Original Articles

NEUROFIBROMATOSIS OF THE MAXILLOFACIAL REGION

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عرض في هذه الدراسة سبعة عشر مريضا بمرض الأورام العصبية الليفية في منطقة الوجه والفكين، لم يكن هناك اختلاف كبير في حدوث المرض بين الذكور والإناث بنطاق عمر مابين ١ ـ ٧٥ سنة (متوسطة ٢١٫٥ سنة). وقد وجد في هذه الدراسة أن ٨٢٪ من المرضى لديهم بقع بنية في مختلف اجزاء الجسم، ٢٩٫٥٪ لديهم تواريخ طبية ايجابية بوجود المرض لدى عوائلهم و ٢٣٫٥٪ لديهم عقد جلدية متعددة. جميع حالات هذه الدراسة كانت وحيدة الجانب، وقد كانت حالات المرضى في الفك السفلي أكثر (٦٥٪).

In this study seventeen patients with neurofibromatosis in the maxillofacial region were presented. There was no great difference in the incidence of the disease between males and females. The patient age range was 1 to 75 years with a mean age of 21.5 years. Family history was positive in 5 cases. The spectrum of the clinical manifestations of this disease, known for its protean characteristics, were evident in all of our 17 patients. 14 (82.4%) patients had cafe'au-lait spots; 3 (17.6%) had multiple cutaneous nodules; malignant transformation was documented in only one case (5.9%). Psychologic depression was recorded in 2 (11.8%) cases, and one (5.9%) case had grand-mal epilepsy. A rare location of neurofibromatous nodules, i.e. in eye (iris nodules), was reported in only one (5.9%) case. The most frequently performed procedure in our cases was excision of the tumor mass which was, in most instances, incomplete. However, massive bleeding during surgical intervention was prominent in four cases and was overcome with extensive packing removed after approximately two weeks. An interesting finding in this study was the incidence of radiologic findings which was higher (76.4%) than previously reported. All cases of this study were unilateral and involvement of the mandible (65%) was more than that of the maxillae.

Neurofibromatosis was first described by Akenside.[1] However, Friedrich von Recklinghausen[2] was the one who concluded that multiple tumors of nerves and skin (neuromas and fibromas) existed simultaneously and were structurally related, and thus justified the name neurofibromatosis, which later became known as Recklinghausen's disease.

Recklinghausen's disease is an inherited disease transmitted as an autosomal dominant trait with a positive family history in most cases. It is considered to be one of the most devastating and destructive diseases in mankind.

In addition to the associated skeletal lesions, neurocutaneous syndrome is characterized by cutaneous and subcutaneous fibrous tumors of the skin, cafe'au-lait pigmentations, vascular and lymphatic anomalies, neurofibromas of the peripheral and central nerves. These are in addition to the associated skeletal lesions.

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Materials and Methods

The data for this study was gathered from seventeen patients with neurofibromas in the maxillofacial region. The patients were seen between 1970 and 1987 at the Department of Oral and Maxillofacial Surgery of the Zurich University Hospital. Cases with inadequate information, or patients whose records could not be traced, were not included in the study.

When diagnosis was made, the patients were analyzed for age, sex, family history of the disease, associated complications and other diseases. Evidence of malignant transformation, clinical site of neurofibromas, associated radiologic findings, and, finally, surgical procedures that were carried out for treating deformities caused by the disease were also noted.

Editorial

THE JOURNAL: A UNIVERSAL FORUM

Saudi Arabia's rapid economic development has been noted as a remarkable accomplishment by the outside world. Its transformation into a modern nation is significantly due to its Islamic precepts. Its strong financial and economic foundation have also been vital factors in its achievement. Establishment of a massive health program has been one of the major components of its developmental thrust and *Dental Health Care* is an integral part of it.

To further the objective of improving the standards of dentistry in the Kingdom and the Arab world, the Saudi Dental Society hereby introduces the publication of the *Saudi Dental Journal.*

The *Journal* appears as the central information network of dentistry in the Kingdom and the Gulf Area. It also monitors the latest developments in dental care and provides a universal forum for exploring the clinical application of technological advances in dental diagnosis and treatment. Scientific research articles, review articles, and case reports illustrating an exceptional presentation or management in all aspects of dentistry are published.

The Society foresees that the *Journal* shall afford our dental professionals a broader and extensive insight in dental health care.

On behalf of the Editorial Board, we welcome the constructive criticisms of the dental professional community. We look forward also to your valuable contributions to perpetuate this publication and to help us attain our objectives.

Abdullah R. Al-Shammery, BDS, MS
Editor-in-Chief

المجلة : المنارة الشاملة

إن التطور السريع الذي مرَّت وتميَّزت به المملكة قد شدَّ العالم كإنجاز حضاري ليس من السهل تحقيقه. فالتحول الكبير الذي حدث على هذه الرقعة المباركة أوجد مجتمعا متحضرا وصل إلى ما وصل إليه بتمسكه بعقيدته الإسلامية، بالإضافة إلى ما حبا الله هذه الأرض من ثروات ساعدت في تحقيق هذه النهضة الشاملة. إن تأسيس برنامج صحي مكثف كان أحد أعظم الأهداف لهذه النهضة والذي تعتبر العناية بأمراض الفم والأسنان جزء من ذلك البرنامج الصحي.

فلنهوض وتحسين مستوى طب الأسنان في المملكة، بالإضافة إلى الأجزاء الأخرى من العالم العربي، ثم إنشاء الجمعية السعودية لطب الأسنان والتي تقدم هنا منشوراتها الرسمية: مجلة طب الأسنان السعودية.

هذه المجلة تعتبر شبكة معلومات مركزية عن طب الأسنان في المملكة ومنطقة الخليج وهي في الوقت نفسه تقدم آخر ما توصل إليه العلم من تطور في هذا المجال من بحوث تهدف إلى الوصول إلى طرق جديدة تمكن من تشخيص وعلاج أمراض الفم والأسنان بصورة أفضل.

إن ما يقدم في هذه المجلة هو إمَّا أبحاث علمية أو مراجعة مقالات في موضوعات معينة أو تقارير عن حالات تمَّ علاجها بطرق أثبتت نجاحها ويشمل ذلك جميع حقول طب الأسنان.

وتؤكد الجمعية على أن المجلة يجب أن تكون بالشكل الذي يمكنها من تزويد كل العاملين في هذا المجال برؤية أشمل وأوسع عن العناية بالفم والأسنان.

بالنيابة عن هيئة التحرير بالمجلة، فإننا نرحب بأي نقد بنَّاء من شأنه الرقي بمستوى المجلة إلى الأحسن ونتطلع إلى مشاركاتكم القيِّمة للنهوض بالمجلة وتمكينها من تحقيق الأهداف التي أنشئت من أجلها.

رئيس التحرير
د. عبدالله ركيب الشمري

Results

Age, Sex and Family History:

Table 1 shows the ages of the seventeen patients when diagnosis was made. There was a wide age distribution from 1 to 75 years (mean : 21.5 years). However, the incidence of neurofibromas was slightly higher in females than males. Ten (58.8%) were females and seven (41.2%) were males.

There was positive family history in five patients (29.4%) as shown in Table 1. Types of complications and other associated lesions seen in these patients are presented in Table 2 and they were as follows:

i) Café au lait spots, an important diagnostic sign in neurofibromatosis were found in 14 (82.4%) patients.
ii) Multiple cutaneous nodules were seen in three (17.6%) patients.
iii) Evidence of malignancy was found in only one (5.9%) patient and this malignancy was reported histopathologically as leiomyosarcoma.
iv) Four (23.5%) patients had mental retardation.
v) One case had grand-mal epilepsy.
vi) Psychologic depression, a social problem in patients with this disease, was noticed in two (11.8%) patients.
vii) Hemorrhage, a difficult operative problem, was encountered in four (23.5%) cases.
viii) Iris nodules were reported in one (5.9%) case.

Clinical Sites:

The distribution of the lesions in various anatomical sites is shown in Table 3. All cases of this study were involved unilaterally. The tumor masses affected one or several anatomical locations. However, the lower jaw was involved in 11 (64.7%) out of the seventeen cases.

Upper jaw lesions were recorded in nine (52.9%) cases. Lips were deformed in six (35.3%) patients. Tumor mass in the nose was evident in two (11.8%) patients. Cheek was disfigured with hyperplastic masses of the tumor in six (35.3%) patients. Orbit and eyelids were involved in three (17.6%) patients. Unilateral macroglossia was evident in two (11.8%) cases while deformity of the ear was present in one (5.9%) patient.

TABLE 1. *Age, sex and family history of each patient.*

Patient numbers	Age at diagnosis	Sex	Family history
1	19	M	–
2	8	M	–
3	16	M	+
4	26	F	+
5	4	M	+
6	17	F	–
7	23	F	–
8	1	F	+
9	31	F	–
10	8	M	–
11	22	M	–
12	12	F	–
13	17	F	–
14	75	F	–
15	8	F	+
16	39	F	–
17	40	M	–

TABLE 2. *Associated lesions and other complications seen in seventeen patients.*

Type	Frequency	% Total
Café au-lait spots	14	82.4
Multiple cutaneous nodules	3	17.6
Malignancy	1	5.9
Mental retardation	4	23.5
Grand-mal epilepsy	1	5.9
Psychologic depression	2	11.8
Massive operative bleeding	4	23.5
Iris nodules	1	5.9

TABLE 3. *Clinical sites of neurofibromas.*

Site	Frequency	% Total
Upper jaw	9	52.9
Lower jaw	11	64.7
Lips	6	35.3
Nose	2	11.8
Cheek	6	35.3
Facial/occlusal asymmetry	8	47.2
Orbit/eyelid	3	17.6
Tongue	2	11.8
Ear	1	5.9

Radiologic Findings:

Radiologic findings of this series are listed in Table 4, and skeletal manifestations, in some cases, are illustrated in Figs. 1 to 4. Skeletal involvements associated with the tumor masses were encountered in 13 (76.4%) cases. These cases were reported as bony changes in the maxilla, clinically presenting as hypoplasia of the maxilla and maxillary sinus 6 (35.3 %), dental impaction, spacing and displacement of the teeth 5 (29.4%), and outwardly curvature of the zygomatic arch 2 (11.8%).

TABLE 4. *Radiologic findings.*

Findings	Frequency	% Total
Maxilla:		
– Hypoplasia of the maxilla/ maxillary sinus	6	35.3
– Spacing/Impaction deviation of teeth	5	29.4
– Hypoplastic zygomatic convexity	2	11.8
Mandible:		
– Hypoplasia/flatenning of contour	10	58.8
– Small condyle and flat glenoid fossa	7	41.1
– Obtuse gonial angle	8	47.1
– Large funnel-shaped ID canal opening	6	35.3
– Large mental foramen	1	5.9
– Increased depth of sigmoid notch	7	41.1
– Deviation of the mandible	5	29.4
– Intra-osseous cystic formation	6	35.3
– Spacing/impaction/ deviation of teeth	10	58.8
Orbit:		
– Enlargement of the orbit	1	5.9
– Hypoplastic deformities of the lateral orbital wall, floor and inferior rim	1	5.9

In the mandible the bony changes were found in 12 (70.6%) cases. They were recorded as: hypoplasia and flattening of the contour 10 (58.8%), small condyle and flat glenoid fossa 7 (41.1%), obtuse gonial angle 8 (47.1%), large funnel-shaped inferior dental canal opening 6 (35.3%), large mental foramen 1 (5.9%), increased depth of the sigmoid notch 7 (41.1%), deviation of the mandible 5 (29.4%), intra-osseous cystic formation 6 (35.3%), spacing, impaction and displacement of the teeth 10 (58.8%).

Orbital involvements were noticed in two (11.8%) cases. The characteristic changes seen were enlargement of the orbit in one (5.9%) case and hypoplastic deformity of the lateral wall, floor, and inferior rim in another case (5.9%).

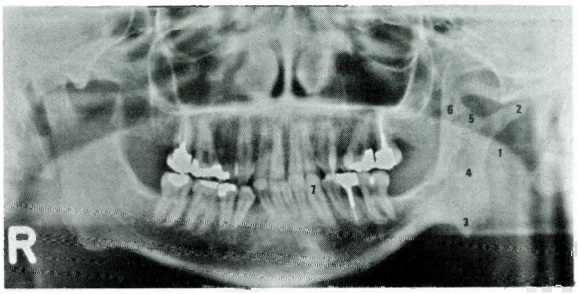


FIGURE 1. Panoramic view of the jaws showing unilateral hypoplasia of the mandible (1), small condyle and flat glenoid fossa (2), obtuse gonial angle (3), large funnel-shaped inferior dental canal opening (4), increased depth of sigmoid notch (5), intra-osseous cycstic formation (6), and drifting of the teeth (7).

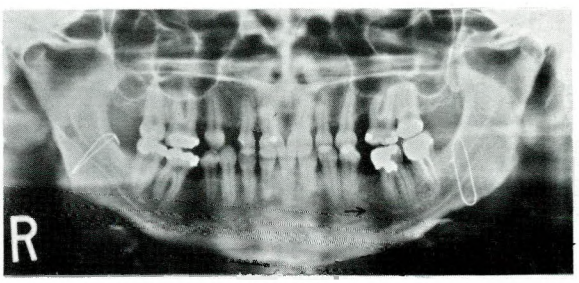


FIGURE 2. Panoramic radiograph showing enlargement of the left mental foramen (arrowed).

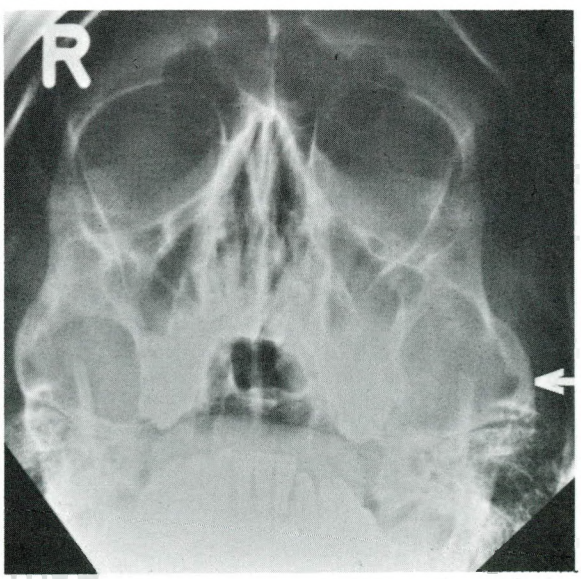


FIGURE 3. Water's radiographic view showing outwardly curved left zygomatic arch (arrowed).

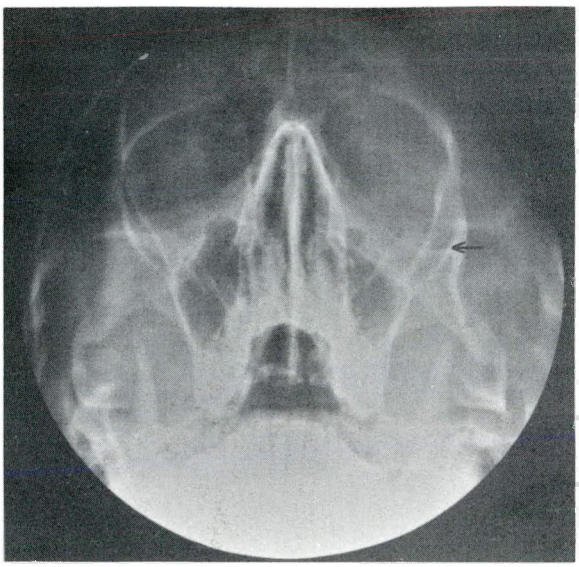


FIGURE 4. Water's radiographic showing enlargement of the left orbital outline (arrowed).

Surgical Management:

Methods used in the surgical management of these patients are listed in Table 5.

The most frequent operative procedure was excision of the tumor mass. Incomplete excision of the tumor lesions was carried out in 11 (84.6%) patients. Complete removal of the mass was done in five (31.3%) patients. One patient failed to present for surgical treatment after being scheduled.

TABLE 5. *Surgical procedures carried out on the patients.*

Procedure	Frequency	% Total
Incomplete excision of the tumor mass	11	84.6
Complete excision of the tumor mass	5	31.3
Sagittal splitting	3	17.6
Genioplasty	2	12.5
LeFort I osteotomy	1	6.3
Nose correciton	1	6.3
Parotidectomy	1	6.3
Extraction/releasing fibrous tissue from crowns	7	43.8
Radical neck dissection/upper jaw resection	1	6.3
Partial glossectomy/face lifting/ eyebrow lifting	2	12.5
Extensive tamponment packing of the operative site	4	23.5

Dental extraction of impacted teeth or surgical release of fibrous hyperplastic tissue from crowns of teeth was carried out on seven (43.8%) cases.

Surgical correction of the facial or occlusal asymmetry included sagittal splitting, genioplasty, and LeFort I osteotomy, in three (17.6%), two (12.5%), and one (6.3%) patient(s), respectively.

Correction of the nose was performed in one (6.3%) case. Two (12.5%) patients had undergone partial glossectomy for removal of unilateral hyperplastic tissue. One (6.3%) case had radical neck dissection because of evidence of malignant transformation. Parotidectomy was done in one (6.3%) case. Face lifting and eyebrow lifting for improved cosmetic outcome were performed in two (12.5%) cases.

Overcoming spontaneous massive hemorrhage during surgical intervention was achieved in four (23.5%) cases by application of massive packing at the operative site. The tamponade was removed or renewed after approximately two weeks.

Discussion

Neurofibromatosis is, by no means, a rare disease although it is not a very common one.

It is probably the most common genetic disease in mankind.[3] The incidence is recorded in most of the reports as 1 in 3000 live births.[4,5,6]

The age distribution of patients in this study is in the same range reported by others.[7,8] There appears to be no significant difference in the incidence of disease between males and females in this series. In most of the previous reports, the sex ratio was approximately equal.[5,9]

Family history may be detected in some instances, and, in our study, it was positive in 5 (29.5%) cases. Other reports have shown inherited transmission in 10 to 50 percent of cases.[8,10]

The presence of cafe'au-lait spots ordinarily may be normal, but association of clinical and skeletal lesions is considered to be a characteristic diagnostic feature of neurofibromatosis.[11]

These cutaneous brown spots were found in 14 (82.4%) of our cases in agreement with previous reports.[11,12]

Multiple cutaneous nodules are mainly found after puberty and are usually manifestations of long standing or adult disease.[13,14] They were recorded in only 4 of our patients. Maceri and Saxon[9]

reported that 66.6% of their 63 patients had these nodules, whereas Crawford[12] found only 18% of his 116 children with neurofibromatosis nodules.

Incidence of malignancy is rare with neurofibromatosis, although it is, beyond question, part of the disease considerations. It is recorded in only one case of our group. Others[8,15,16,17] found malignant frequency of between two and five percent. Mental retardation in patients with neurofibromatosis[18] was associated with four of our patients. Psychologic depression[10] is a problem of patients with neurofibromatosis due to isolation from the surrounding society. Two of our patients suffered from this problem. Other clinical findings reported by others,[10,19] which we also found in our series, were grand-mal epilepsy and iris nodules (one case each).

Hemangiomatous and lymphangiomatous malformations in neurofibromatous lesions are anomalies of vascular and lymphatic systems contributory to massive bleeding.[20-26] However, in our study, four patients did show this problem and were managed without difficulty. Preliminary ligation of feeding vessels was not considered by us, as advocated by some authors,[26] since the procedure increases vascularity by opening up the collateral vessels.

Adekeye et al[17] used boiling water as a sclerosing agent. This caused operative difficulty and post-operative hematoma in 7 of their 28 patients. Intra-arterial embolisation by introducing strips of lyophilized dura into the main feeding vessels was recommended by Littlewood and Stillwell.[27] Frame et al[28] suggested the use of Gelfoam and Polyvinyl sponges as embolising agents. However, extensive tamponment packing was used to overcome spontaneous massive hemorrhage in our cases. It was left in the operative site and removed after approximately two weeks without significant post-operative bleeding. Pressure dressing was applied to reduce post-operative hematoma. The neurofibromatous changes of this series were exclusively unilateral, whereas Vincent and Williams[29] reported a rare case of bilateral involvement.

In contrast to the report of Koblin and Reil,[25] the lower jaw was the most involved site in our patients (11 out of 17 cases). Occlusal plane distortion and facial asymmetry are common findings with this disease[14,16,30] and were noticed in 8 of our patients. Tongue is a common site for neurofibromatous lesions,[6,22,31-32] and two of our patients presented with unilateral macroglossia. Hyperplastic deformities of other common sites, as reported by other authors,[21,32] were also encountered in this series in the palate and alveolar process, lips, nose, cheek, orbit, and ear. Rather surprisingly, skeletal lesions were associated with 76.4% of our cases whereas other comparable studies[4,6,7,9] reported bone lesions in the range of 18-70% of the cases.

All skeletal deformities of our cases were of hypoplastic features. Several authors[9,25,33-35] drew attention to deformities of the facial bones in patients with neurofibromatosis as hypertrophy, hypoplasia, asymmetry, and radioluscent defects. However, the bony defects in this study which had been reported in various previous studies were recorded as hypoplasia of the maxilla and maxillary sinus, maxillary teeth impaction and spacing,[16] hypoplasia of the zygoma with prominent convexity of the zygomatic arch,[36] mandibular hypoplasia with flat contour,[14] small size of the mandibular condyle and flatness of the glenoid fossa,[37] obtuse gonial angle, large funnel-shaped opening of the inferior dental canal, enlargement of the mental foramen,[38] increased depth of the sigmoid notch,[35] intra-osseous cystic radiolucencies,[4,39,40,41] deviation of the mandible,[34] mandibular teeth impaction and spacing,[25] enlargement of the orbit, and hypoplastic deformities of the lateral wall, floor, and inferior rim.[33,38,42,43]

As yet there are no means of curing or even arresting neurofibromatosis, it is generally recommended that deforming, or symptomatic lesional tissue masses, be surgically removed electively. In doing this, the benefit of surgical resection must be weighed against the final aesthetic result and the function preserved.

Shack and associates[44] recommended total excision when feasible, and judicious subtotal extirpation when vital structures are involved, or when total excision would produce considerable deformity. However, the most frequently performed procedure in our cases was excision which was, in most instances, incomplete.

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POTENTIAL OF THE Co-Cr-Ni-Nb AS A DENTAL ALLOY SYSTEM

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أربعة عشر سبيكة من الكوبالت كروم نيكل نيوبيوم حضرت مع مراعاة ثبات النسب بين الكوبالت والكروم والنيكل وتغيير نسبة النيوبيوم من صفر إلى ٢٠٪. أربعة عينات لاختيار الخواص الميكانيكية والميكروسكوبية حضرت من كل سبيكة. السبيكة الثلاثية (خالية من النيوبيوم) لها مقاومة انثناء قدرها ٤٢×١٠^{٣} ومقاومة كسر قدرها ٧٢×١٠^{٣} رطل للبوصة المربعة وقدره على الاستطالة قدرها ٢٩٪. على عكس استعمال التانتلوم فإن إضافة النيوبيوم حتى ٣٪ كان له أثر قليل على خواص القوة مع استمرار القدرة على الاستطالة ثابتة إلى حد ما (٢٥٪). اضافة النيوبيوم حتى ٦٪ سبب زيادة غير مهمة من مقاومة الثني (٥٤×١٠^{٣}) ومقاومة الكسر (٨٠×١٠^{٣}) وتناقص شديد في القدرة على الاستطالة والتي أصبحت أقل من ٦٪. حينما اضيف وزن ذري مماثل من التانتلوم (١٢٪ وزنا) للسبيكة الثلاثية فإن خواص القوة زادت زيادة كبيرة لتصل إلى ٧٤×١٠^{٣} و ١٠٦×١٠^{٣} بينما تناقصت القدرة على الاستطالة تناقص قليل لتصبح ٢١٪. استمرارية التناقص الشديد لخاصة الاستطالة مع تزايد غير متكافيء في خواص القوة استمر مع استمرار زيادة النيوبيوم. الفحص الميكرسكوبي للسبائك أوضح طرد النيوبيوم من مكونات السبيكة (عدم ذوبانه). حينما زادت نسبة النيوبيوم عن ٦٪ تكونت سبيكة غير متجانسة (هشة) وظهرت السبيكة سيجما بكميات كبيرة. السبائك الناتجة عن اضافة النيوبيوم تميزت بقوى أضعف واستطالة أقل مما يلزم لاستعمالات طب الأسنان.

Fourteen quarternary Co-Cr-Ni-Nb alloys were prepared maintaining a constant Co:Cr:Ni and varying the concentration of Nb from 0-20%. Four tensile testing specimens of each alloy composition were cast and tested. The ternary alloy possessed a yield strength (YS) of 44X10^3 psi and elongation of 29%. Contrary to Ta, the addition of up to 3% Nb had little effect on strength (YS 45X10^3, UTS 79X10^3 psi). Ductility remained rather constant (25%). Concentrations up to 6% Nb caused mild increase in strength (YS 45X10^3, UTS 80X10^3 psi) and substantial decrease in elongation (5.9%). An equivalent amount of Ta raised YS to 74X10^3, UTS to 106X10^3, and reduced elongation to 21%. Deterioration of elongation with minimal gain in strength continued with increasing Nb. At concentrations higher than 6% an eutectic was observed. Higher concentrations caused large amounts of both sigma and the brittle eutectic. The alloys produced by adding Nb lacked both strength and ductility necessary for dental applications.

In an alloy design study, Mohammed-Al Tahawi[1] et al indicated that coherent intermetallic compound precipitation is the mechanism of choice for strengthening cobalt-base alloys. A study by Drapier[2] et al indicated that tantalum, tungsten, molybdenum, titanium, and niobium (Nb) react with cobalt to produce coherent Co_3X, where X is one of the above five elements. They could not detect Co_3Nb by X-ray diffraction due to the extreme fineness of Co_3Nb. A study by Koster[3] showed that tantalum, niobium, and titanium raise the stacking fault energy (SFE) of cobalt and stabilize the ductile face centered cubic phase. Rideout[4] et al showed that a given atomic percent of tantalum or niobium will have an equal effect on the precipitation of the embrittling sigma phase. The twelve criteria in Table 1 were used for selecting the most appropriate strengthening agents from the five elements. These criteria indicated that tantalum is the most efficient strengthener, followed by niobium. Several studies[5-8] showed that the addition of tantalum to a 40Co-30Ni-30Cr alloy base produced strong, ductile, heat-treatable alloys characterized by a slow rate of work hardening.[9]

The purpose of this investigation was to determine whether Nb has strengthening characteristics similar to those of tantalum. Studies on the strengthening abilities of tungsten, titanium, and molybdenum are currently in progress.

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