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The Gonial angle relation with different dentitiontal status on orthopantomogram in iraqi sample

A project

Submitted to Collage of Dentistry, University of Baghdad. Department of Oral and Maxillofacial Radiology in fulfillment for the requirement to award the degree B.D.S

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Dedication

To my parents who were their for me in every step of the way with their have love and support…

To my supervisor for his guidance, help and endless support throughout this project…

Hadeer Majid Ali

Abstract

Background: Mandibular angle plays an important role in ensuring a harmonious facial profile from esthetic point of view so it is a representative of mandible morphology. Resorption of alveolar bone is the best recognized feature of mandibular aging in the edentate subjects and changes of the mandibular cortical shape and thickness may be used as indications to many abnormalities, such as osteoporosis. Panoramic radiographs are a useful tool for the measurement because majority of dentists request an Orthopantomogram for patients during routine dental examination.

The Aim of the study: to correlated the gonial angle relation with different dentitional status they are in three group dentulous, partial dentulous and edentulous using digital panoramic imaging system with age, gender and dental status.

Subjects, Materials and Methods: This study was conducted on 30 Iraqi in three group dentulous , partial dentulous and edentulous attending to the digital panoramic clinic of the hospital of college of dentistry university of Baghdad Information from each subject was recorded in a special case sheet. Subjects were divided into 3 study groups:

1.fully denated study group 10 subjects

2.Partially dentated study group 10 subjects

3.Edentulous study group 10 subjects Using digital panoramic image, the gonial angle were measured on left sides for 3 study groups The collected data were possessed and analyzed using storage Package of Statistical Science SPSS package program (version 13).

Results: The gonial angle was significant different in mean between complete dentition and edentulous (p-value 0.001) and between partial dentition and edentulous p-values 0.001) and between dentition and partial denition p-values 0.001 the angle size showed a highly significant between 3 groups

Conclusions: In this study, elderly edentulous subjects had larger gonial angle than did younger dentate subjects.

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Introduction:

Mandible is the largest and strongest bone of the face, serves for the reception of the lower teeth. It consists of a curved, horizontal portion, the body, and two perpendicular portions, the rami, which unite with the ends of the body nearly at right angles (***Gray, 2009***). Throughout one's lifetime, the mandible undergoes remodeling and morphological alterations occur in various areas of the mandible, including the gonial region, antegonial region, condyle and ramus. The word "gonion" is derived from the Greek word "ywvtx meaning angle. The gonial angle, also called mandibular angle or angle of jaw, is the angle at which the lower border of the mandibular body meets the posterior border of the ramus (***Ghosh et al.. 2009***). Goinal angle is particularly important in orthodontic research for understanding change during the developmental period. orthodontic studies have shown that the directions of the growth of condyls are correlated with goinal angle. Differences in gonial angle are not seen only during the growth period and between the genders but also exist among races. It plays an important role in ensuring a harmonious facial profile from an esthetic point of view so it is a representative of mandible morphology and its increase may cause the face to appear older (***Bayat et al.,2006; Giingor et al., 2007***). Different parts of the mandibular bone are exposed to changes by means of many factors. The values gonial angle tend to increase in both sides after tooth extraction also there is a continuous remodeling in the mandibular cortex with age and this is influenced by dental status and gender (***Ardakani and Niafar, 2004;Yanikoglu and Yilmaz, 2008; Dutra et al., 2004***) Height of mandible (indicative of mandibular bone loss) decreased both h age of subject and with time after extraction (***Bairam&Miller, 1994***). Resorption of alveolar bone is the best recognized feature of mandibular aging in the edentate subject (***Merrot et al 2005***) In edentulous patients, alveolar bone loss is a critical factor that affects denture retention, stability and masticatory function in addition to their use for Panoramic radiography is a radiographic procedure that produces a single image

of the facial structures including both maxillary and mandibular arches and their supporting structures. This additional information is possible because its coverage exceeds that of the conventional full-mouth survey .Studies indicate that panoramic radiographs, because of their increased coverage, reveal conditions that may otherwise remain undetected van der (***Poel et al, 1973; Goaz and White, 1987***). Panoramic radiographs are a useful tool for the measurement of gonial angle, which is an indicator of mandibular steepness and subsequently mandibular growth direction. The ability to determine growth direction from the orthopantomogram will be useful because majority of dentists request an OPG for patients during routine dental examination (***Alhaija, 2005***). Reliable measurement of individual gonial angles is difficult because of the superimposed images appearing on the lateral cephalograms, thus assessment of gonial angle from panoramic film was almost identical to that measured on the dried mandible (***Larheim and Svanaes, 1986; Cevlan et al, 1998***).

1.1. Mandible anatomy (Inferior Maxillary Bone):

Mandible is the largest and strongest bone of the face, serves for the reception of the lower teeth. It consists of a curved, horizontal portion, the body, and two perpendicular portions, the rami, which unite with the ends of the body nearly at right angles (***Palastanga et al.. 1994; snell, 2004***).

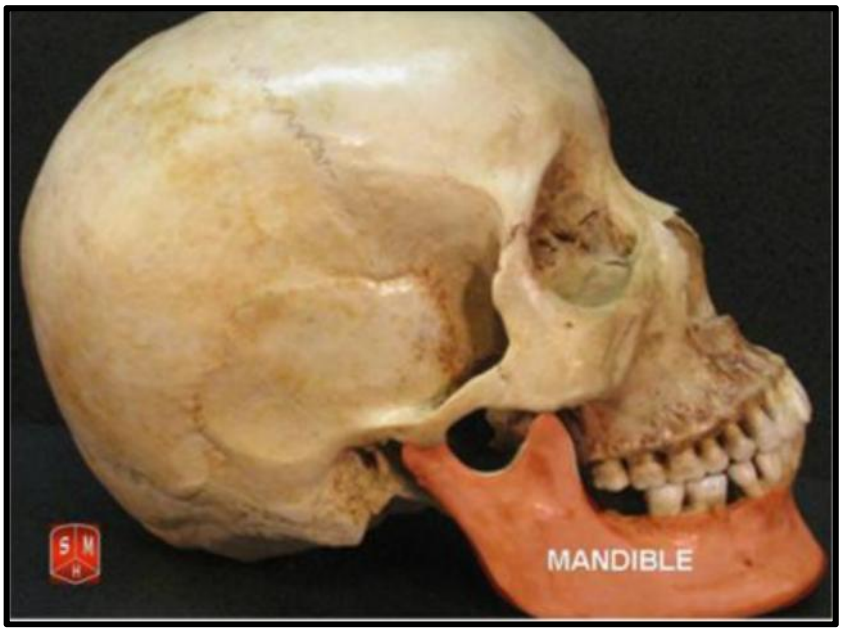

Fig (1.1): Mandibular bone (Anatomist ,2011)

1.1.1. Body (corpus mandibule):

The body is curved somewhat like a has two surfaces and horseshoe and two borders.

1.1.1.1. Surface:

The external surface is marked in the median line by a faint ridge. indicating the symphysis or line of junction of the two pieces of which the bone is composed at an early period of life. This ridge divides below and encloses a triangular eminence, the mental protuberance, the base of which is depressed in the center but raised on either side to form the mental tubercle. On either side of the symphysis, just below the incisor teeth, is a depression, the incisive fossa, which gives origin to the Mentalis and a small portion of the orbicularis oris.

Below the second premolar tooth, on either side, midway between the upper and lower borders of the body, is the mental foramen, for the passage of the mental vessels and nerve. Running backward and upward from each mental tubercle is a faint ridge, the oblique line, which is continuous with the anterior border of the ramus; it affords attachment to the Quadratus labii inferioris and angularis; the Platysma is attached below it.(***Snell,2004; Jahan-Parwar,2005***) The internal surface is concave from side to side. Near the lower part of the symphysis is a pair of laterally placed spines, termed the mental spines, which origin to the Genioglossi. Immediately below these second pair of spine, or more frequently a median ridge or impression, for the origin of the geniohyoidei. In some cases the mental spines are fused to form a single eminence, in others they are absent and their position is indicated merely by an Irregularity of the surface Above the mental median foramen and spines a furrow are sometimes seen; they mark the line of union of the halves of the bone. Below the mental spines, on either side of the middle line, an oval depression for the attachment the anterior belly of the Digastricus. Extending upward and backward on either side from the lower part of the symphysis is the mylohyoid line, which gives origin to the Mylohyoideus; the posterior part of this line, near the alveolar margin, gives attachment to a small part of the Constrictor pharyngis superior, and to the pterygomandibular raphé. Above the anterior part of this line is a smooth triangular area against which the sublingual land rests, and below the hinder part, an oval fossa for the submaxillary gland (**Gray, 2005: Jahan-parwar, 2005**)

1.1.1.2 Borders:

The superior or alveolar border, wider behind than infront, is hollowed into cavities, for the reception of the teeth these cavities are sixteen in number, and vary in depth and size according to the teeth which they contain. To the outer lip of the superior border, on either side, the Buccinator is attached as far forward as the first molar tooth. The inferior border is rounded, longer than the

superior, and thicker in front than behind; at the point where it joins the lower border of the ramus a shallow groove; for the external maxillary artery, may be present (***Gray,2005***)

1.1.2. The ramus (ramus mandibule perpendicular portion)

The ramus is quadrilateral in shape and has two surface, four borders, and two processes

1.1.2.1. Surfaces: The lateral surface is flat and marked by oblique ridges at its lower part: it gives attachment throughout nearly the whole of its extent to the Masseter. The medial surface presents about its center the oblique mandibular foramen, for the entrance of the inferior alveolar vessels and nerve. The margin of this opening is irregular, it presents in front a prominent ridge, surmounted by a sharp spine, the lingula mandibulae, which gives attachment to the sphenomandibular ligament, at its lower and back part is a notch from which the mylohyoid groove runs obliquely downward and forward, and lodges the mylohyoid vessels and nerve. Behind this groove is a rough surface, for the insertion of the Pterygoideus intemus. The mandibular canal runs obliquely downward and forward in the ramus, and then horizontally forward in the body, where it is placed under the the alveoli and communicates with them b small openings. on placed arriving at the incisor teeth, it turns back to communicate with the mental foramen, giving off two small canals which run to the cavities containing the incisor teeth. In the posterior two-thirds of the bone the canal is situated nearer the internal surface of the mandible: and in the anterior third, nearer its external surface.

It contains the inferior alveolar vessels and nerve, from which branches are distributed to the teeth. The lower border of the ramus is thick, straight, and continuous with the inferior border of the body of the bone. At its junction with the posterior border is the angle of the mandible, which may be either inverte or everted and is marked by rough, oblique ridges on each side, for the attachment of the Masseter laterally, and the Pterygoideus internus medially; the

stylomandibular ligament is attached to the angle between these muscles. The anterior border is thin above, thicker below, and continuous with the oblique line. The posterior border is thick, smooth, rounded, and covered by the parotid gland. The upper border is thin, and is surmounted by two processes, the coronoid in front and the condyloid behind, separated by a deep concavity,the mandibular notch (***Netter,1989;Gray,2005***).

1.1.2.2. Processes:

Coronoid Process: (processus coronoideus) is a thin, triangular eminence, which is flattened from side to side and varies in shape and size. Its anterior border is convex and is continuous below with the anterior border of the ramus; its posterior border is concave and forms the anterior boundary of the mandibular notch. Its lateral surface is smooth, and affords insertion to the Temporalis and Masseter. Its medial surface gives insertion to the Temporalis, and presents a ridge which begins near the apex of the process and runs downward and forward to the inner side of the last molar tooth. Between this ridge and the anterior border is a grooved triangular area, the upper part of which gives attachment to the Temporalis, the lower part to some fibers of the Buccinator (***Gray, 2005: Snell, 2007***).

Condyloid Process (processus condyloideus) is thicker than the coronoid, and consists of two portions: the condyle, and the constricted portion which supports it, the neck the condyle presents an articular surface for articulation with the articular disk of the temporomanibular joint it is convex from before backward and from side to side, and extends farther on the posterior than on the anterior surface. Its long axis is directed medial ward and slightly backward, and if prolonged to the middle line will meet that of the opposite condyle near the anterior margin of the foramen magnum. At the lateral extremity of the condyle is a small tubercle for the attachment of the temporomandibular ligament. Neck is flattened from before backward, and

strengthened by ridges which descend from the forepart and sides of the condyle . Its posterior surface is convex; its anterior presents a depression for the attachment of the Pterygoideus externus. Mandibular notch, separating the two processes is a deep semilunar depression, and is crossed by the masseteric vessels and nerve (***Gray, 2005; Snell,2007***).

1.1.3.Ossification:

The mandible is ossified in the fibrous membrane covering the outer surfaces of Meckel's cartilages. These cartilages form the cartilaginous bar of the mandibular arch and are two in number, a right and a left . Their proximal or cranial ends are connected with the ear capsules, and their distal extremities are joined to one another at the s by mesodermal tissue. They run forward immediately below the condyles and then, bending downward, lie in a groove near the lower border of the bone; in front of the canine tooth they incline upward to the symphysis. From the proximal end of each cartilage the malleus and incus, two of the bones of the middle ear, are developed; the next succeeding portion, as far as the lingula, is replaced by fibrous tissue, which persists to form the sphenomandibular ligament. Between the lingula and the canine tooth the cartilage disappears, while the portion of it below and behind the incisor teeth becomes ossified and incorporated with this part of the mandible (***Gray, 2009***).

Ossification takes place in the membrane covering the outer surface of the ventral end of Meckel's cartilage and each half of the bone is formed from a single center which appears, near the mental foramen, about the sixth week of fetal life. By the tenth week the portion of Meckel's cartilage which lies below and behind the incisor teeth is surrounded and invaded by the membrane bone. somewhat later, accessory nuclei of cartilage make their appearance, viz., a wedge-shaped nucleus in the condyloid process and extending downward through the ramus; a small strip along the anterior border of the coronoid

process; and smaller nuclei in the front part of both alveolar walls and along the front of the lower border of the bone. These accessory nuclei possess no separate ossific centers, but are invaded by the surrounding membrane bone and undergo absorption. The inner alveolar border, usually described as arising from a separate ossific center (splenial center), is formed in the human mandible by an ingrowth from the main mass of the bone. At birth the bone consists of two parts, united by a fibrous symphysis, in which ossification takes place during the first year (***Foster, 1990; Gray, 2009***).

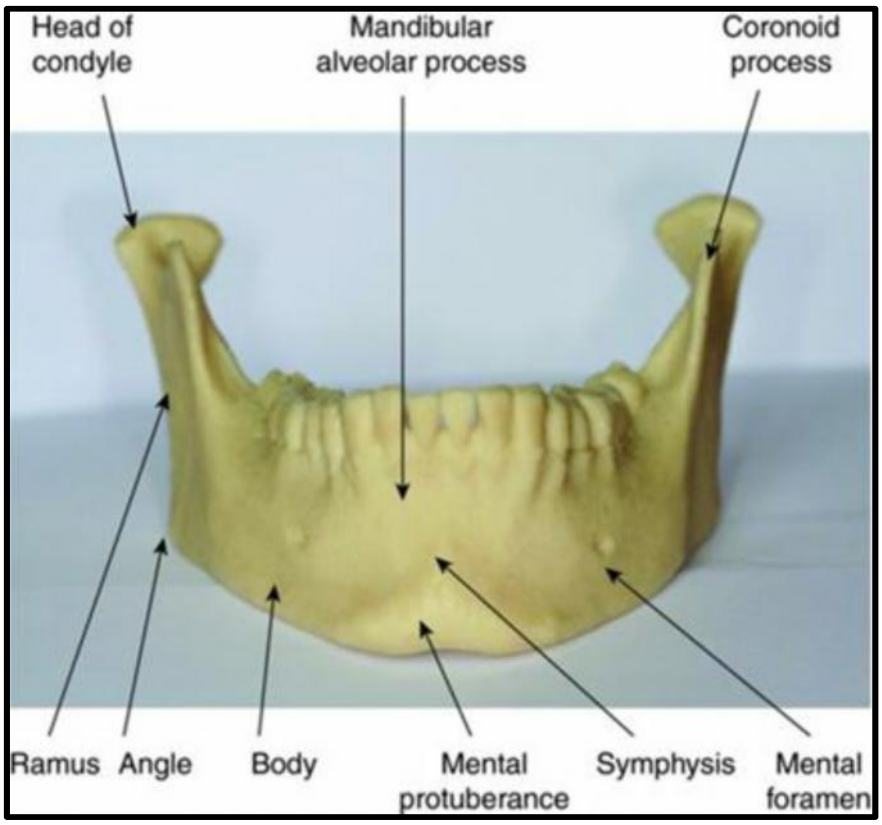

Fig (1.2):Mandible anterior view(Hollins,2012)

1.2. Gonial angle: The external gonial angle is an important angle of the craniofacial complex. It is significant for the diagnosis of craniofacial disorders (***Shahabi et al., 2009***) as Fig (1.3)

Fig (1.3): Angle of the mandible (Amanda,2015).

1.2.1. The effect of age, gender and dental status on gonial angle size:

for the growth in orthodontic Measurement of gonial angle GA is important researches, the degree GA shows change during growth process, and when of with females having the growth slight sexual dimorphism appears ceases a higher degree a study of 267 panoramic radiographs of Turkish adults with no craniomandibular disorders, orthodontic history or treatment they concluded that there were no significant difference between right and left GAs of the individuals but there was a significant difference at the left GA between genders Lonberg (1951) reported a study on 2 groups with and without teeth at the age of 24 and 72 years using cephalograms. He found that in the 24 years group subjects with teeth had smaller GA than those without teeth Lin and Hung (1997) investigated the change of GA with respect to the age and gender of 1009 chinese adult subjects (505 female and 504 m ages ranging from 20 to 90 years using lateral cephalometric radiographs .They concluded that the female GA was larger than the respective male Furthermore in both genders no

statistical difference could be found in the size of GA at different age groups. In 1999, a study done by ***ohm*** and ***silness*** to demonstrate the variables often related to the development of the size of GA, e age, degree of tooth retention and gender. The size of the GA was measured in cephalograms of 431 Norwegian adults. The average age for 220 female was 51 6t20-6 years (range 20-90 years) and for 211 males 49.8 19.4 years (range 18-86 years).

They GA found that the number of teeth had a decisive influence on the size of the The correlation coefficients between size of the angle and age stated that age explained approximately 8-16 of the variation of the angle through its relation with age. Gender differences in age and size of the angle were not statistically significant in relation to degree of tooth retention during this study ***Xie and Ainamo (2004)*** evaluated the GA size with cortical thickness at the angle and height of mandibular residual body of 356 panoramic radiographs of 3 groups of subjects, the young dentate group; the older dentate group and the elderly edentulous group mean age of the whole study sample was ranged from 27-80 years. They found difference in size of the angle between dentate male and female young ps05, in older dentate group <.001) but not between elderly edentulous male and female also the angle size was negatively related to cortical thickness at the GA only among 76-year-old edentulous female (p<.01) and was associated with average height of the mandibular residual body in the edentulous male and female (p<.01).No association existed between angle size and duration of edentulism. Elderly edentulous subjects had larger GA than did dentate subjects as shown in fig (1.4).

Fig (1.4):The gonial angle in panoramic radiography T1 :posterior tangent, T2 inferior tangent,GA:gonialangle,H:headofcondyle,MN:mandibularnouch,CP:coronoidprocess,A R:ante riorrim of the ramus,PR:posterior rim of the ramus.(Shilpa,2014)

In ***2010, Humane et al***. evaluated the association shape of mandible (ie.GA, ramus height and condylar height) in subjects aged 60 years and older. A total of 1056 subjects (667dentate, 389 edentulous: the number of female was 554 and male was 502) The GA of the mandible mandibular and condylar height were measured using panoramic radiographs. In edentulous subjects, the angle was significantly larger (ps0.001) while the ramus and condylar height was significantly smaller on both sides compared with dentate subjects. Female had a significantly larger angle ($p<0.001$), smaller ramus and condylar height on both sides compared to male ***Mattila et al***. In 1977 done a study to compare the size of the GA obtained from both orthopantomograms and lateral cephalograms .601 patients aged from s to 20 years while the gender of the patient was not taken into consideration as only the exposure procedures were to be compared .The study demonstrated that the size of the GA could be determined from the orthopantomogram with the same degree of accuracy as from the generally used lateral cephalogram. It also showed that the right and left GAs could be quite easily determined individually from orthopantomograms thus avoiding the disturbing influence of the superimposed images found on lateral cephalograms and proved conclusively that the

orthopantomogram is the more obvious choice for determination of the GAs. On comparison between lateral cephalograms and panoramic radiographs for determination GA a study done by ***Shahabi et al***. in (2009) to compared of the external GA of 70 adult Iranian patients(48 females and 22 males) with Angles class 1, their age ranged from 15-30 years. They concluded that panoramic radiography could be used to determine the GA as accurately as a lateral cephalogram in addition to both right and left GAs of a patient without interferences due to superimposed images of anatomical structures in a lateral cephalogram therefore determination of the GA, panoramic radiograph might be a better choice than lateral cephalogram.

in 2008, Sakar et al. investigated the relationship between mandibular ridge resorption and the size of the GA of 158 panoramic radiographs of edentulous Turkish subjects and they showed that females had wider GAs and more alveolar ridge resorption compared to males. However, there was no and mandibular ridge statistically significant correlation between the GA s resorption level To investigate the correlation of GA with condylar and ramus heights in addition to estimate of electromyography (EMG) activity of masseter muscle a study done by Raustia and Salonen in (1997), 30 complete denture wearers (18 female, 12 male) coming for renewal of their dentures were measured using panoramic radiographs. The mean period of edentulousness was 26 years (range 10-53 years .They found no statistically significant difference between genders in sizes of GAs, condylar and ramus heights although right GA was statistically significant smaller than left one and correlated negatively with the ramus height in both sides but positively with the increased (EMG) activity in the right masseter muscle also the size of the GA, condylar and ramus heights did not correlate with the age of the patients, edentulous period or alveolar ridge resorption To examine the relationship of GA size with dentate status Casey and Emrich in 1988 done a study to compare the GA in edentulous male individuals who had never worn dentures with the angle in individuals with a nearly intact

mandibular dentition, 68 angles were measured on 34 radiographs. They showed widening of the angle in edentulous and the mean size of angle was 2.4 larger for the edentoulus group Engstrom et al. (1985) compared the w angle sizes in two groups one of them with total loss of teeth and the other group who were in possession of all teeth using cephalograms. They concluded that a larger angle was found in edentulous subjects than in subjects i possession of all teeth.

Vanikoglu and Yilmaz the GA measurements of 20 (2008) evaluated e range from 40-70 years and 9 female, age male, It Turkish patients (rang from 42 65 years) by using panoramic radiographs to assess difference edentate state-with dentures. Panoramic radiographs were from dentate state to h while the patients were dentulous and in the first month, six month. first year and third year after tooth extraction and wearing dentures after a 2-3 month healing period. Difference in the size of the angle was found for both sides between continuous measurements and values tend to increase in both sides after tooth extraction. After wearing denture for 3 years, a statistically significant decrease was found in the GA values according to the edentulous state .05) Changes in the antegonial, antegonial depth and GA in edentate and dentate patients were found in a study done by Yang et al. in 2009 to examine panoramic images of 312 grouped into four 0-year age groups (by decades) The youngest age group was (40-49) years and the oldest (70-79) years. They found no significant differences of GA regarding age, gender and edentulism where as the antegonial region had a resorptive pattern in the edentulous mandible therefore morphology of the antegonial region was influenced by gender and dental status. To demonstrate the relation between the GA & height of mandible at incisor area & body, an anthropometric study to investigate the mandible done by antero-posterior and lateral radiograph of both dentate and edentate subjects older than 70 years subjects did not show any maxillo-mandibular dysmorphosis.

This study showed that increase in the mandibular angle, diminution in the height of the mandibular incisor and height of the mandibular body in edentate subjects (***Merrot et al.. 2005***). The relationships of age, gender, gonial angle, ramus length and the temporomandibular opening index TOI were evaluated by Moipolai et al. in 2003 for 42 subjects (24 female and 18 male, age ranged from 12-68.

years regression analysis showed that the TOI was dependent on gender Linear ($p<0.644$),GA (p 0.327), ramus length (p 0.248) and age (p 0.690),therefore they found that it's better to measure the mandibular movement through a study of the effect of the GA ,ramus length, age and gender on the temporomandibular opening index. Also developmental position of lower third molar in relation to GA and lower second molar was investigated by ***Altonen et al.***in 1977 reported that 649 subjects aged (5-19) years with orthopantomograms measurement revealed that the GA decreased with age this decrease was more rapid before the age of puberty than after it the decrease in the GA was not continuous but slight enlarging occurred between the age groups 5-6 and 7-9 as well as 15-16 and 17- 18. The angulation of the third molar in relation to the second molar did not correlate with size of the GA but decreased with age, it creased more rapidly after the age of puberty than before it, the mesial angle between the longitudinal axis of the second molar and the mandibular base line correlated highly significant with the size of the GA.

1.3. Osteoporosis:

disease characterized by lo osteoporosis is a chronic systemic skeletal bone mass and micro-architectural deterioration resulting in increased bone fructure (***Anonymous, 1991: Reddy et al.. 2008***). The World Health organization (wHo) has defined osteoporosis based o normal bone mineral density (BMD) (***Reddy et al., 2008***). The primary reasons for developing this condition include poor bone acquisition during growth and accelerated bone loss during aging and both of these processes are regulated by environmental

and genetic controls. Loss of bone mass can be due to a combination of hormone deficiency, poor nutrition, decreased physical activity and various pharmacological agents (***South-Paul 2001***).

One of the defining features of osteoporosis is reduced bone mass. In normal individuals bone mass increases during skeletal growth to reach a peak between the age of 20 and 25 years, but falls the in both sexes, with an accelerated phase of more rapid bone loss in women due to the effects of estrogen deficiency at the menopause. The loss of bone Review of Literat when bone resorption mass is One possible hypothesis formation (***Haslett et al, 2005***) system that controls normal aging adaptation to mechanical mediate the process. Changes may occur in the response to mechanical paired production of local factors that is the most stress (***Rais and Rodan, 2003***). health problem common metabolic disease and presents a major public and Asian among the elderly, especially among postmenopausal Caucasian women (***Mohammad et al., 1999***). The disease affects the women because estrogen receptors on the bone resorbing osteoclasts recognize the estrogen and respond by increasing th (McBe receptors on the bone forming et al, 1994), Although osteoblasts also recognize the paucity of estrogen (***Looker et al.. 1995; Richard et al.. 1999***). ***pster and Lindsay, 1993***; Thus, during the skeleton's remodeling process, the rate of trabecular (cancelous) and cortical bone resorption exceeds that of trabecular and cortical bone formation. During this postmenopausal osteoporotic process, women lose 30-50% of the trabecular bone and 25-35% of the cortical bone mass that was present during the peak bone mass years between ages 20 and 30 years (***Morse et al., 1994***). Bone loss is most rapid in early menopause, followed by a slowing 8-10 years after the last menstrual period. The disease results in more than 40% of postmenopausal women experiencing a fractured bone sometime during the rest of their lives (***Genant et al., 1998***).

Aging is associated with resorption bone and an increased risk of oral and systemic bone resorption. Osteoporosis and osteopenia are characterized by resorption of bone and may lead to skeletal fragility and fracture. Studies to date indicate a possible correlation between systemic and oral bone resorption. Oral signs of osteoporosis include loss of teeth due to resorption of tooth supporting include loss of teeth due to alveolar bone alveolar bone of the jaw thought to undergo Because and loose teeth may be resorption prior to other bones, changes in jaw structure 2005) early signs orosteoporosis (***DE Paola et al 1999; Jeffcoat:1993***), osteoporosis i no Once though o be a natural part of aging among women, ions and at a longer sidered age or gender dependent It occurs in ages. Starting in midlife,men and women experience an age-related decline in bone density. Women experience more rapid bone loss in the early years following menopause, which places them at earlier risk for fractures. Men and pos enopa sal women with osteoporosis more commonly have secondary uses for the bone loss than do postmenopausal women. Reduction in estrogen production with menopause is the major cause of bone density loss during later lito. Timing of menarche, absent or infrequent menstrual cycles and the timing of menopause influence both the attainment of peak bone mass and the preservation of bone density (***National Institutes of Health, 2000***). Normally there is a decrease in bone mass after the age of 35-40 years. In persons with osteoporosis; bone loss is characterized by accelerated loss of calcium from bones without sufficient replacement (***Murray and Pizzorno, 1991***), Many women mistakenly believe that osteoporosis is something they need be concerned about only after menopause; however, recent evidence indicates that osteoporosis often begins early in life and is not exclusively a postmenopausal problem (***Balch and Balch, 1997***). The percentage of women who have osteopenia (a bone density that i somewhat low) depends on age, race and use of hormones. By definition, 16% of white women aged (20-29) years have osteopenia and less than 1% has osteoporosis.

Currently about 38% of women aged 65 have osteopenia years and 20% have osteoporosis. By age 80 years, only 15% of women still have normal bone density and those with are above average for the age penia (***Kanis et al., 2002***). The bone mass attained life early in is perhaps the most important determinant of life-long skeletal health. A woman has lost half of all the spongy bone (spine, wrist) she'll ever lose by the age of 50 years, but very little of the dense (hip, hand, forearm) bone. Attention to bone formation at every stage of life vital there is no time when woman is too old to create healthy new bone (***Weed, 1992***) If exercise and food rich in calcium are presently part of your lifestyle, you may have lost only a little bone-mass. If you are sedentary and regularly ingest foods that interfere with calcium absorption (such as coffee, soda pop, alcohol, white flour products, processed meats, nutritional yeast and bran, oxalic acid, phytates and phosphorus) you may have lost a lot of bone (**Weed, 1992**).

1.3.1. Anatomical changes in osteoporotic bone:

osteoporosis is a bone disease that causes bones to weaken as well as increase the risk fracture of bones which is a result of both trauma and decrease bone strength as bone strength depends on both the density (quantity) and quality of bone (***walker, 2009***) as Fig(1.5)

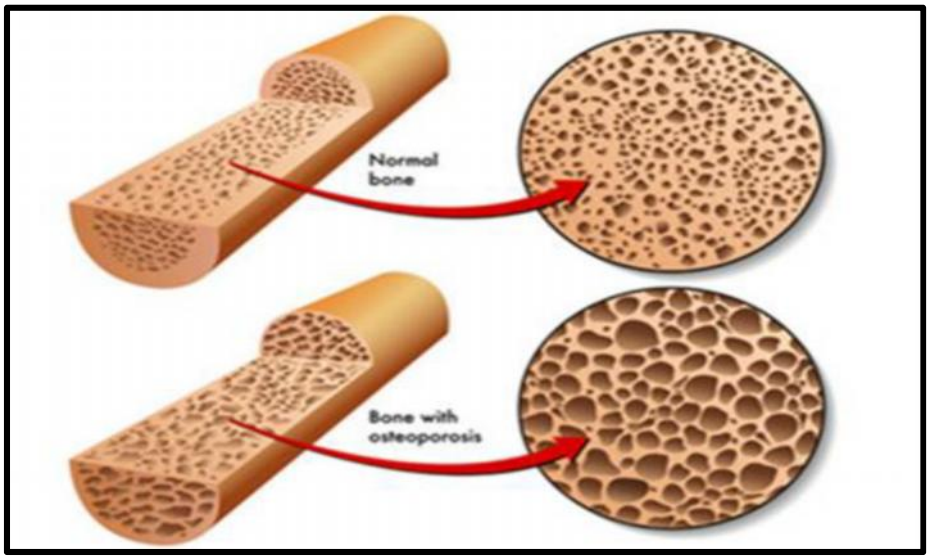

Fig (1.5):Difference between normal and osteoporotic bone (Daniel Macris, 2015)

1.3.2: Type of osteoporosis:

Many physicians classify osteoporosis as Primary (Type I) or Secondary (Type Primary osteoporosis is the deterioration of bone mass occurring as a result of menopause or the aging process. Primary osteoporosis is more common and accounting for approximately 80% of cases of osteoporosis in women. Early menopause or premenopausal estrogen deficiencies can accelerate the development of primary osteoporosis (***Templeton, 2005***).

Estrogen and progesterone are two hormones that play important roles in Estrogen controls the osteoclasts g the rate at which bone is lost. (breaks bone down and progesterone influences osteoblasts to make new bo Other hormones are important too (***Dawson and Spinasanta, 2008***). Secondary osteoporosis is less common and can arise as a consequence of many variables, including: lifestyle factors eating disorders, smoking and alcoholism disease processes (e g., endocrinopathies, gastrointestinal tract disease and hepatobiliary disease), organ dysfunction and neoplastic conditions, or as th result of treatment of these (e.g., corticosteroids and chemotherapeutic agents) and other conditions. Because of improved diagnosis and treatment, patients with chronic and life-threatening conditions are surviving longer. This improved survival has led to increased recognition of the long-term effects of these conditions and their treatments on bone. When present in young patients, secondary osteoporosis can interfere with development of peak bone mass increasing the risk of future fracture, while in older adults, the rate of physiologic bone loss is enhanced. Although osteoporosis in postmenopausal women is usually linked to their hormonal status, secondary causes are now being identified more often. As is true of the primary disease, secondary osteoporosis is frequently diagnosed after the patient has sustained a fracture Templeton, 2005). The osteoporosis is found in sedentary or immobilized individuals and in patients on long term steroid therapy (***Farman et al., 1993***) The most common medication-related inducement of osteoporosis is long-term use of glucocorticoids, which is

associated with suppression of osteoblastic activity. Other contributing factors include prolonged periods of inactivity or immobilization, inadequate calcium intake and alcohol and tobacco abuse (***Cummings et al., 1995; Kanis and McCloskey, 1998: odan and Martin, 2000***).

Secondary osteoporosis be caused by certain medical conditions and medications that can disrupt bone reformation (***awson and spinasanta, 2008***) If women are past menopause, undergoing chemotherapy or radiation treatment, or have chronic diagnosed back pain, make an appointment to see the ssential to prevent osteoporosis-related fractures doctor. Early treatment is (***Walker, 2009***).

1.3.3Sign & Symptoms of osteoporosis:

osteoporosis is sometimes called "the silent disease" and with good reason Early disease there may be no symptoms. Many patients only begin to in the suspect something is wrong when dull bone or muscle pain develops in the low back or neck and as time passes, sharp pain may develop suddenly and last for several months.

As osteoporosis progressively robs bone density or core bone strength, the risk for fracture increases and the wrists, hips and spine are common fracture sites. If left undiagnosed and untreated, osteoporosis can cause sudden and painful spinal compression or fractures and such fractures may cause a loss in height (***Walker, 2009***) Osteoporosis can lead to pain, especially in lower back and it can also result in pathologic fracture, loss of physical stature and severe kyphosis (***Farman and Nortje, 2004***) spine to curve Those spinal compression fractures may also cause the upper curve is or forward. This forward curve is called kyphosis. A very severe forward called hyperkyphosis. In serious cases of spinal osteoporosis, the nervous system is affected and she may experience numbness, tingling, or weakness. If woman has severe kyphosis, she may also experience difficulty in walking and problems with balance, which means she is at increased risk of falling and breaking other bones, such as the hips (***Walker, 2009***).

1.3.4 Risk factors of osteoporosis:

Patients with decreased bone density usually have no specific abnormal physical findings. However, there are predictors that may help assess a person's risk f developing osteoporosis as well as risk for bone fracture. both trauma and decreased bone strength as bone strength depends on the density (quantity) of the bone and on the quality of the bone (***Walker 2009***).

1.3.4.1Risk factors for primary osteoporosis:

Postmenopausal osteoporosis is the most common form of osteoporosis, and risks associated with low bone density are supported by good evidence including large prospective studies. Predictors of low bone mass include: Gender Ethnicity Low body weight Family history of osteoporosis Alcohol and caffeine o History of prior fracture Menopausal status and aging Smoking.

1. Gender: Women are simply more likely to develop osteoporosis (**Me bean et al., 1994: Lane, 2006; Walker, 2009**).

2. Ethnicity: Osteoporosis is more common among postmenopausal Caucasian and Asian women (**Cummings et al., 1995; Mohammad et al., 1996: Kanis and McCloskey, 1998; Lane, 2006**). White and Asian people are more likely to be affected by osteoporosis the black or Hispanic people, but this does not mean that black or Hispanic people are not at risk (**Walker 2009**).

3. Law Body Weight: Petite and small boned women have less bone mass to begin with, so they need to be particularly vigilant about their bone health (**Cummings et al. 1995: Kanis and McCloskey. 1998; Lane, 2006: Walker, 2009**).

you're 4.Family History: If someone in your family has or had osteoporosis, more at risk (***Cummings et al 1995: Kanis and McCloskey, 1998 Walker, 2009***). Alcohol and caffeine: Use of 5.alcohol and caffeine-containing beverages is inconsistently associated with decreased bone mass. In contrast, some measures of physical function and activity have been associated with increased bone mass, including grip strength and current exercise.

A lot of alcohol-abusing it can lower the calcium supply and how efficiently the body uses calcium, also too much caffeine limits how well the body absorbs calcium (**Cummings et al 1995: Kanis and McCloskey, 1998; Lane. 2006: Walker, 2009**). Also, the adequate calcium, vitamin D and minerals intake are the key- nutrients for optimum bone health and the inadequate 6 intake of them will affect the bone health (**Kaye, 2007**).

5. History of prior fracture: If there was a history of broken bones, the could be more at risk for osteoporosis because the broken bone probably lowered the bone mineral density (BMD) (**Walker, 2009)**

6. Menopausal status and aging: At birth ovaries containing more than 2 million primordial follicles, each containing single ovum, during the reproductive years (between 13 and 46 years of age) more than 299000 of these follicles degenerated steadily and the remaining 400 or so follicles mature into vesicular follicles and expe an ovum each month under the influence of various hormones (ovulation) approximately every 28 days (***Friedlander, 2002***).

Smoking: Bone is a living tissue dependent on the functions . When the systems are not a perform normally, bone is unable to rebuild itself. The formation of bon is particularly influenced by physical exercise and hormonal activity, both of which are adversely affected by cigarette smoking; many smokers have le physical endurance than non-smokers, mainly due to decrease lung function. Cigarette smoking reduces the amount of oxygen in the blood and increases die level of harmful substances, such as carbon monoxide. This combined with the effects of smoking on the heart and blood vessels could limit the benefits from physical activity (***Davidson, 2007***). One of the contributing factors for the bone loss is the cigarette smoking (***Cummings et al., 1995; Kanis and MeCloskey, 1998***). There is experimental evidence to suggest that nicotine as well as cigarette smoke had detrimental effects on bone cells and osteoprogenitor cells (***Liu et al. 2001, 2003; Walker et al. 2001, Akmal et al. 2004, oda et al. 2004***). Also it's further realized that several other agents in

Cigarette smoke may exert a toxic action on bone cell metabolism causing retardation or obstruction of regenerative functions, such an action would lead to an imbalance between build-up and breakdown functions (***Baljoon et al. 2005***). Smoking leads to an increased risk for osteoporosis. The tobacco in cigarettes decreases bone density because it adversely affects the bone cells. more cigarettes used in life time, the higher fracture rise when the person get older (***Walker, 2009***). smoking is considered as a risk factor for developing osteoporosis (***Cooper and Melton, 19%: South-Paul, 2001***).

1.3.4.2 Risk factors for secondary osteoporosis:

Common forms of osteoporosis unassociated with other diseases include idiopathic, postmenopausal and senile osteoporosis. All other causes of accelerated bone loss should be ruled out before a diagnosis of osteoporosis is made. Some other factors that may cause accelerated bone loss. (***Murray and Pizzorno, 1991***).

1.4 Mandibular bone resorption:

Bone resorption in the oral cavity may occur due to many causes, including , local or systemic alterations in the host response, or multifactorial causes (***Jeffcoat, 1993***).

Aging is associated with resorption bone and an increased risk of oral and systemic bone resorption. The factors influencing bone resorption in young adults are primarily those of traumatic and inflammatory nature, with pressure, tension, stress, and nutrition playing the dominant part. Control of resorption for this age group can be managed effectively by sound prosthetic procedures an adequate dietary measures (***Jeffocat, 2005***). The rate of resorption and total amount of bone removed vary from individual to individual, within the same individual at different times as well as even at same time in different parts of the ridge (***Carlsson and Persson, 1967 Atwood, 1971***).

1.4.1 The effect of age, gender and edentulism on mandibular bone resorption:

to evaluate the rate of residual ridge resorption in relation to different factors a study done by ***Kovacia et al. in 2003***, the lateral cephalograms of 50 complete denture wearers were analyzed in 5 different regions of both jaws during a one year period. The factors included were: body mass index, gender, age, time of edentulousness, number of previous dentures, night-time denture wearing, period of postmenopause in women, surface of denture bearing area and place of last extraction and revealed that the only statistically significant factors contributing to RRR were the period of edentolousness and number of previous dentures ($p<0.05$) To compare the measurement of vertical heights of maxilla and mandible between elderly dentate and elderly edentate a study done by ***Xie et al. in 1997***, vertical height measured on panoramic radiographs for (91 elderly dentate subjects, 177 elderly edentate subjects) Significant differences in heights of the mandibular body and maxilla were found between the dentate and the edentulous (P 0,001).

Saglam in 2002 assess the differences in measurements between dentate and edentulous jaws to determine the variation in maxillary and mandibular (96 vertical measurements. Panoramic radiographs of 192 alveolar ridges dentate and 96 edentulous for both gender) were examined. The mean ages of the dentate and edentulous groups were 51.05 and 59.89 years, respectively. Measurements were made from reference lines drawn from anatomic landmarks. In the dentate group, there was no statistically significant difference between male and female in the height of the maxilla, however, the height of the mandible was significantly greater in male than in female while in the edentulous group the heights of maxilla at the anterior and first premolar regions and the mandibular heights were significantly greater in male than in female therefore there are differences between the gender in alveolar ridge resorption after tooth loss In ***1996, Soikkonen et al***. Investigated alveolar

atrophy and its relation to osteopenia of the mandible of 124 edentulous (32 males and 92 females) by using panoramic radiographs. Mandibular alveolar atrophy was found to be more severe in female (structure of the mandiblar bone was osteopenic in 38 subjects (30.7%). The relationship between the observed osteopenia and the severity of the mandibular alveolar atrophy in female was statistically significant ($p<0.05$) ***Yuzugullu et al. 2009*** study showed the influence of age and gender on the mandibular cortical width (at mental foramen region),as well as alveolar bone loss and bone height In ***1997a, Xie et al.*** examined some local factors as they were related to residual ridge resorption RRR. Among 177 edentulous elderly subjects effects on RRR were investigated with regard to history of edentulousness and denture- wearing, the condition of the dentures and soft tissues, dental status of the opposing jaw, and oral hygiene habits. No significant association was found between degree of resorption and duration of edentulousness in either the mandible or the maxilla, RRR was related to denture quality ($P< 0.05$) however, severe resorption was not found in maxilla, the use of removable partial denture was a factor contributing to the resorption flabby ridge was related to the severity of the resorption. This study showed local factors related to RRR more often in the maxilla than in the mandible, thus suggesting that severe resorption in the mandible is influenced more by systemic factors than by those investigated local factors Karaagaclioglu and ozkan,(1994) investigated the relationship between mandibular height reduction to age and the length of edentulism period in 2 resorptive age groups composed of 120 edentulous male subjects (complete denture wearers). The edentulism period of subjects was classified as (1 to 5,5) (10) and (over 10 years. Ridge resorption was estimated on panoramic radiograph by estimating the original height of the alveolar process as being three times the distance from the inferior border of the mandible to the inferior edge of the mental foramen. They reported that the amount of mandibular height reduction increased in the group of (over 10) years edentulism period the mandibular resorption rate was

greatest in the earlier stages of edentulism and slowed with longevity of edentulous.

1.5. The effect of teeth lost on bone:

As people grow progressively older in modern societies, health problems associated with advanced age increase dramatically.

These include, among others, oral diseases that finally may lead to tooth loss.

Tooth loss may have a variety of causes such as periodontal disease, caries and trauma leading to pulpitis.

Whatever the reason might be, the effect of tooth loss is always the same: The physiologic masticatory forces applied via the roots of teeth to the cancellous alveolar bone no longer persist (***Devlin & Ferguson, 1991; Ulm et al., 1997***).

According to Wolff's Law (***Wolff, 1892***) and the Mechanostat Model (***Frost, 2003***) disuse and a loss of mechanical stimulation is followed by the reduction of bone mass.

loss of teeth leads invariably to atrophy of the residual alveolar ridge being irreversible, chronic, progressive and cumulative (***Atwood, 1971***).

The rate of atrophy varies greatly between different individuals (***Bras, 1990***) and even within one and the same.

person at different times or in different regions within the jaw (***Atwood, 1971; Atwood, 1973***). However, atrophy.

is greatest during the first year after tooth loss; the reduction of the residual ridge is a lifelong process (***Sennerby et al., 1988***) but the rate of bone loss does decrease (***Denissen et al., 1993***) .

Anatomic conditions of the jaws, systemic factors such as sex and age, hormonal balance, local inflammations and masticatory habits are supposed to act as co-factors in the development of residual ridge resorption after

tooth loss (***Atwood, 1971; Gruber et al., 1993; Kingsmill, 1999***).

It is well established that tooth extraction is followed by a reduction of the buccolingual as well as apicocoronal dimension of the alveolar ridge at the edentulous site it was found that the resorption of the buccal/lingual walls occurred in two overlapping phases. In a first phase, the bundle bone was resorbed and replaced with woven bone. The second phase included resorption from the outer surface of both bone walls. It was stated that the reason for this additional bone loss was not understood.

The above literature gives the impression that the reason for bone loss after tooth extraction is unknown. In ***the year 1881, Roux15*** suggested that the loss of alveolar bone occurring after tooth loss in the old age is an example of disuse atrophy. His reasoning was that after tooth loss, the forces on the bone are reduced, which means that less bone is needed and that the body gets rid of bone that is not sufficiently used. Our knowledge of bone physiology has expanded greatly since 1881.

1.6 The effect present of the teeth or not on the gonial angle

Keen JA supports the concept of a widening of the angle as a consequence of the loss of teeth (***Keen JA 1945***) the morphological change in the gonial region in the edentulous individual compared to a young individual has received little attention in the literature. Literature holds diverse studies, where a few observed no significant change in gonial angle, with others concluding gonial angle to be greater in edentulous individuals than in dentate ones. (***Carlsson GE, Persson G.1967 –. Engstrom C, Hollender L, Lindqvist S1985).*** The present study also observed a 6° increase in gonial angle for edentulous subjects. In accordance with our observation, ***Keen*** found an increase in the gonial angle of edentulous individuals by an average of 5°, and also ***Casey DM and Emrich LJ*** in their study found an increase in the mean gonial angle by 2.4° in the edentulous group (***Keen JA1945. Casey DM, Emrich LJ1988***).

This may be attributed to the atrophic alterations of the basal part of the mandibular bone (***Atwood AD1971***) ***Enlow et al., and Xie et al***., found that bone deposition takes place throughout the inferior border, except in the antegonial region. (***Enlow DH, Bianco HJ, Eklund S1976, Xie Q, Wolf J, Soikkonen K, Ainamo A1996***).

The antegonial region underwent resorption in the edentulous individuals, perhaps due to the reduced muscle function in this region in comparison with that of the gonial angle. Muscle function tends to preserve bone at its point of insertion; therefore, the structure of the gonial region will be maintained by the insertion of the medial pterygoid and masseter muscles (***Dutra V, Yang J, Devlin H, Susin C2004***).

When teeth are present, the muscular activity associated with mastication preserved the angle from any change in size. However, with loss of teeth, the bone undergoes remodeling and, consequently, an increase in size is seen. Also, other factors affecting this parameter are tooth loss due to lack of awareness, occupation, as well as social and attitudinal aspects relating to tooth extraction and early loss of teeth.

Although several studies found no significant differences between dentulous and edentulous individuals, (***Wafáa Al-Faleh 2008, . Dutra V, Yang J, Devlin H, Susin C2004***) in a cephalometric study of the gonial angle measurement***, Ohm E and Silness J*** found the mean gonial angle measurement for edentulous patients to be 131 degrees versus 127 degrees for partially dentate, without consideration of gender.(***Ohm E, Silness1999***) Casey DM and Emrich LJ used panoramic radiographs and they found that the mean size of the gonial angle was 126.3 for the edentulous and 123.9 for dentate Panoramic imaging system .

1.7 Panoramic imaging system:

is a technique for producing a single tomographic image of the facial structures that includes both the maxillary and mandibular dental arches and their supporting structures (***White and Pharoah, 2009***).

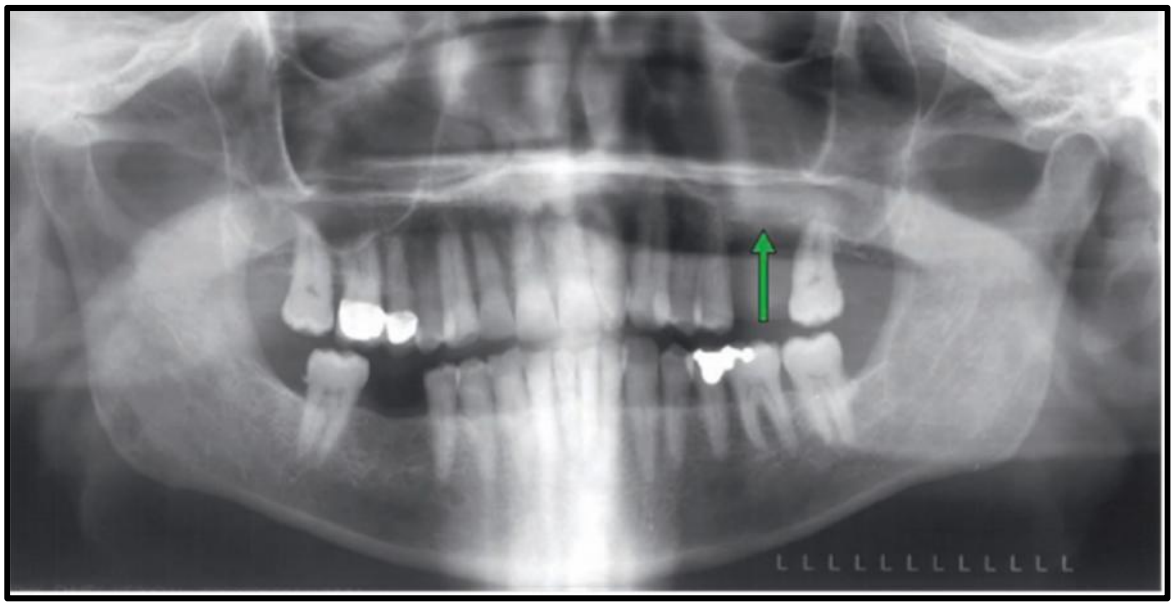

Fig. (1-6) Panoramic Radiography (Faraman, 2006).

1.7.1Uses of panoramic radiograghy:

Panoramic radiography PR was introduced for the first time by Professor ***Yrjo Paatero*** of the University of Helsinki in 1961 (***Staley, 2001; Akcam et al, 2003***). Using of PR includes the following different aspects: (***Wilding et al..1987; Kjellberg et al., 1994;Ceylan et al., 1998; Thomas et al.,2001;Lupi-Pegurier et al.,2002: Roberts, 2005;Laskin,2009***)

1.It is frequently used in orthodontic practice to provide important information about the teeth, their axial inclinations, maturation periods, and surrounding tissues.

2.it is reproducible and accurate for the linear and angular measurements of mandibles, PRs used to metrically assess gonial , condylar and ramus heights, as well as asymmetries and showed high correlations for gonial angles, inter jaw base angle, and anterior and posterior face height.

3. It can be used to evaluate treatment outcomes for endodontic restorations.

4. Panoramic radiographs have been made preoperatively for diagnosis and postoperatively at various intervals to monitor patient healing and possible loss of the bone and implant material as well as used to locate anatomic landmarks in planning the placement of dental implants into the anterior mandible, such radiographys provide a graphic picture of the jaws.

5. They used for detection of occlusal dental caries, no statistical significance was demonstrated between panoramic and bitewing radiography.

6. careful observation of the panoramic radiographs disclosed abnormalities other than temporomandibular joint TMJ arthrosis, including, obliteration of the posterior maxillary sinus wall caused by squamous cell carcinoma of the maxillary sinus), resorption around the condylar neck (caused by hemangioma), and radiopaque foci at the anterior area of the right TMJ (synovial chondromatosis) (***Suei et al.,1997***).

7. Panoramic radiographs are useful for predicting the location of impacted maxillary canines and the subsequent surgical approach required for exposure and orthodontic appliance attachment (***Katsnelson et al.,2010***) Many studies have been done to demonstrate the role of PR in the diagnosis of different conditions, Neal and Bowden (988) examined the diagnostic value obtained from panoramic radiographs made on Patients at (9-10) years of age. The panoramic radiographs from 982 patients were examined and 261 (26.5%) showed findings of significance for orthodontic diagnosis and treatment planning**.** ***Demirjian and Levesque (1980)*** studied dental development of a genetically homogeneous French-Canadian group of children ranging in age from (2.5 to 19) years using 5,437 PRs. The maturity of each mandibular tooth was evaluated individually. For each stage of each tooth, the developmental curves of boys and girls were compared. Up to (5-6) years of age, no difference was found in the timing of dental development between boys and girls, in contrast to at older ages girls were always more advanced dentally than boys.

adolescents aged (0-15) years (797 males and 811 females) to determine the prevalence of tooth and jaw abnormalities. Abnormalities were detected in 21% of the radiographs (23% of females and 17% of males); 879 teeth were diagnosed with abnormalities from 331 radiographs. The most common abnormalities were malpositioned teeth, missing teeth, misshaped teeth, and teeth appearing hypoplastic, bony abnormalities and growth problems were also detected from PR. Also ***in 2009, Yamanel et al.*** used PR to examine 3,031 of an urban Turkish to assess the total and average numbers of radioopaque restorations, missing or impacted teeth, root canal fillings, crown-fixed partial denture and implants with respect to age and gender.

1.7.2Panoramic anatomy include,

1. Middle cranial fossa
2. Orbit
3. Zygomatic arch
4. Zygomatic arch
5. Styloid process
6. Septa in maxillary sinus
7. Maxillary tuberosity
8. External oblique line
9. Angle of mandible
10. hyoid bone
11. Glenoid fossa
12. Articular eminence
13. Mandibular condyle
14. Vertebra
15. Coronoid process s
16. Pterygoid plates
17. Maxillary sinus

18.Ear lobe

19.Mandibular canal

20.Mental foramen

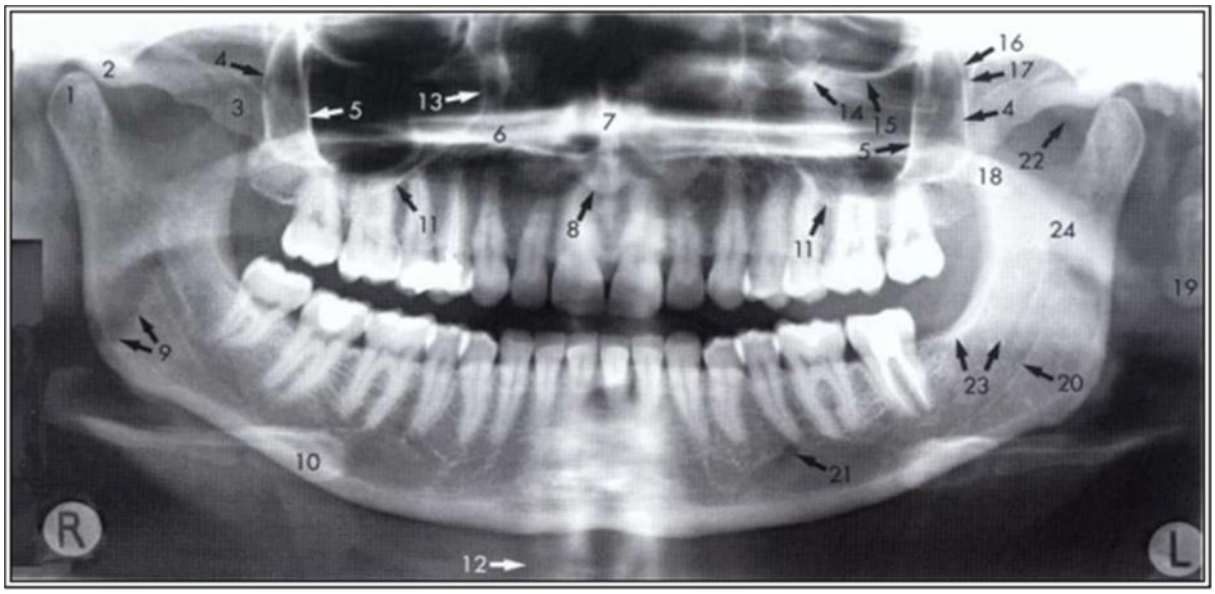

Fig (1-7).

Fig.(1-7) show Radiographic Appearance of Normal anatomy: 1,Mandibular condyle 2, Articular eminence 3, Coronoid process of mandible superimposed on zygomatic arch 4, Posterior wall of maxillary sinus 5, Posterior wall of zygomatic process of maxilla. 6, Hard palate. 7, Nasal septum. 8, Tip of nose. 9, Dorsum of tongue. 10, Hyoid superimposed over inferior border of mandible. 11, Inferior border of maxillary sinus. 12, Image of cervical spine. 13, Medial border of maxillary sinus. 14, I nfraorbital canal. 15, Infraorbital rim. 16, Pterygomaxillary fissure. 17, Anterior border of the pterygoid plates. 18, Lateral pterygoid plate superimposed over soft palate and coronoid process of mandible. 19, Ear lobe. 20, Inferior border of mandibular canal. 21, Mental foramen. 22, Posterior wall of nasopharynx. 23, Inferior border of mandible superimposed from opposite side. 24, Soft palate over mandibular. (***White & Pharoah, 2009***).

1.7.3 Advantages and Disadvantages of Panoramic radiography

The principle advantages of PR were summarized by ***Haring and Howerton (2006)*** as follows-:

1. Field size. The panoramic radiography includes coverage of the entire maxilla and mandible. More anatomic structures can be viewed on a panoramic film than on a complete intra oral radiographic series. In addition, lesions and conditions of the jaws that may not be seen on intraoral films can be detected on a panoramic radiography.
2. Simplicity. Exposure of a panoramic radiography is relatively simple and requires a minimal amount of time and training for the dental radiographer.
3. Patient cooperation. The exposure of a panoramic radiography is readily accepted by the patient because there is no discomfort involved Minimal exposure. A panoramie radiography results in minimal radiation exposure for the patient the main disadvantages were summarized as follows: (***Haring and Wh Howerton: 2006***).

1.Image quality: The images seen on a panoramic radiography are not as harps as those on intraoral radiographs because of the intensifying screens. As a result, the panoramic radiograph can not be used to evaluate dental caries, periodontal diseases or periapical lesions

2. Focal trough limitations objects of interest that located outside the focal trough are not seen.

3. Distortion. A certain amount of magnification, distortion and overlapping is present on a panoramic radiograph, even when proper technique is used.

4. Equipment cost. The cost of panoramic x-ray unit, compared to the cost of an intraoral x-ray unit, is relatively high Magnification in panoramic radiography Panoramic radiographic image is larger than the structures it represented In rotational PR, the x-ray tubes to object distance and object-image receptor distance considered as factors that control the degree of vertical magnification.

However, horizontal magnification is affected by an important additional factor which is the speed of the image receptor in relation to x-ray beam speed at object point. Most of the manufacturers try to control the film speed to produce constant vertical and horizontal magnification over the whole film Digital PRs exhibit identical distortion effects as compared to conventional panoramic rays. Exact quantification of regional magnification requires (spherical) reference objects with known dimensions (***Schulze et al. 2000***).

Many studies were done to evaluate the magnification of different x-ray machines. ***Sattayanskull et al. (1988)*** showed that an image magnification of approximately 36% occurs in vertical plane in incisors and premolars region. but that degree of magnification increases to 39% in molars region in horizontal plane, the degree of magnification is more variable ranging from 15% in incisors region to 23% in premolars region and decreasing to 21 in molars region.

1.8 Conventional imaging:

Conventional intra-oral radiographic film consists of silver halide grains in a gelatine matrix. When this film is exposed to x-ray photons the silver halide crystals are sensitized and are reduced to black during the developing process. The film acts as both the radiation detector and the image display. With extra-oral films indirect action receptors are used to help record the image. This type of film is sensitive to light photons which are emitted by adjacent intensifying screens. Although the film is constructed of silver halide crystals these are primarily sensitive to light rather than x-rays. The use of intensifying screens reduces the dose and can be used where fine detail is not required (***Brennan, 2002***).

1.9 Digital imaging:

ln digital radiography, instead of the silver halide grain the image is constructed using pixels or small light sensitive elements. These pixels an be a range of shades of grey depending on the exposure, and are arranged in grids and rows on the sensor, unlike the random distribution of the crystals in standard film. However, unlike film the sensors are only the radiation detector and the image is displayed on a monitor The signal that is produced by the sensor is an analogue signal, i.e. a tage that varies as a function of time.

The sensor is connected to the computer and the signal is sampled at regular intervals. The output of each pixel is quantified and converted to numbers by a frame grabber within the computer. The range of numbers is normally from 0 to 256 with o representing black, 256 representing white and all others are shades of grey The number of grey levels relates to contrast resolution and the size of the pixels is related to spatial resolution. Together these determine the overall resolution (i.e. the ability to distinguish between small objects close together) of the image. Resolution can also be expressed in line pairs permillimetre. Most conventional E speed films have a resolution of 20 LP/mm whereas with digital images the resolution ranges from 7-10 LP/mm. The reduced resolution should not interfere with clinical diagnosis (***Brennan, 2002***) ***Keifer et al.. (2004***) have investigated the dose exposition in the head and neck region by use of conventional and digital radiographic dental systems. Four (conventional and digital) radiographic devices were tested: PR and full- mouth-survey FMS. Organ doses were measured, their results showed that the value of exposure was lowest in digital FMS and highest in conventional FMS, i.e. dose was reduced by 47% by using a digital device. In PR, doses were 17% lower using digital technique. digital PR on subjective image quality and diagnostic performance. They have made two digital panoramic radiographs for 100 patients receiving dental care. The first image was taken at the standard exposure setting. For the second and (80-81%) respectively, 10 observers rated both images for specific

anatomical details and 30 pathological findings. Their results showed that all radiographs taken at reduced mA levels had a significantly inferior score for anatomical details but there was no difference in the scores for pathological findings. So they have recommended a reduction in tube current of approximately 50% in this panoramic digital technique.

1.9.1 Digital Panoramic radiography:

The phosphor storage plate PSP method of panoramic digital imaging is very similar to conventional film. The film and intensifying screen are replaced by a storage phosphor plate. The plate is scanned after exposure, which can take up to 3 minutes or longer depending on the product used. The resolution of these systems is greater than 4 LP/mm (***Brennan, 2002***).

To compare the accuracy of digital and film panoramic radiographs for determining the position and shape of mandibular third molars before surgical removal and the prevalence of dental anomalies and pathologies A study done by ***Benediktsdottir et al. in 2003*** using 388 third mandibular molars. Position and morphology of third molars observed on film radiographs and on digital panoramic images from five different systems were recorded by two observers and were compared with surgeons' findings at the time of the operation. One observer further recorded the prevalence of dental anomalies and pathologies using both imaging modalities. Few differences were found between the digital and film based panoramic systems in the assessment of accuracy of position and morphology of mandibular third molars. While the prevalence of dental anomalies and pathoses determined with these two modalities was similar. The five digital panoramic systems used in this study were evaluated to be equally as useful for third molar treatment planning and diagnosis of dental anomalies and pathologies as conventional film-based PRs.

2.1 Subject Sample

In this retrospective study 30 digital panoramic radiographs gathered from Iraqi patients attending the hospital of college of dentistry university of Baghdad

The subjects were Iraqi in origin and study the gonial angle relation with different dentitional status they are in three group dentulous , partial dentulous and edentulous.

2.1.1 Criteria of exclusion

All subjects participated in this study were clinically healthy and they should have no history of any metabolic bone diseases (hyperparathyrodisim, pagets disease, osteomalacia, renal osteodystrophy or osteogenesis imperfecta) cancer with bone metastasis significant renal impairment, also patients who were taking any glucocorticoids for a long period of time or estrogen that affecting bone metabolism smoking habit since it influence the estrogen function affecting the rate of bone loss, were excluded (***Baylink et al., 1974 Stafne and Gibilsco,1985;Moore et al. 2001: Graves et al..2004; Jeffcoat,2005***).

2.1.2. Dental evaluation:

Dentate and partial dentate patients should have no periodontal problems, periapical lesion and no impacted third molars while edentulous patients should give no history of wearing a complete denture and the last tooth in mandible should be extracted at least 6 months before the study. In partial dentition group the patients should have no more than 4 teeth lost.

2.2 The Material

2.2.1 x-ray machine

The panoramic x-ray machine that was used in the present study is dimax 3digital X-ray machine manufactured by ***Planmeca Oy, Helsinki, Finland*** figure (2-1).the digital panoramic machine was supplied with sensor which is responsible for transferring digital image to the computer unit.

figure (2-1) Digital panoramic radiographic machine and its parts used in study

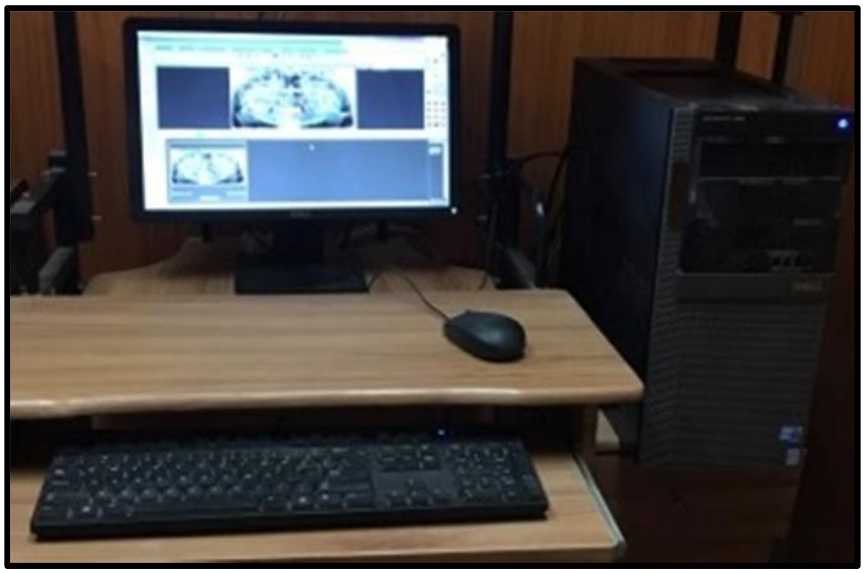

Figure (2-2) computer system

2.3 Methods

2.3.1. Measurement the gonial angle by planmeca romexis dental imaging software

First we turn on the computer open Romexis program will appear screen for us as it's showing in figure (2-3)

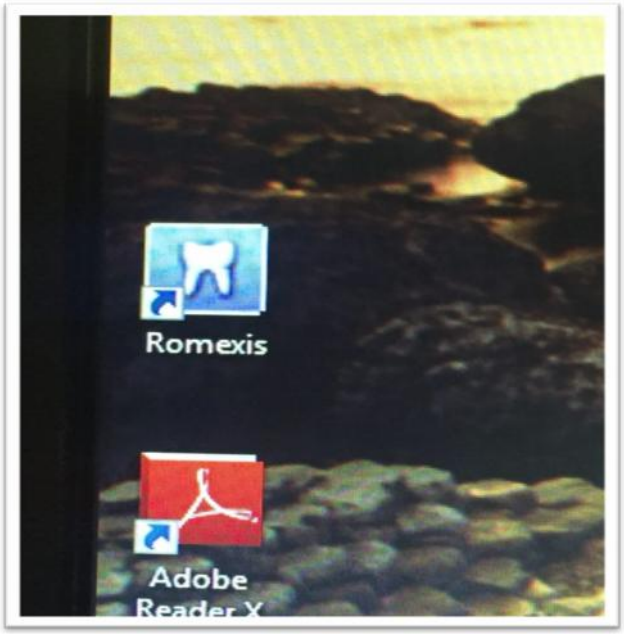

Figure (2-3) Romexis program

After that will write serial number of the patient for ex 54 as it's in figure (2-4)

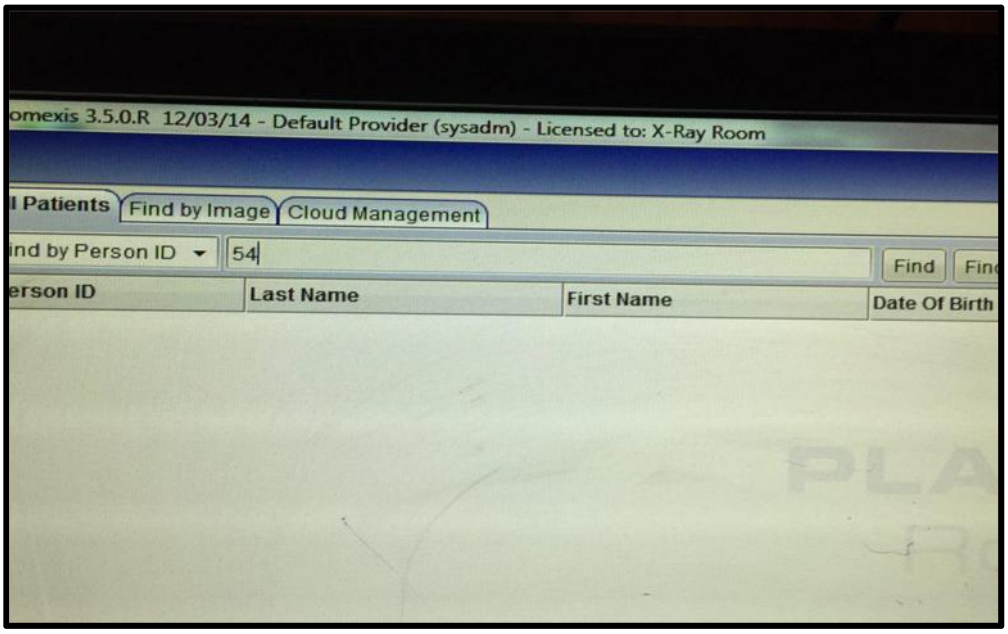

figure (2-4)

and will press on (find) after that will appear this screen as it's showing in figure (2-5)

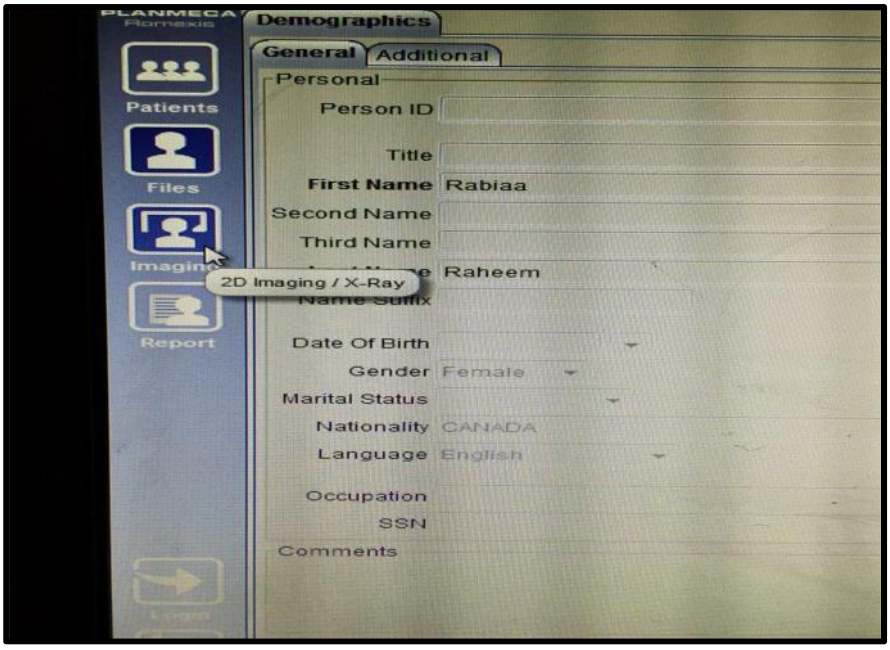

figure (2-5).

And we press on (imaging) will appear as it's showing in figure (2-6)

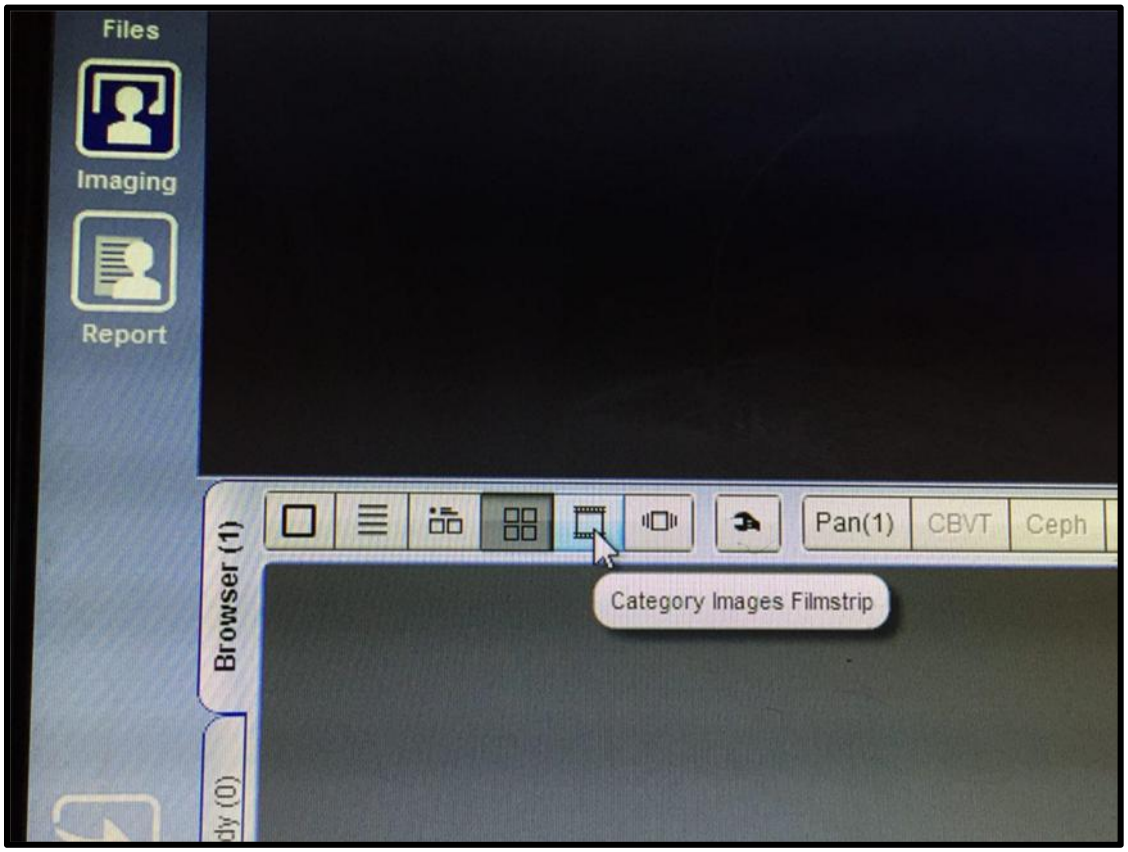

figure (2-6)

We will press on (category images filmstrip) ,will appear image of x-ray (opg) which it is an patient x-ray ,after that will measure the gonial angle figure (2-8) by chosing (measure angle) as it's appear in figure (2-7).

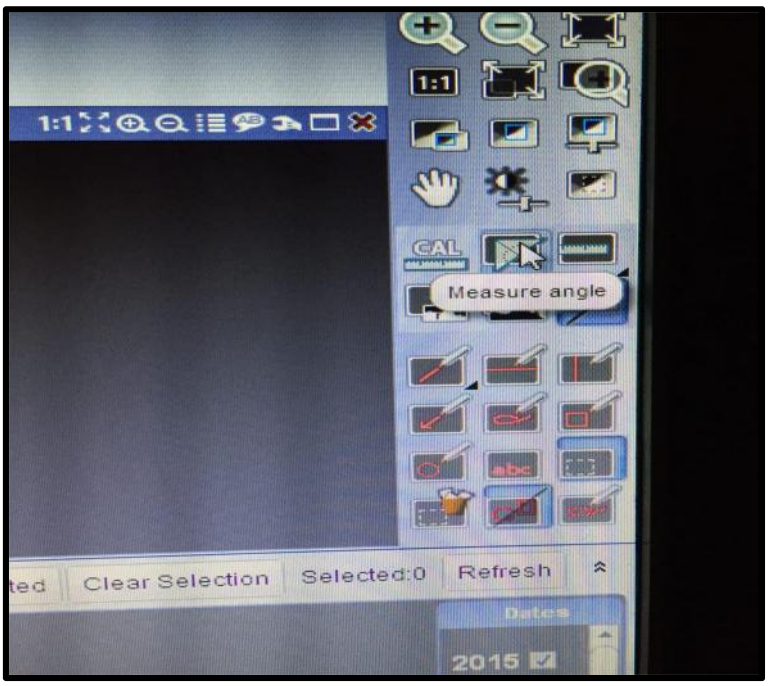

Figure (2-7)

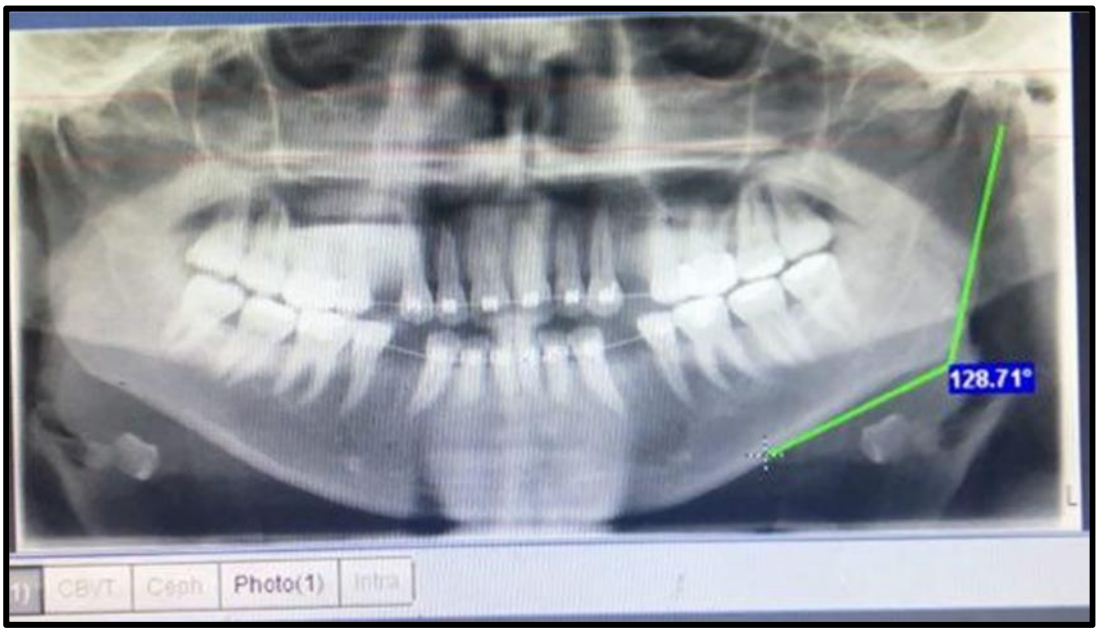

Figure (2-8)

2.3.2. Radiographic technique:

The routine radiographical technique that used to get a digital panoramic.

The following criteria should be available in each radiographic image:

1. The image should show no distortion and no magnification beyond that reported by the manufacturer.(**wical and swoope,1974**).
2. The image should give a clear representation for anatomy of the structures of interest.(**wical and swoope,1974**).
3. The image of the edentoulous mandible should show no evidence of any retained root or impacted tooth in the area of gonial angle,any side with undefined mental foramen or in both side excluded from the sample,in case of a multible foramen ;the largest one was recorded of a mental foramen (**yosue and brooks,1989**).
4. The image of the superior and inferior border of the mandible and mental foramen should be clear and distinct (**bairam,1984**).
5. the left sides of radiographic image must meet the preceding criteria **(wical and swoope,1974).**

2.3.3. Radiographical measurements:

the image should give a clear representation for anatomical structures of interest in order to measure gonial angle on left side of mandible .the radiographic measurement the GA size for (dentate,partial dentate and edentulous mandible)

2.3.4. Measurement of gonial angle:

gonial angle was measured by tracing a line on panoramic radiograph tangential to the most inferior point at the GA and the lower borders of the mandibular body, and another line tangential to the posterior borders of the ramus and condyle. The intersection of these 2lines formed the GA, which was measure the left side of the mandible (**xie and ainamo,2004).**

Result

Table (3-1) descrption the mean for three group (fully dentated, partialy dentated and edentulous) patient that range from (117.8, 126.5,136.6) respectively , and description SD range from (3.765339, 2.635231, 3.238655) respectively , and show SE that range from (1.191563, 0.833934, 1.024891) respectively and show ANOVA is 84.10 And p-value is P<0.001

That is mean highly significant

Table (3-1) the mean gonial angle by study in three group

	D	P.E	E
Mean	**117.8**	**126.5**	**136.6**
SD	**3.765339**	**2.635231**	**3.238655**
SE	**1.191563**	**0.833934**	**1.024891**
ANOVA	**84.10**		
P-value	**P<0.001**		
Sig	**HS**		

***High significant**

Table (3-2) show comparing the 3 group between D&P.E the p- value is <0.001 it is HS and between the D&E the p- value is <0.001 it is HS and between P.E&E the p- value is <0.001 it is HS

	P-value	Sig
D&P.E	**P<0.001**	**HS**
D&E	**P<0.001**	**HS**
P.E&E	**P<0.001**	**HS**

***High significant table (3-2) comparing the 3 group**

Figure (3-1) Histogram show the mean of complete dentition and partial dentition and edentulous

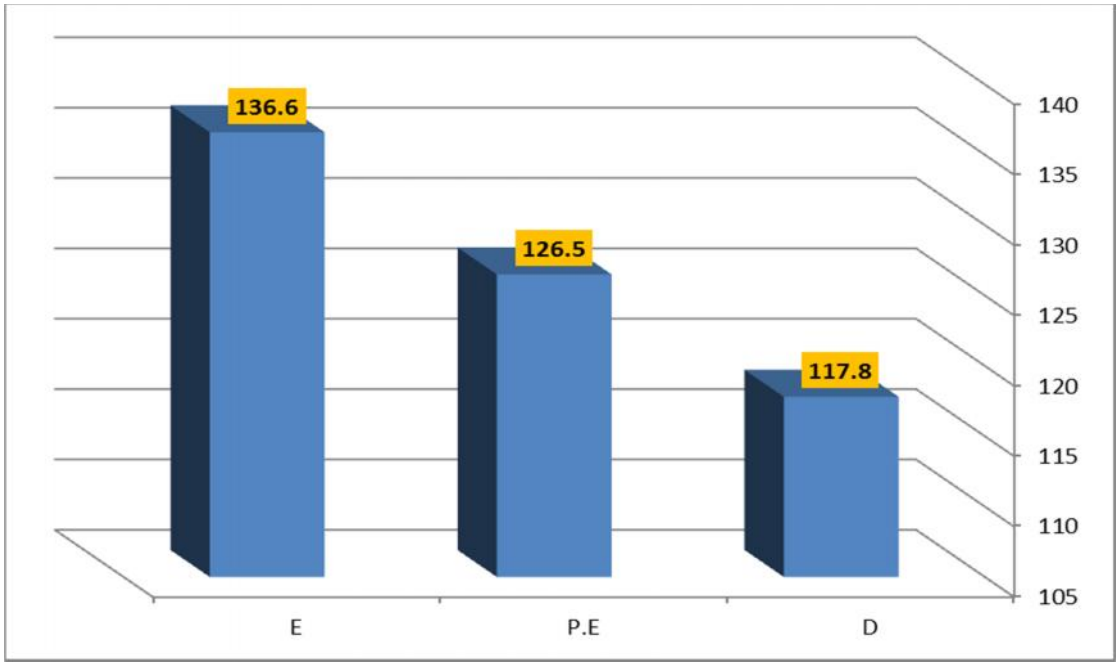

figure (3-1)Histogram showing the distribution of gonial angle value in 3 groups

Figure (3-2) show the distribution of the data of the 3 group for 10 patient

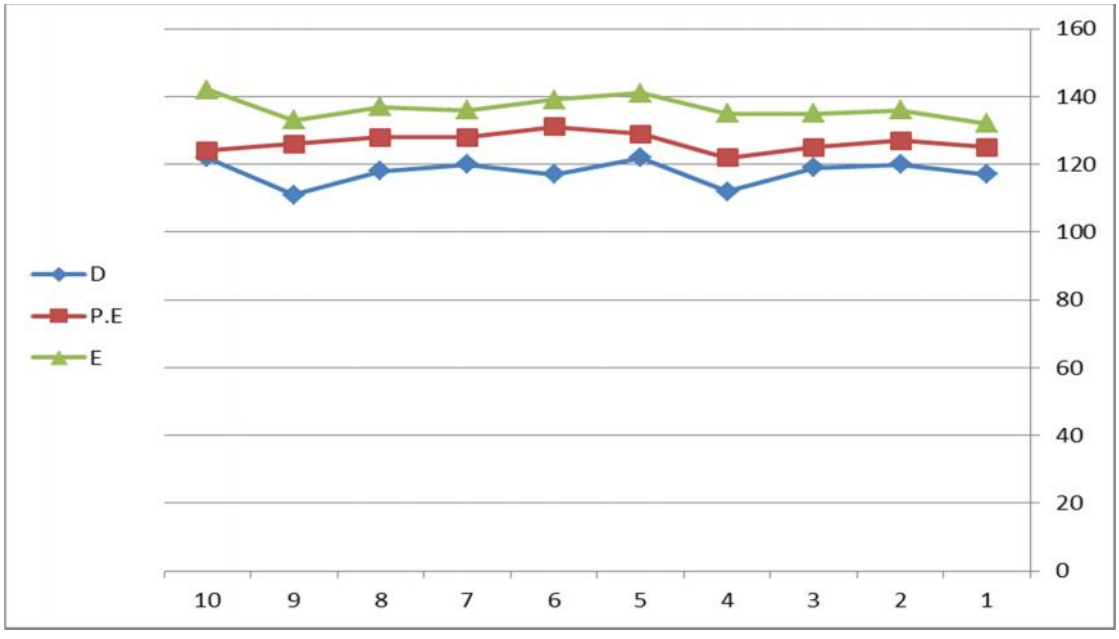

Figure (3-2) showing distribution in 3 group

Figure (3-3) show the mean between three group of gonial angle the curve is elevated

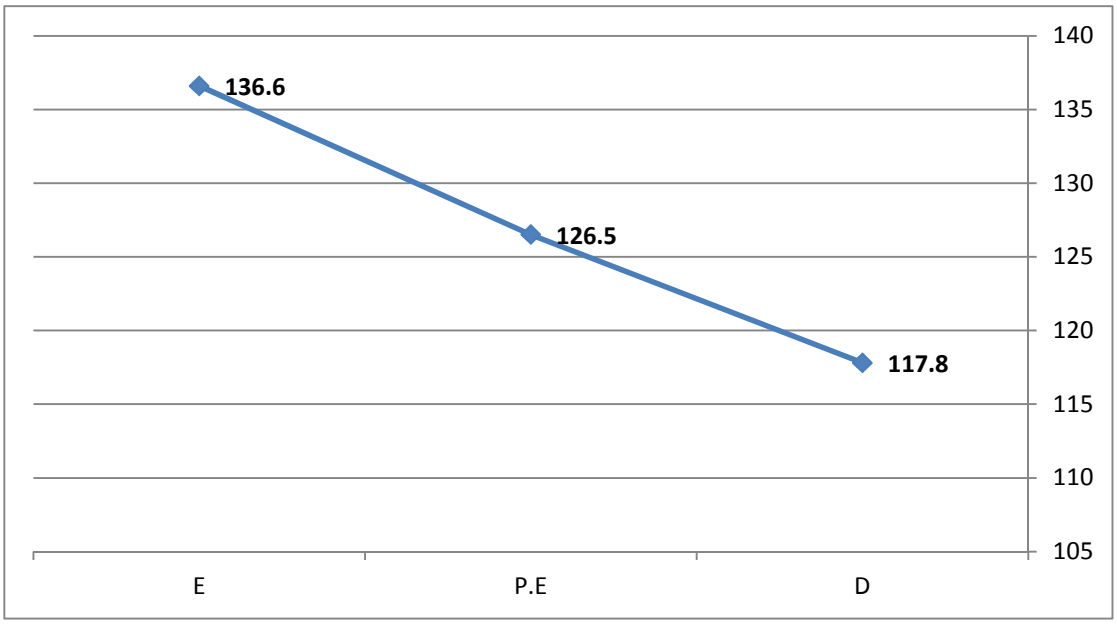

figure (3-3) showing mean between 3 group.

4-1. effect the dental status on gonial angle

Certain structural and functional peculiarities to the site of gonial angle such as smaller diameter, compared to other sites of the jaws, thinner compact bone plate, shape changes during life,frequent impacted or not fully erupted 8^{th} teeth, bilateral muscle cover and endo-osseous and extra-osseous blood circulation- condition give the peculiarities of the site (***Schubert et al ,1997; Hendler,1998; Heibel et al.2001; Halmos and Ellis (2004); Razukevicius,2004***) and this agree in our study

From esthetic point of view, the gonial angle plays an important role in ensuring a harmonious facial profile (***Claudio et al , 2005***)

Morphology of the mandible changes as a conswquence of tooth loss which can be expressed as a widing of gonial angle, shorting the ramus and condylar height (***Huumonen et al 2010***).

In our study multiple linear regression showed that older age group have larger GA compare to younger age group in 3 study groups. Gonial angle showed a statistically significant strong positive (direct) linear correlation with age in all study groups.

Xie and Ainamo in 2004;Huumonen et al . in 2010 ,stated that elderly edentulous subjects had larger GA than did dentate subjects which was in agreement with our finding .

The result of our study was disagree with that of Lin and Hung in 1997 and ***Raustia and Salonen in 1997*** as they found non significant difference in the size of GA at different age groups this may be because of different sample size and different race and nationality

Casey and Emrich in 1988;Engstrom et al in 1985 showed that edentulous subjects had larger angle than in subjects in possession of all teeth which is in agreement with our finding

This finding is in conformity with ***Merrot et al in 2005 and Yanikoglu & Yilmaz in 2008*** who found that the size of the angle was different between continuous measurement and values tend to increase after tooth extraction .

On the other hand ***Ohm and Silness in 1999*** found that the number of teeth had a decisive influence on the size of GA and such difference could be related to race.

5.1 conclusions

The role of dentist in quantitative assessment of the mandibular bony structure by using dental panoramic radiography is of great importance .there is strong siginificant linear correlation of GA size with age in edentulous and complete and partial dentition. the gonial angle increase in older age group compared to younger age group. In edentulous GA is the best parameter to predict older age group from younger age group.

5-2 suggestions

1.measuring of gonial angle and angular cortical thickness directly on the dry skull.

2.measuring of gonial angle using cephalometric radiographs.

3. measuring of the gonial angle in patient with different occlusal relationship.

4. compareing the measurement of the angle before and after orthognathic surgery.

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