to genetic factors rather than environmental factors.

The first phase of the research has clinically evaluated patients; in some cases the clinical examination showed different degrees of craniofacial asymmetry in patients without syndromes due to asymmetry. According to the research project described above, we have gone to the recruitment of subjects, to perform a diagnostic study, according to the following criteria:

Inclusion criteria

- Patients with mild to moderate malocclusion;

- Presence of craniofacial asymmetry> 4mm < 10 mm,(The literature reports that asymmetries of less than 4 mm of difference of skeleton and soft parts between the two halves of the face are to be considered without clinical significance);

-patients during growth;

-non syndromic patients;

-patients in good general health, oral and periodontal.

Exclusion criteria

- Adults subject ;
- Presence of premature contacts due to dislocation;
- Presence of cross-bite unilateral or bilateral;
- Presence of temporomandibular Mandibular Dysfunction clinically detectable;
- Presence or suspicion of malformation syndromes or paintings because of asymmetry;
- Previous orthodontic treatment;
- Presence of systemic comorbidities;
- Auto-immunologic acute and / or chronic dependents of the musculoskeletal system;
- Patients who have not provided the support for the deepening diagnostic;
- Total or partial lack of radiographic evaluations required and / or radiographs do not conform to the required standards.

Subjects who met the inclusion criteria and provided informed consent deepening diagnosis were subjected to the following diagnostic evaluations:

- history;
- extraoral physical examination;
- Intraoral physical examination;
- clinical and photographic evaluation of the asymmetry of the patient;
- Photographic evaluation of the asymmetry of the patient's mother;
- Photographic evaluation of the asymmetry of the patient's father;
- Teleradiography cephalometric analysis of the skull in lateral view;
- Teleradiography cephalometric analysis of the skull in Postero-Anterior projection;

MEDICAL STORICAL HOSTORY OF THE FAMILY

Each patient was subjected to a family medical history, physiological history, past medical history, next pathological history, past medical history and dental history pharmacology.

1 *Family history.* When he was asked if the patient and / or family members were suffering from systemic diseases such as hypertension, diabetes, immune system diseases, abnormal bleeding and allergic diathesis. Also investigated were all previous paintings morbid in the ascending and the patient's side, in order to reveal any hereditary disease (autosomal dominant, recessive and X-linked) and recognize special abnormal situations.

2 *History physiological*. Which is investigating the duration and the state of pregnancy, the type and the time of delivery, the type of breastfeeding, time of weaning, bad habits, trauma and physical, mental and motor development of the patient.

3 *History pathological remote*. He is asking the patient and / or the mother of the same, if you had never been treated for the following diseases: exanthematous diseases, bone diseases, myopathies, respiratory system diseases, viral infections, kidney diseases, hemorrhagic syndromes, pathologies gastrointestinal, allergic diseases, heart diseases and surgeries.

4 *History next pathological.* Reason for the visit and whether they recognized the parents in the child stretches of asymmetry in the face.

5 *History pathological dental remote*. Investigate the previous dental treatment and localization of any facial trauma.

6 *History drug.*

Physical examination extraoral

The extra-oral examination was performed during the patient's first visit.

Each patient was inspected in frontal vision that the patient was placed in an upright position, with the head looking straight ahead and the Frankfurt plane parallel to the floor; it is necessary at this stage, do not use light together, but rather take advantage of natural light to avoid false shadows that alter the extraoral appearance. From her face and taken hair they were moved (if long) behind the ears baring (can highlight asymmetries of the middle third of the face).

To assess facial symmetry lines of symmetry were evaluated:

In the vertical plane:

1 facial median line: passing through the glabella (G), the point subnasale (Subnas) and pogonion

Cutaneous (PGC).

2 internal intercantali Lines: loops to the inner voice and the distal end of the

wings of the nose.

3 vertical lines: loops to the medial border of the iris and the angle of the lip end rhyme.

4 external intercantali Lines: passing through the outside of the eye and the hand notch antegoniale.

The horizontal plane:

Line 1 eyebrows

Line 2 bipupillar

Line 3 of the wings of the nose

Line 4 of the oral rhyme

In a symmetrical face the vertical lines should be parallel to each other and the horizontal lines perpendicular to the midline. Furthermore, the three points of the median line of the face should be on the same axis.

To analyze the vertical proportions of the face, it must be divided into thirds by reference cutaneous points:

The third superor. trichion from the glabella.

The middle third: from the glabella to the point subnasale.

The lower third: from the point subnasale to menton skin. It can be further sudiviso in third: the mouth should stay at a third of the distance between the base of the nose and the chin.

The aspect ratio of height to width facial (facial index) establishes the general facial type and the basic proportions of the face.

The extra-oral clinical examination in frontal view is then integrated inspection in view from above and below to evaluate the asymmetry of the nose, cheekbones, lips, chin, and the bodies of the mandibular angle.

Followed the evaluation of extra-oral soft tissue in terms of tone and symmetry, palpation of the masticatory muscles and the examination of the smile.

Palpation of the masticatory muscles, in particular, the tone of the masseter muscle and the right temporal muscle with their left-wing counterparts both at rest and in contraction was compared.

Physical examination intraoral

It includes examining the hard and soft tissue tissues. In order they were evaluated:

the general healt of oral cavity, the presence of caries th, and the oral hygiene and the periodontics condiction.

Functional examination

Examination evaluated:

Breathing, swallowing, phonation, bad habits like the presence of finger sucking habit to bite the upper or lower lip, and nail biting habit to bite pens or pencils.

Following a dynamic scanning through the inspection assessment of mandibular movements (centric occlusion, mandibular movements and rest position) and A.T.M evaluation (position of the condyles in closed and mouth open, condylar movements and tenderness). In addition to the patient she was asked if there was a hand in which he chewed more frequently.

Photography Rating

During the patient's evaluation we were collecting a complete photographic documentation of the patient's face and the patient's mother.

The extra-oral photographs in both cases included:

Frontal photo with lips in the usual position, with lips at rest and smile, with horizontal tongue depressor to the level of the posterior dental sectors, and with the patient in the highest intercuspidation. Photos of right and left profile, and of three-quarters with lips in the usual position and also with smile.

It has been used a conventional picture of the face in frontal view, using a digital SLR camera (Nikon).

The patient and the patient's mother were photographed with the following features:

- head of the subject with the horizontal plane parallel to the Camper floor;
- teeth intercuspidation.

- hair from her face were moved and taken (if long) behind the ears baring (can highlight asymmetries of the middle third of the face);
- was removed all accessories (goggles, headband ..) that could interfere with the photographic image;
- the vertical orientation of the camera;
- the positioning of the camera perpendicular to the patient;
- the face size of the subject centered from top to bottom and from right to left;
- the distance between the camera and subject is 50cm;

Both the mother and the patient were applied inside the ear pavilion external two reference points: Disposable caps wax.

The frontal photos were shown, using AutoCAD, actual size, scale 1: 1, in order to re-evaluate the data obtained through aesthetic examination. On photographs of the face of all the subjects we have been identified the following anthropometric landmarks:

- Median line of the face, defined as the perpendicular to the interpupillary line.

- Points Ord and ORs (right ear, left ear) defined as points on the right and left outer profile of the subject's face, where a line joining the centers of the in-ear reference intersected the outer contour of the face.

- Points God and GOs (gonion right gonion left), defined as the points on the outer profile of the subject's face, intersected by the tangent lines of the center-ear references and the mandibular angle,

- Point MEc (menton skin), defined as the lowest point of the outer contour of the subject's face.

-Zy (Dx) / - Zy (left) defined as points located at the center of the outer edge zygomatic arch.

The differences between the items mentioned above and the midline were measured to evaluate any dysmetria and compared to the line that pass through the two pupils to assess any differences. For all measurements, values ??within 0 ± 3DS were considered not clinically significant (3 mm). Values ??less than 0 - 3DS were thought to indicate an asymmetry of the point to the right and values ??between 0 and + 3DS, an asymmetry of the point to the left. Therefore, it was considered "asymmetry" the deviation of at least one of the above points, between 4 and 9 mm. It is to emphasize how literature provides no upper limits to define mild to moderate asymmetry of the face. The reference of this research has been established by researchers on the basis of the experience clinical / diagnostic. In fact, on the basis of the collected data, it is believed that asymmetries exceeding 9 mm, although non-syndromic, require diagnostic work aimed at preventing borne comorbidities soft tissue and / or hard of the subject under examination face.

Statistical analysis conducted

The values ??of the individual variables examined (Zy (dx) / lms-Zy (left) / lms, Go (dx) / lms-Go (left) / lms, Go (dx) / lbp-Go (left) / lbp , mental line deviation) related to the children and parents, are the result of series of five linear measurements with a gauge.

The result of each series of measures is expressed in the form:

Result = (± Ax) units of measurement

where the most reliable value or probabilty, coincides with the arithmetic mean and the absolute error Ax with the standard deviation, or standard deviation, σ (square root of the variance σ2), defined as:

-(1)where the quantity is defined simple deviation and represents the distance from the average, a value of any of the distribution, xi. The total number of measurements made is indicated with n.

In (1) the sum of the squares of the deviations (numerator) is divided by n-1 and not for n. In this way you want to correct a tendency that would, dividing by n, to underestimate the scattering of the measurements, especially if their number is small. This trend is evident in the extreme case of n = 1, that is, the case where a single measurement is effected. In this case it would be that the average value is the only measurement made and the deviation would be zero. Would give the undefined result σ = 0/0 that highlights the complete inability to determine how they are distributed measurements, while dividing by n we would have the result σ = 0, which is absurd as it would lead to the conclusion that there are errors in the measurement.

Writing the outcome of a series of measures in the form () is meant to say that the probability that, repeating a single measurement, it is falling in the range of 68.3%.

In practice it is more significant, in order to determine the goodness or accuracy of a measurement, the concept of relative error, and the error percentage, x 100. Both, unlike the absolute which has the same unit of measurement of the analyzed variable, they are dimensionless. And 'evident that a measure is all the more accurate the smaller the percentage error. The results of measurements (for all variables covered) were plotted by the use of software Microcal OriginPro 8.0 as bar graphs.

During the frontal aesthetic examination it was

evaluated:

Inclination of occlusal plane compared to bi pupillary plane relationship between angle and gonial bipupillare plan.

The asymmetry and unevenness of the cheekbones, the jaw angles, and the orbits of the external ear.

In the pictures in frontal view with lips at rest vertical proportions we were evaluated by dividing it into three thirds of the face by straight lines the following horizontal lines:

the upper third: from the line through the trichion the eyebrow line.

The middle third: from the brow line to the line passing through the wings of the nose.

The lower third: from the line through the wings of the nose to the mental line. It can be further divided into an upper third, which goes from the line through the wings of the nose to the line of oral rhyme and two lower TEZI always delimited by the line of oral and mental line rhyme.

It was also conducted a carefully examination of Orthopanoramic, and cephalometric analysis on Latero-skull Lateral projection (TLL) and in Postero-anterior Projection.

Results

From the sample examined emerge the following data:

Sex. Of the 30 selected patients, 70% were female and 30% were male. This finding may indicate greater susceptibility of women to facial asymmetry with respect to the male sex. There is no evidence in the literature with respect to the correlation between sex and type of facial asymmetry.

Route of delivery. Of the 30 selected patients, 73% had a natural birth and the remaining 27% a cesarean delivery. Natural childbirth has a higher chance of complications compared to caesarean section. Among these complications there may be more pressure of a middle facial each other which led to an asymmetry at birth for greater malleability of the infant bones. In reality, however, precisely this greater malleability should lead to self-correction later. There is no evidence in the literature with respect to the relationship between mode of delivery and facial asymmetries.

Preterm births. 40% of the sample were born preterm. These individuals are more likely than those born at term to have problems during delivery, temperature control problems, metabolic.

B*irth trauma and impaired fetal posture .* The 30% of patients had birth trauma and impaired fetal posture. As described in the literature facial deformations may be caused by abnormal pressures onto the jaw due to the positioning of the fetus in the intrauterine space or at the time of childbirth. In particular, the fetus can be reclined so comfortable inside the mother's womb in which one leg or both are stretched along the body, carrying a foot to a side of the face and then forcing her head against the opposite shoulder. The juxtaposition of the chin on the shoulder can help develop clear asymmetry at birth but can self-correct 1-2.

Trauma borne on the craniofacial distirct. 17% of the sample suffered trauma of the cranio-facial region. Asymmetries can also be caused by trauma or mandibular fractures. In these cases, more fracture line is close to the head of the condyle,more it’s possible to have a modification of the mandibular growth process. The condylar fractures therefore, are those that most affect the symmetrical growth of the middle third of the face. A trauma to the condylar level generally leads to ankylosis of the temporo-mandibular region, resulting in a limitation of the function of the affected side and a stop of mandibular growth, with consequent alteration of the morphology and symmetry. The result is a midline deviation to the fractured side. According to Blackwood, following a crush injury of the condyle intra-articular hemorrhage and hematoma resulting as factors that predisposing to the development of ankylosis. In some cases the condyle fractured bone apposition can start a process for compensatory growth, leading to a mandibular deviation to the opposite side 3.

Breathing. 43% of the subjects had an oral breathing, 27% a mixed breathing and 30% a nasal breathing. A breathing pattern alterato4, such as oral breathing in place of the nasal, can change the lingual posture, mandibular and head. This in turn, may alter the balance of the pressures that develop on the jaws, the teeth and influence the position of the teeth and the growth of bone bases. The hypothesis of the nasal septum Scott JH. the 19535 is based on the role played by the cartilaginous structures of the skull and in particular that of the nasal septum during the embryo-fetal development and the possibility that they continue to direct and influence the craniofacial growth after birth. So an altered breathing pattern can affect the balance of the growth of the bone bases and therefore be a factor to consider in the development of facial asymmetry.

Swallowing and tongue posture. 53% of patients had an atypical swallowing and 57% a low posture of the

tongue. The tongue protrusion that occurs during the atypical swallowing is too short to be able to influence the position of the teeth and thus significant skeletal effects. On the other hand, if a patient has a tongue positioned before during rest, the duration of such pressure, though very slight, could affect the position of the teeth and dental arches. The growth of the jaw bones can be affected by a lingual improper posture.

Bad habits.

33% of patients had the bad habits. The duration of the forces exerted by muscles on the teeth and on the bases mascellari7 is biologically more relevant to its intensity. As for the finger sucking or pacifier use of the baby bottle or where the threshold value to determine dento skeletal abnormalities appears to be of 6 hours, most of the other bad habits has such a short duration that is unlikely to cause effects on the teeth , much less significant skeletal effects.

Chewing. 73% of patients had no preferential side during chewing. The pressure generated by masticatoria8 function is a potentially significant factor in determining the facial development for two reasons: (1) an increased use of the maxillary occlusal forces with heavier and longer may cause an increase in size of the jaws and dental arches or (2) less use of the jaws could lead to a development deficit of the dental arches, crowding and irregularities of the teeth. Thus favoring one side over the other during mastication may cause facial asymmetry.

Type of malocclusion. 30% had a first skeletal class, 60% a second skeletal class and the remaining 10% a third skeletal class. This finding is at odds with those reported by Chew et al who reported the presence of asymmetry in 35% of patients (n = 2012) affected by dentofacial alterations; the majority of patients had a III9 class. One explanation for this discrepancy may be provided by the fact that the Class III is more common in Caucasian and Asian populations is therefore reasonable to assume that there are more patients with asymmetry in class III with respect to the population of Western countries.

It is also true that in excess asymmetries the subject shows typically a Class III structure while the asymmetries by default show a first or a second skeletal class. So in this sample we have a greater number of defect for asymmetries.

M*olar and canine class.* 93% of patients had a class I or II molar and canine. Asymmetries by default have a molar ratio of Class I on the healthy side and Class II alter the side.

MId-Facial more developed and mandibular deviation. Based on the cephalometric tracing on the posterior-anterior and clinical and photographic analysis confirms carried out in asymmetric patients, it is determined the location and the side of the asymmetry: the more developed emivolto resulted in 57% the left (side right 47%) and 60% of the subjects had a mandibular deviation to the right (40% deviation to the left side).

This is in disagreement with the literature and that is that in cases of minor facial asymmetry, the right emivolto result usually wider than the left, and the chin is deviated to the left. This discrepancy is probably given by the number of the sample.

Rating more developed and the mandibular deviation of parents and the matching of lateral asymmetry between parent and child. 80% of female patients had the same hemifacial most developed of the father. In male patients there is this fundamental difference between mother and father.

The parents of 83% showed both a mandibular deviation, 10% had a mandibular deviation of only one parent and the remaining 7% in both parents was not present clinically significant mandibular deviation.

71% of female patients had the same side of the mandibular deviation of the father. In male patients there is a clear predominance of one parent over the other.

Asymmetries 1/3 average patient. 67% of the examined patients had at least one dependent asymmetrical segment 1/3 medium (cheekbones, ears, nose).

Asymmetries 1/3 average of the parents. 80% of mothers and 70% of fathers had at least one dependent asymmetrical segment 1/3 medium (cheekbones, ears, nose).

Conclusions

In the sample (n = 30) there is a significant correlation between facial asymmetry of the little patients and facial asymmetry of their parents. This shows the genetic predisposition of some individuals to develop asymmetric facial features, especially at the lower third level, because the growth of the mandible period is temporally longer.

By the examination of history of the patients's habits came out how theseenvironmental factors may be important in the etiology of facial asymmetries are better represented as a result of abnormal pressures that occurred during the fetal period and in the first

months of life. Further studies need to investigate all the factors within the etiopathogenesis of facial asymmetries.

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