History and Evolution of Modern Implantology

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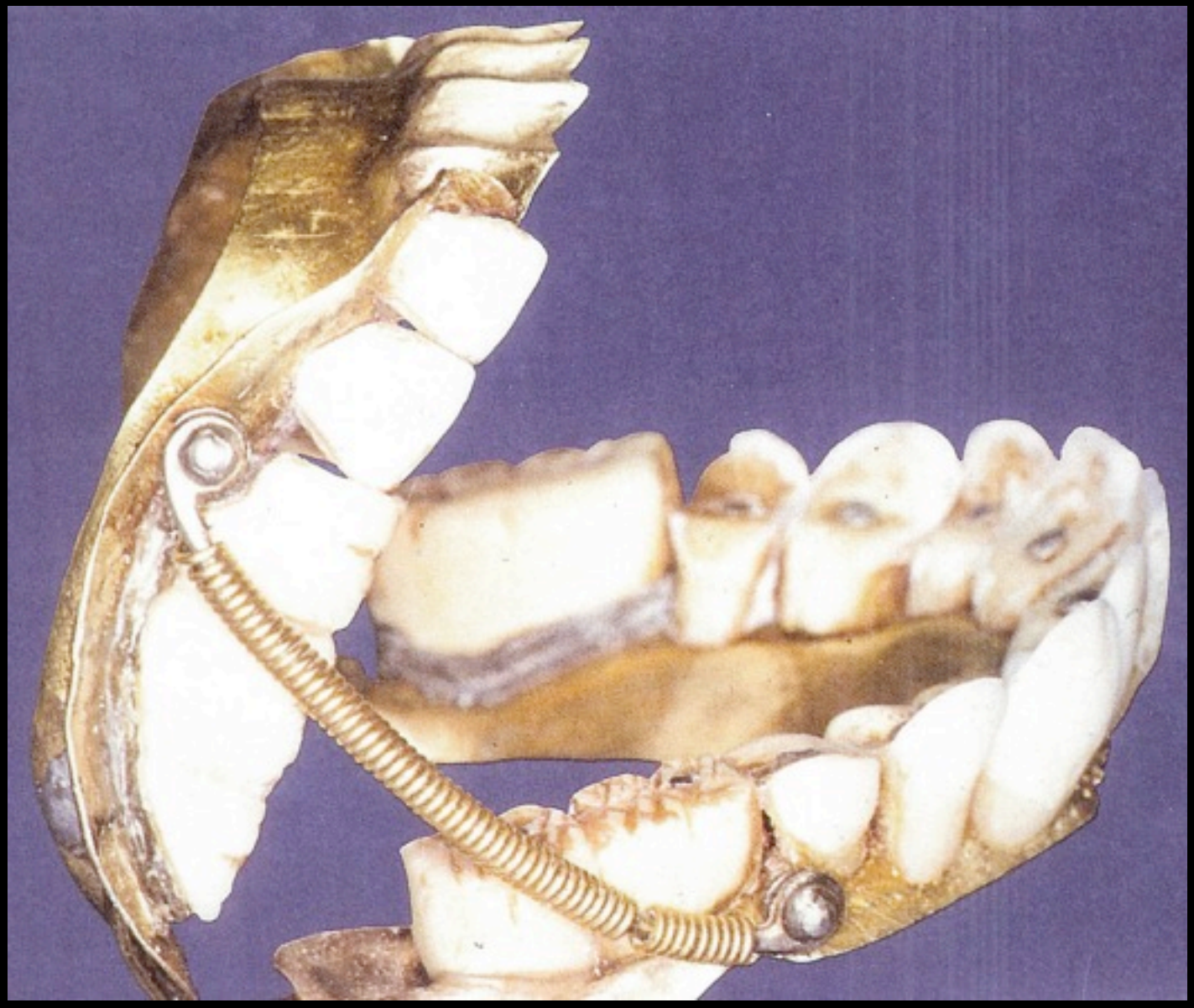
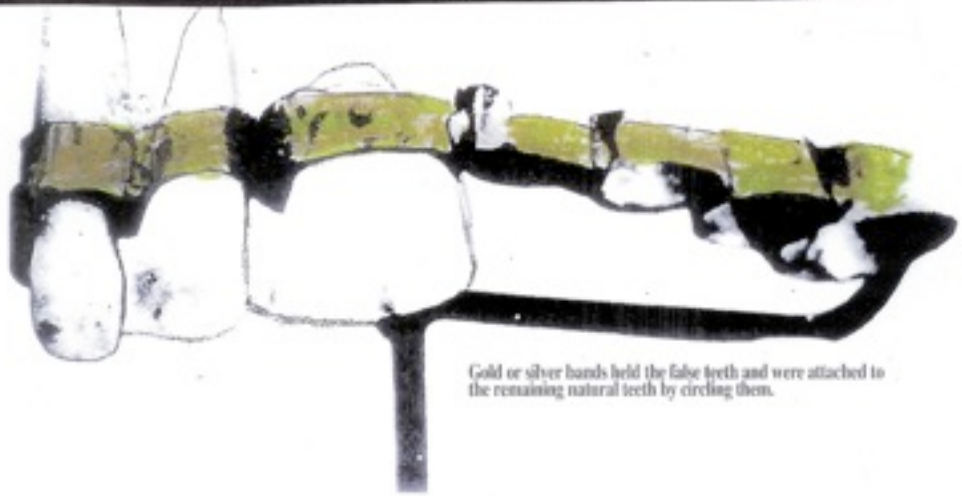
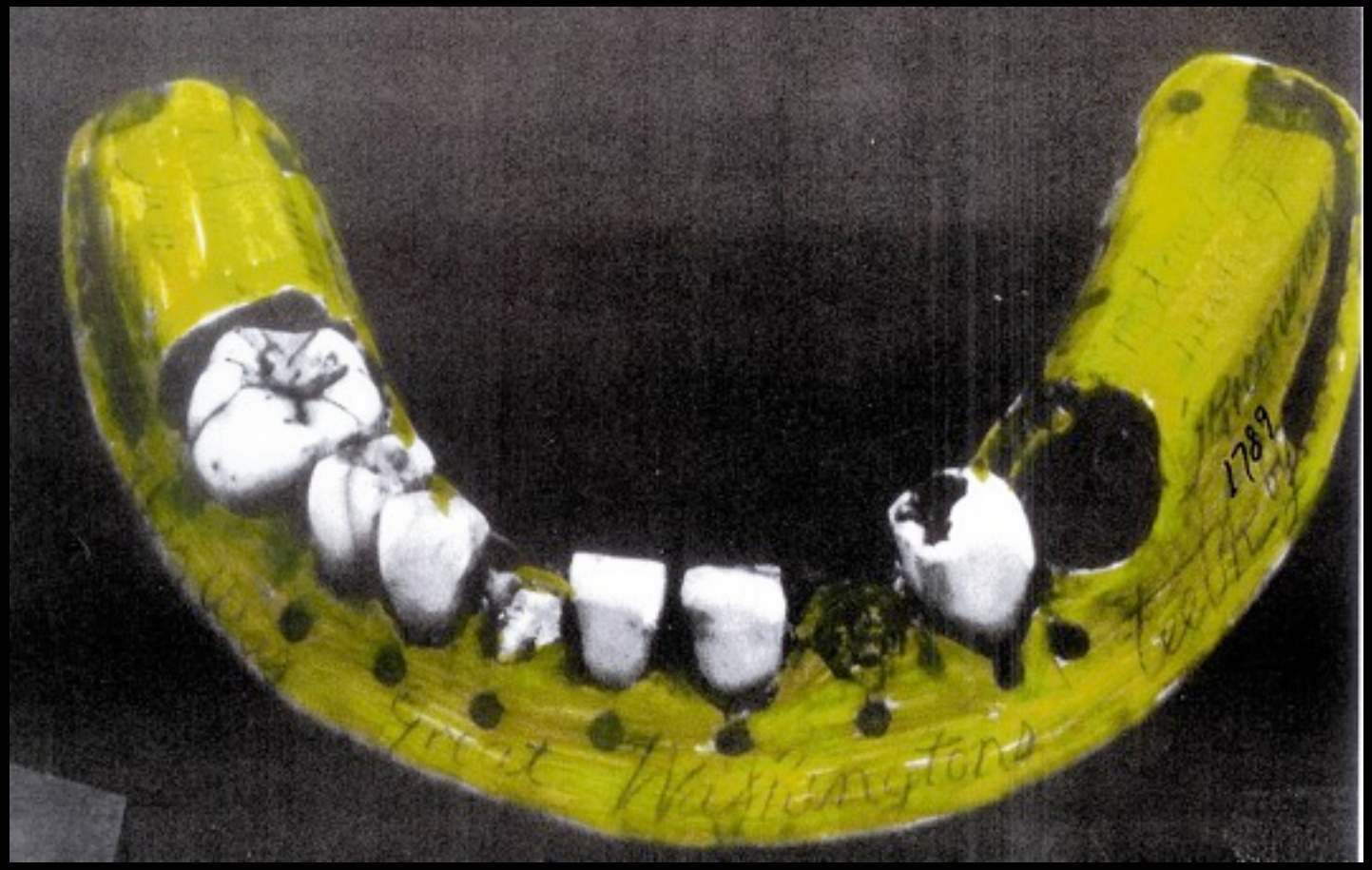
Shankar Iyer DDS
AAID India Maxicourse®
Director

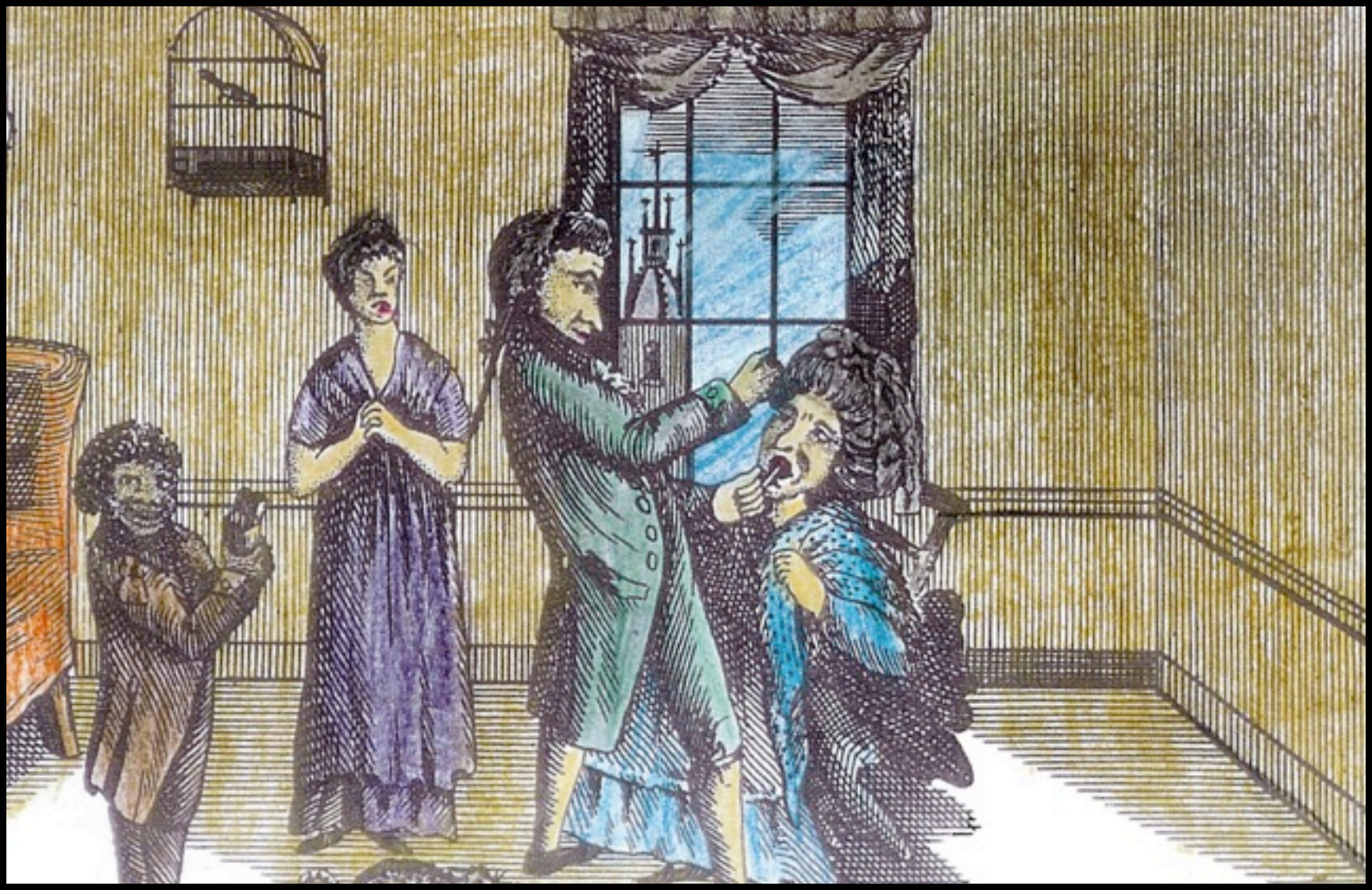
"Those who cannot learn from history are doomed to repeat it" ..George Santayana

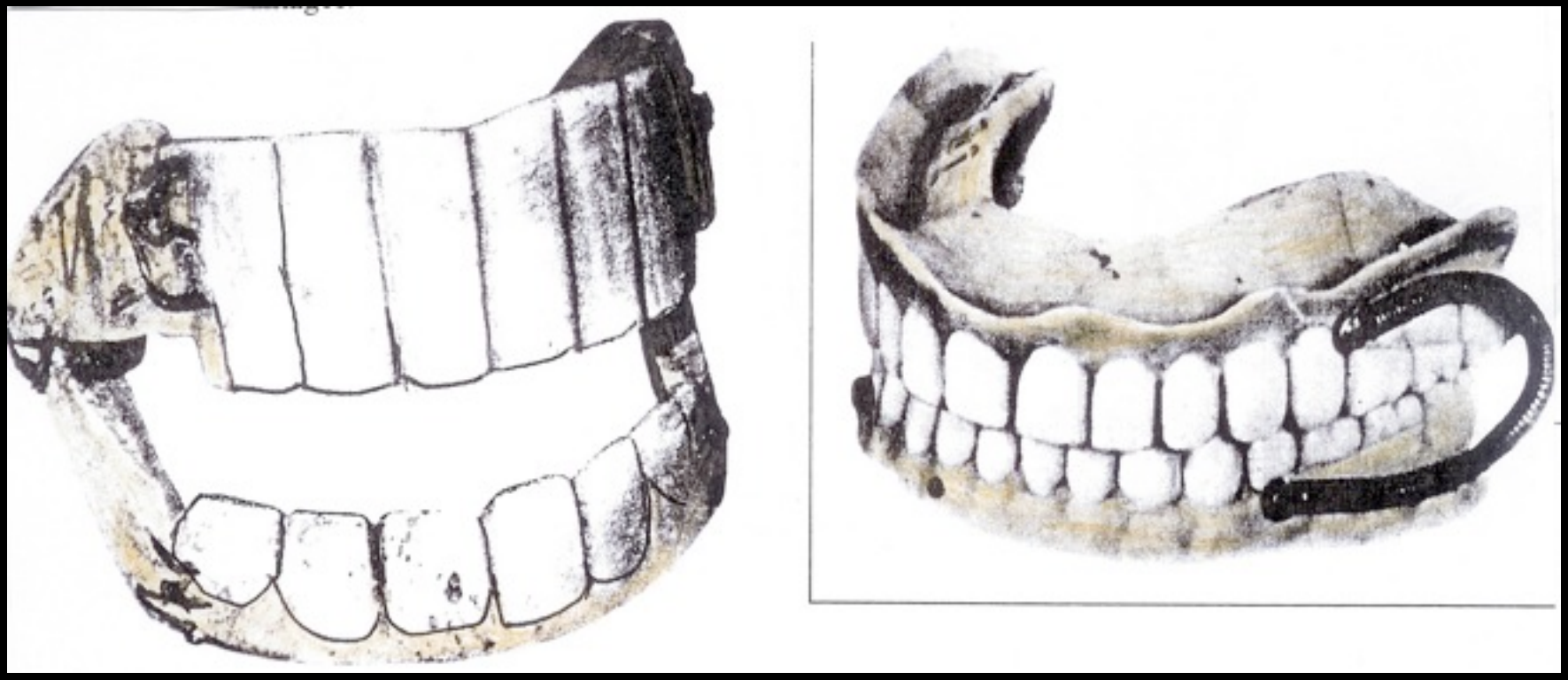




Gold or silver bands held the false teeth and were attached to the remaining natural teeth by circling them.


1789





Dr. KING.

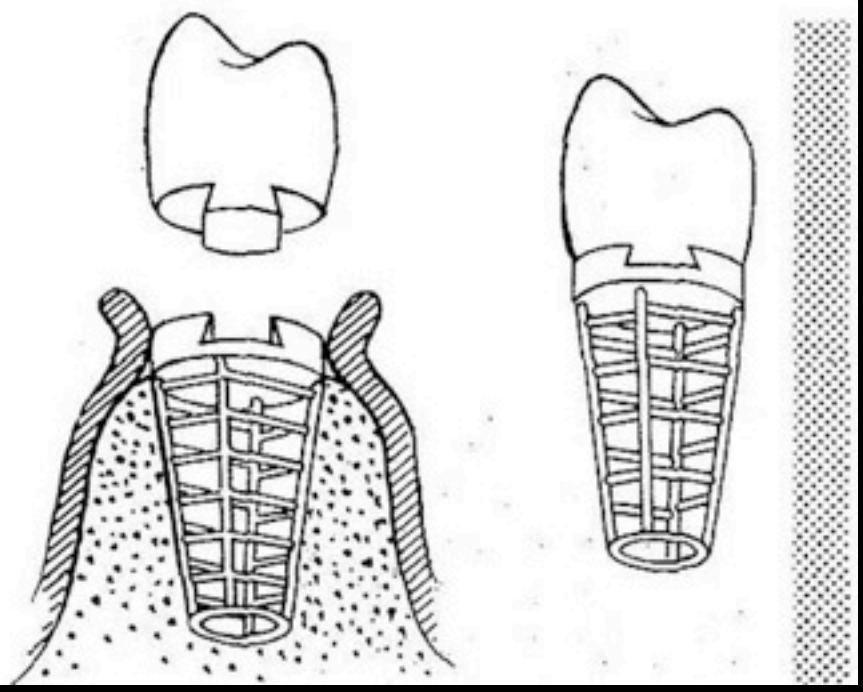
Originator of the King Safe System of Painless Dentistry and Inventor of the "Natural Gum" Set of Teeth.

NO PAIN, HIGH PRICES

Y OLD STYLE TEETH. Full Set $5 PAINLESS EXTRACTION FREE

130 Hinterglasmalerei der Hausfassade der Firma W. Valleau Jr. & Co., New York. Museum of the City of New York

The Greenfield cage, 1913.



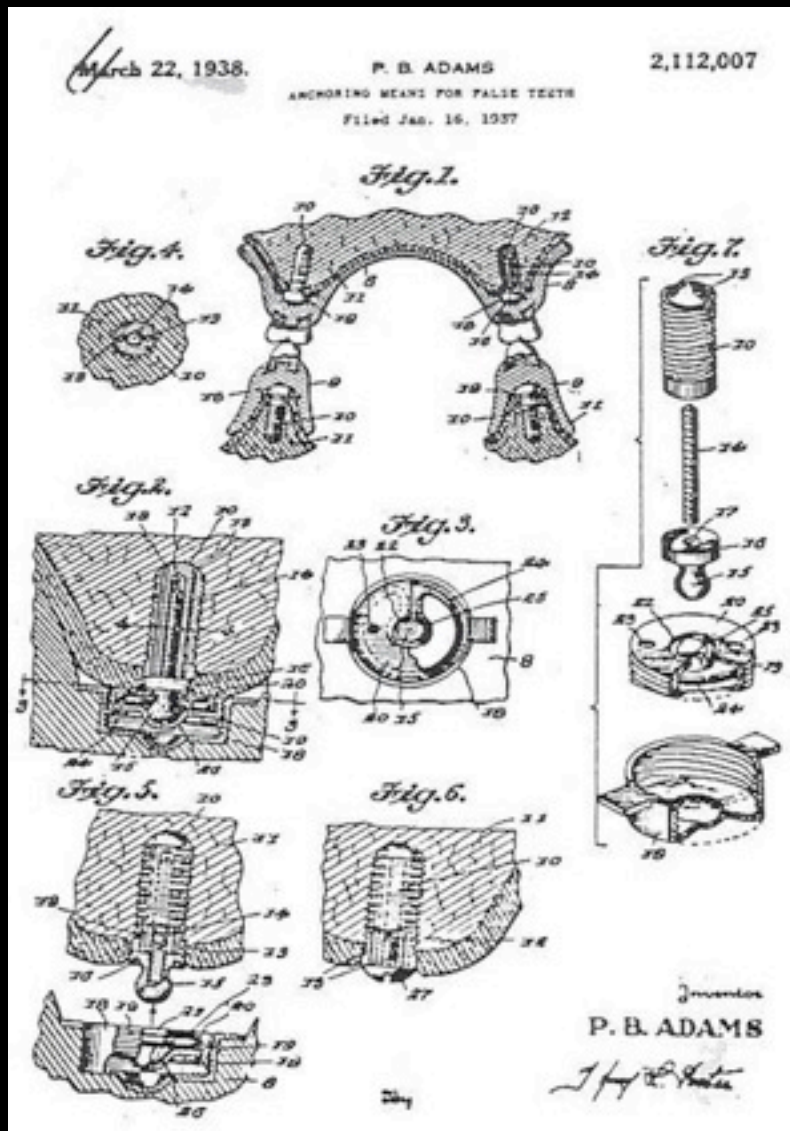


Fig. 3 e. Adams from Arkansas also in 1938 received a patent for his « anchoring means for false teeth » using « O » ring attachments.

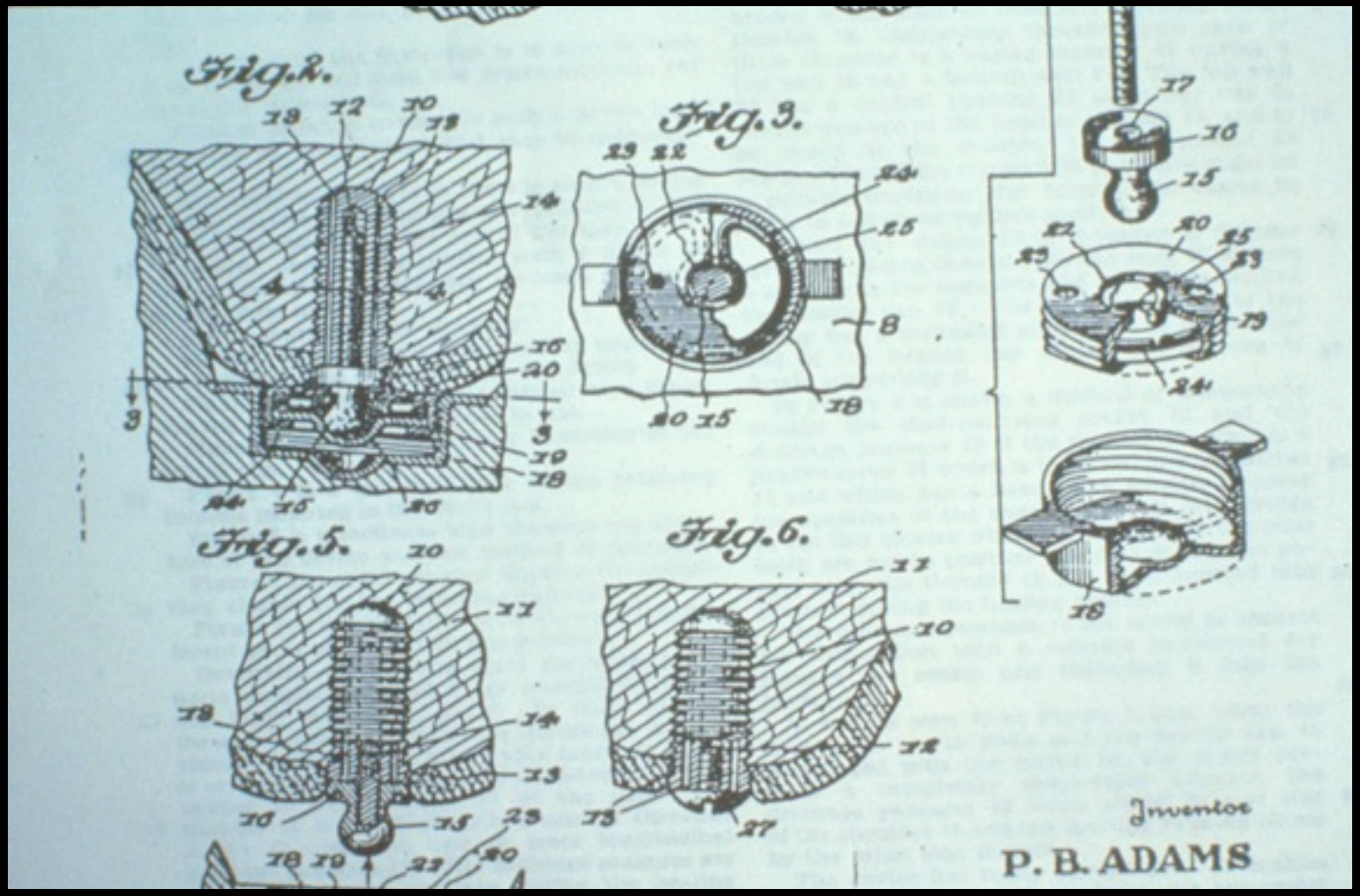
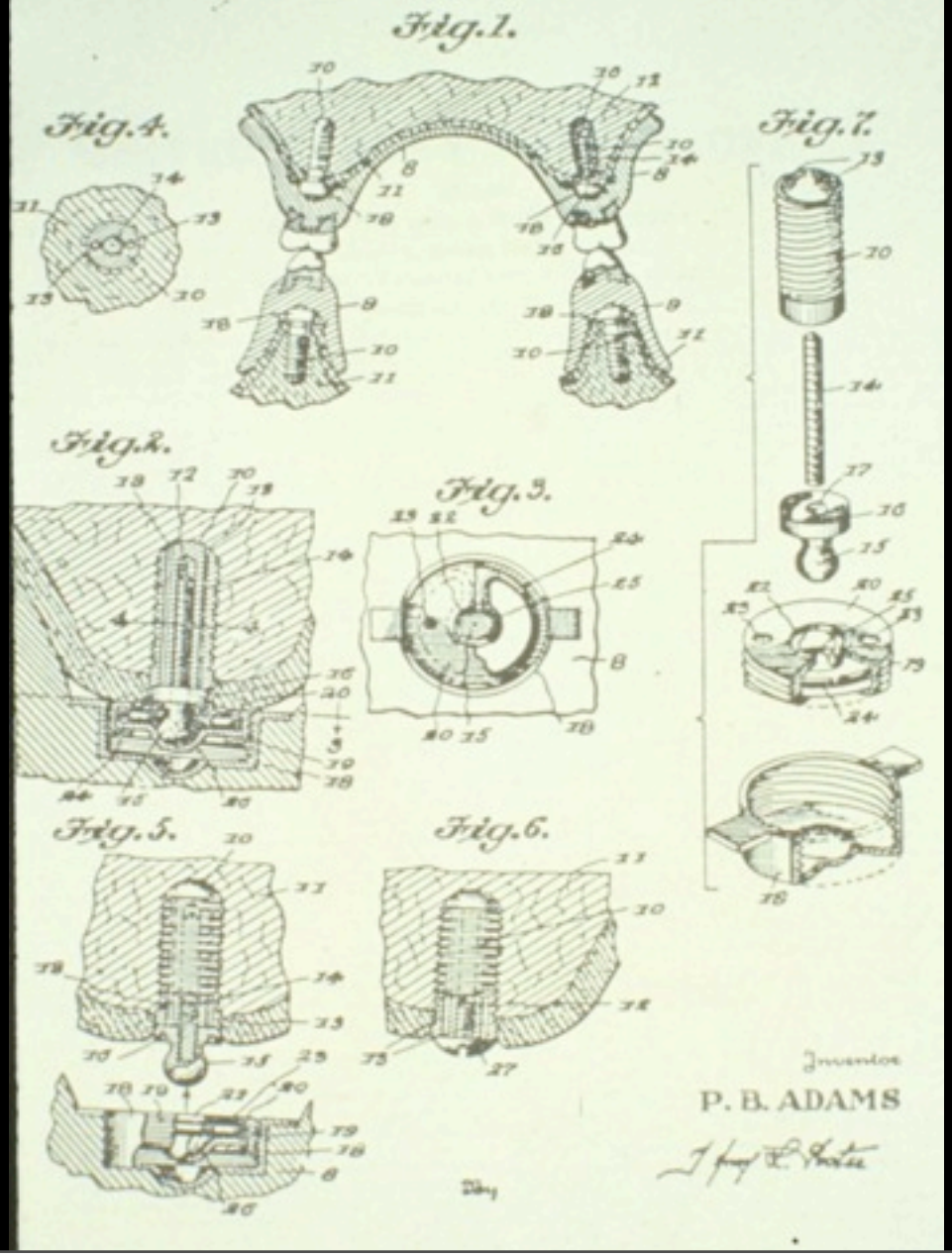


Fig. 2.
Fig. 3.
Fig. 5.
Fig. 6.
Inventor
P. B. ADAMS

March 22, 1938. P. B. ADAMS 2,112,007

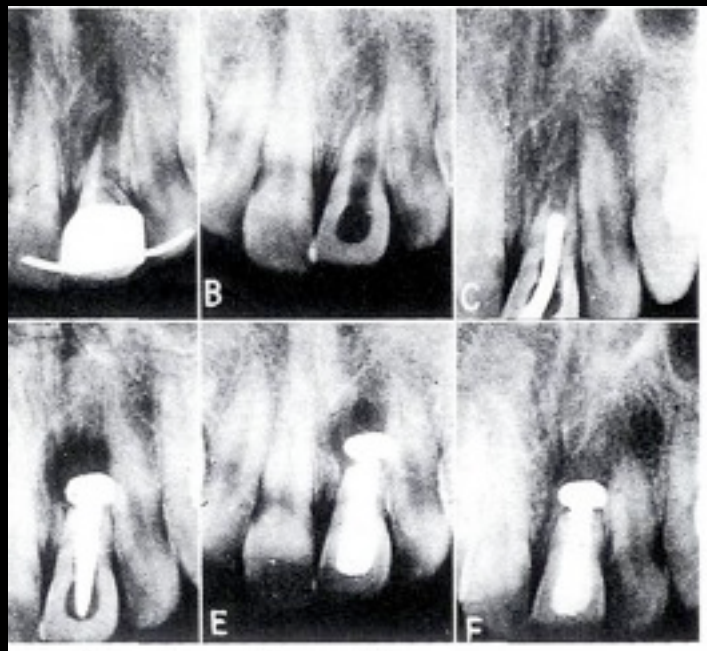
ANCHORING MEANS FOR FALSE TEETH

Filed Jan. 16, 1937

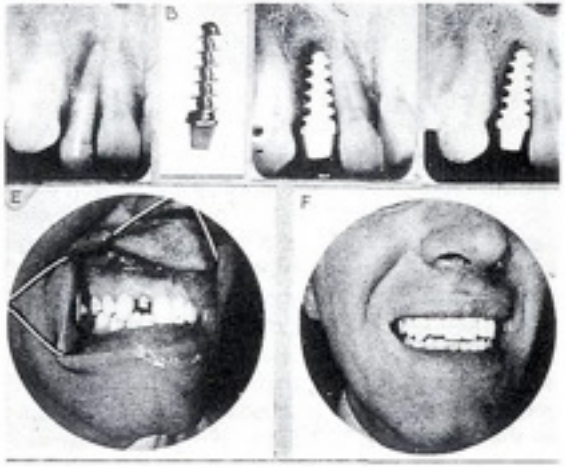


Sunday, October 4, 2009

Pretto's trombone implant. Because of its length, it was difficult to bury deep enough in bone. Also, its smooth sides provided little surface for retention. (Courtesy P. Pretto.)

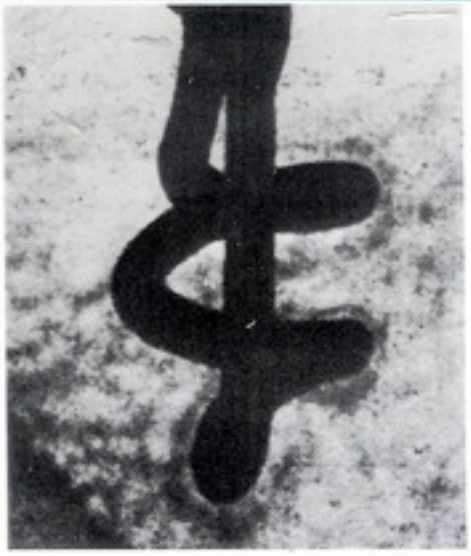


One of the earliest endodontic stabilizers.

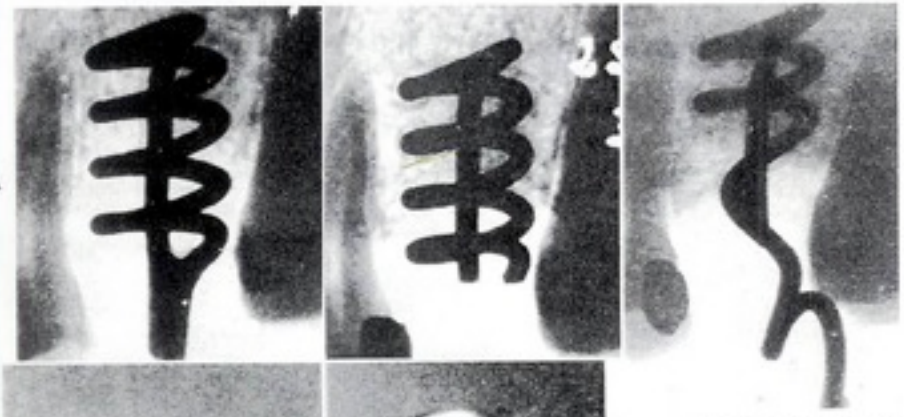


HISTORICAL SERIES DR. STROCK
FIRST SUCCESSFUL HUMAN DENTAL IMPLANT
E.B. 1938-1955

Shows the design of the Strock brothers early vitallium screw implant and its insertion and the immediate post-operative x-ray and completed crown.



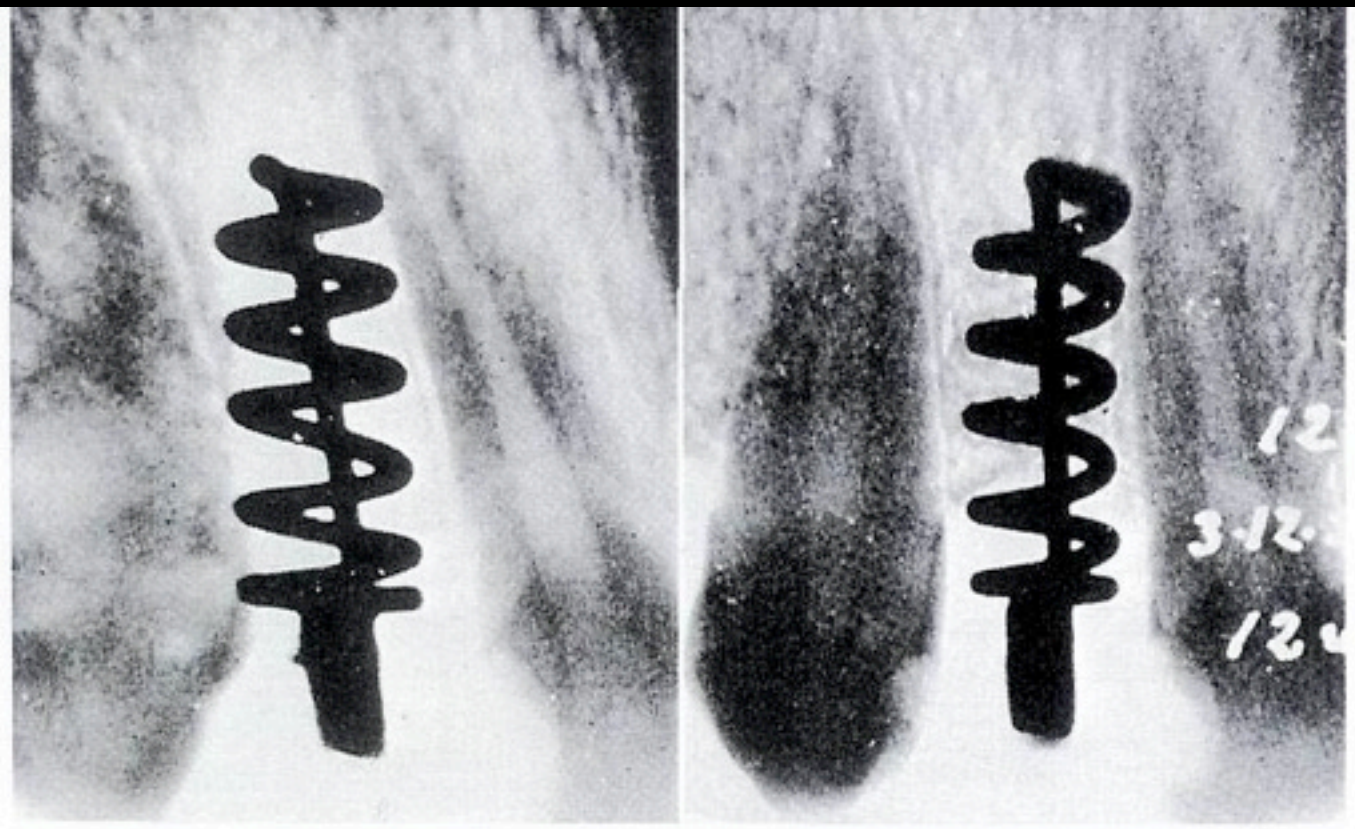
Here is excellent proof that bone did grow right up to, around, and through the spires of a Formiggini hand-fashioned implant.



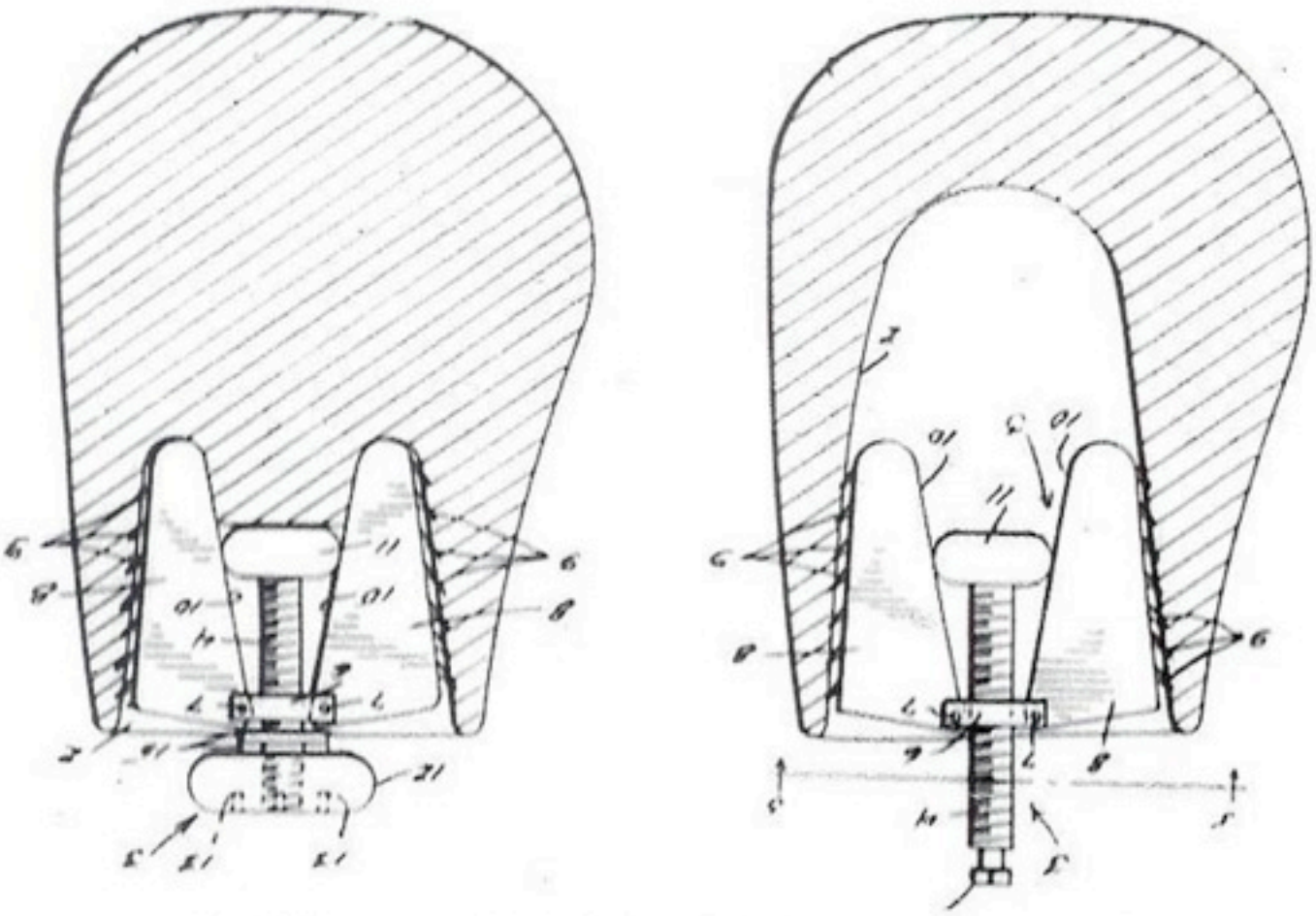
B, C

A, The Formiggini implant in place, with bone regrowth evident at its base. B, Another implant. C, The same implant with the post and most superficial spire broken off. D, Radiographic proof that bone has regenerated into the lowermost spires and firmly holds them is shown by the distortion of the upper spires as the implant resisted extraction. E, The extracted Formiggini implant. Bone has clearly grown around the implant's base. (From Cherchève, R.: Les implants endo-osseoux, Paris, 1962, Librairie Maloine.)

E

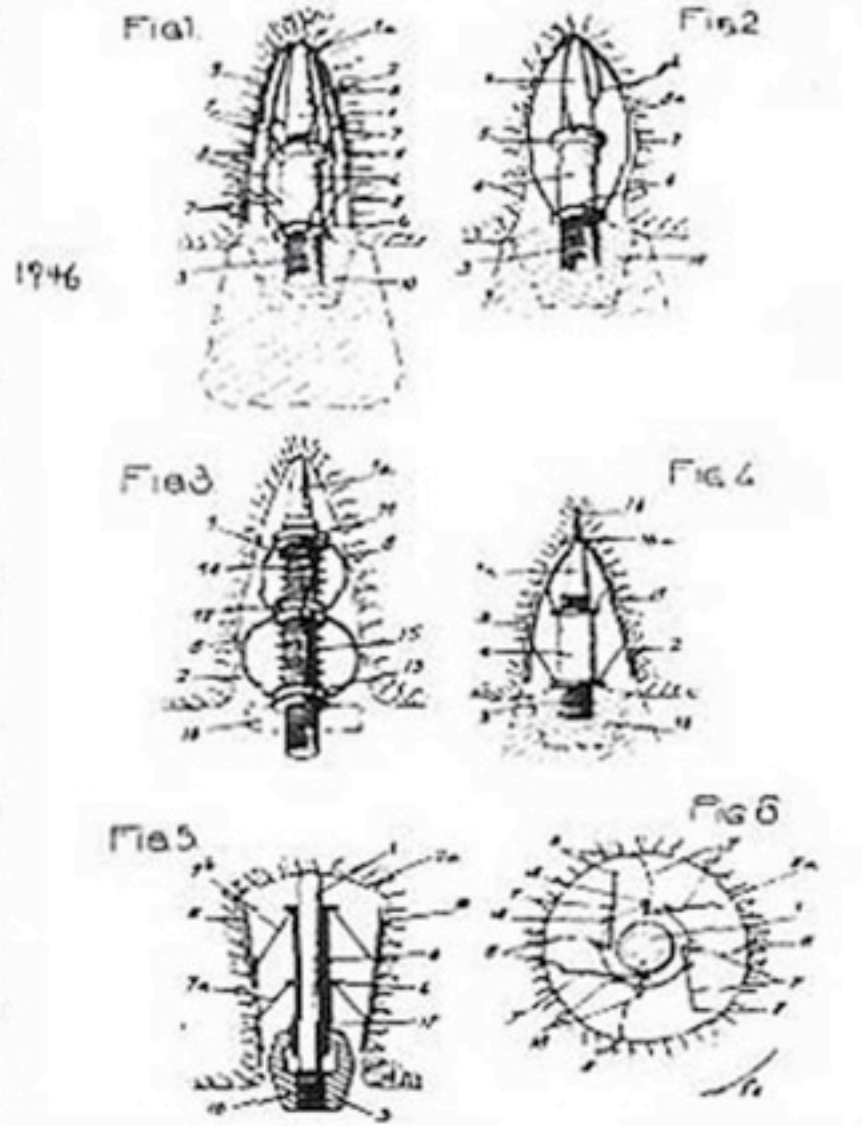


A, A partially successful Perron-Andres implant just after insertion. B, Bone has clearly grown around and through most of the spirals. However, the superficial spires are surrounded by scft tissues. (From Cherchève, R.: Les implants endo-osseoux, Paris, 1962, Librairie Maloine.)



The Glenn Irwin implant of 1941 to be used in extraction sites

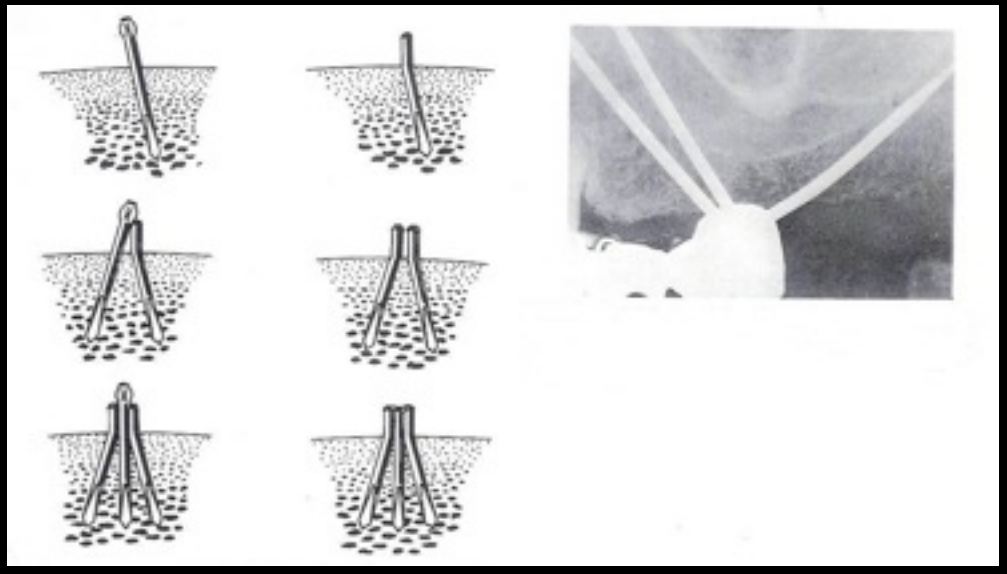

Implant of J. Maggiolo



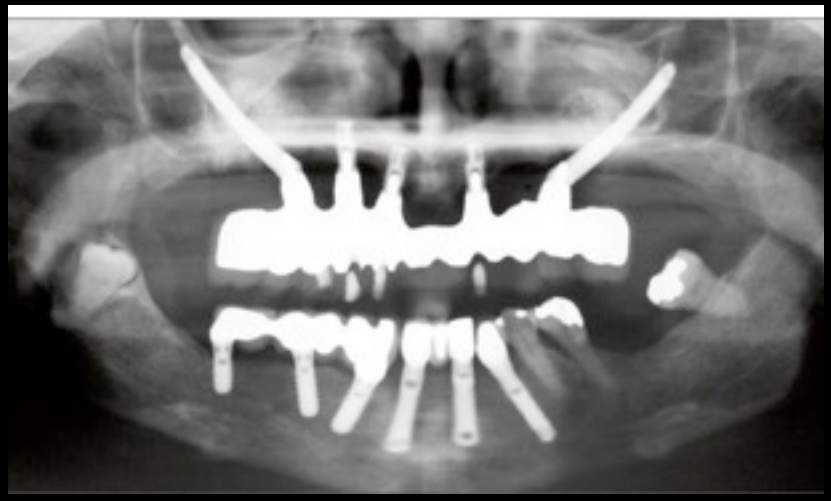
The 1946 version of the implant of Meylan.

Precursors to the Zygomatic and Pterygoid implants

Scialom Pins - 1950



Zygomatic Implants 2000



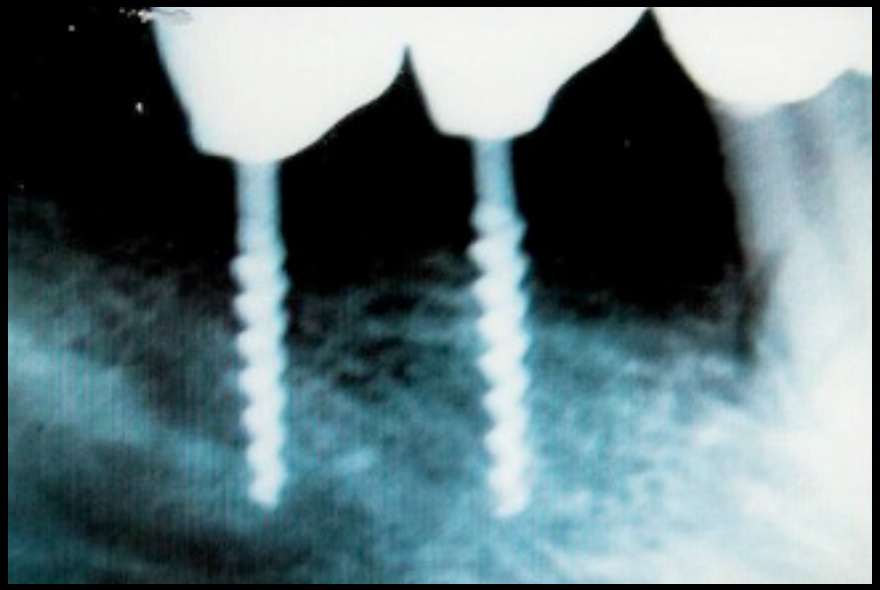
The Thread designs

Strock 1948

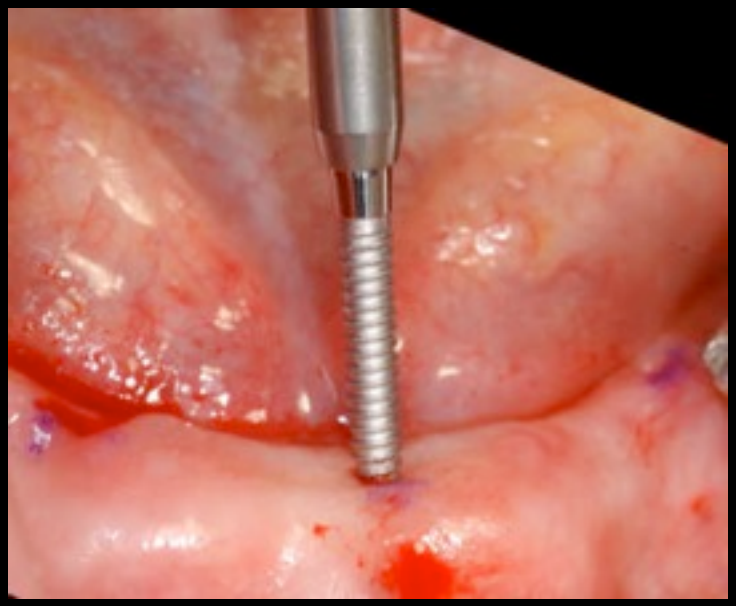
Nobel Active - 2008

The narrow ridge implant of Michael Cnercheve.

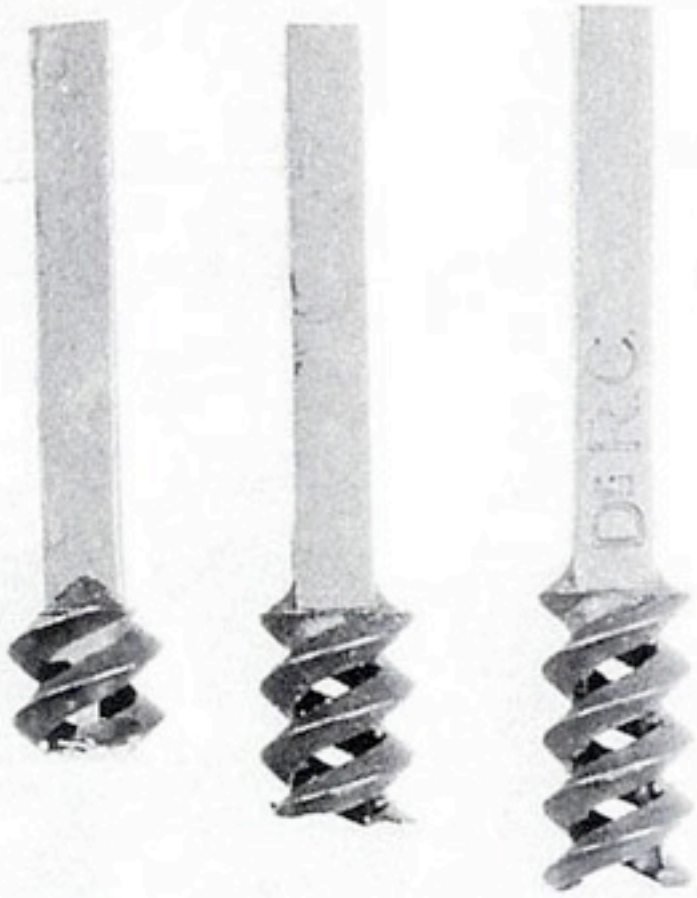
The Mini-Implants



1952



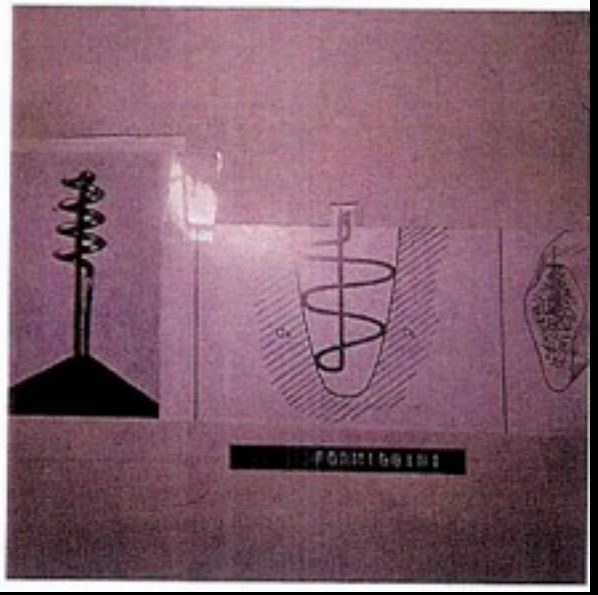
2002



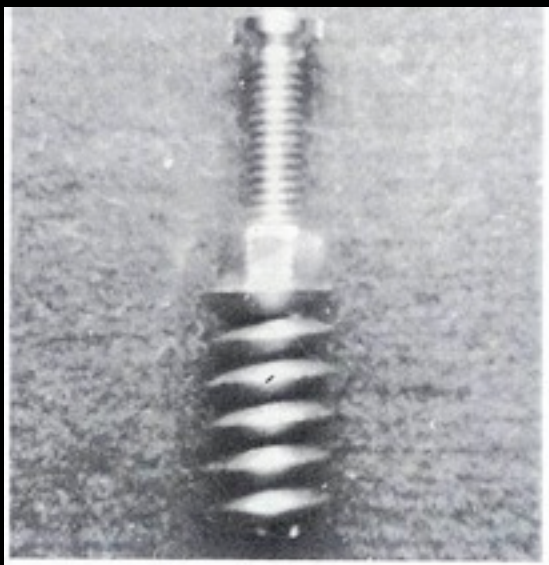
The double-helical spiraled implant of Raphael Cherchève. This excellent double-helical idea capitalizes on the advantages of the spiral idea and permits modification of the length of the implant by cutting off the lowermost spirals until the implant suits the site.

the Formiggini implant on the left and the Peron-Andres on the right.

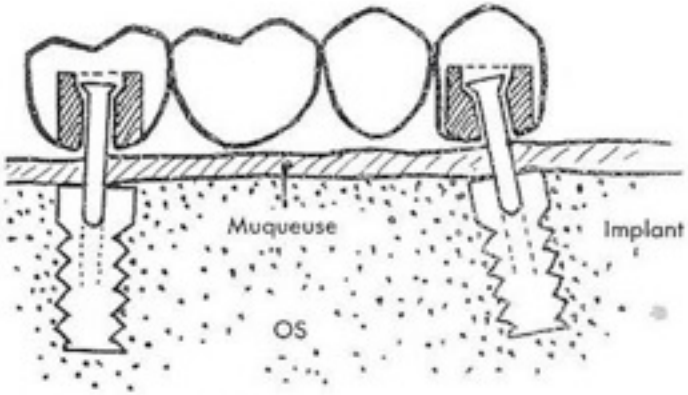
The Formiggini implant consisted of an inert wire bent upon itself to form the spirals, therefore no two could be alike.



The coil spring implant of Chercheve.



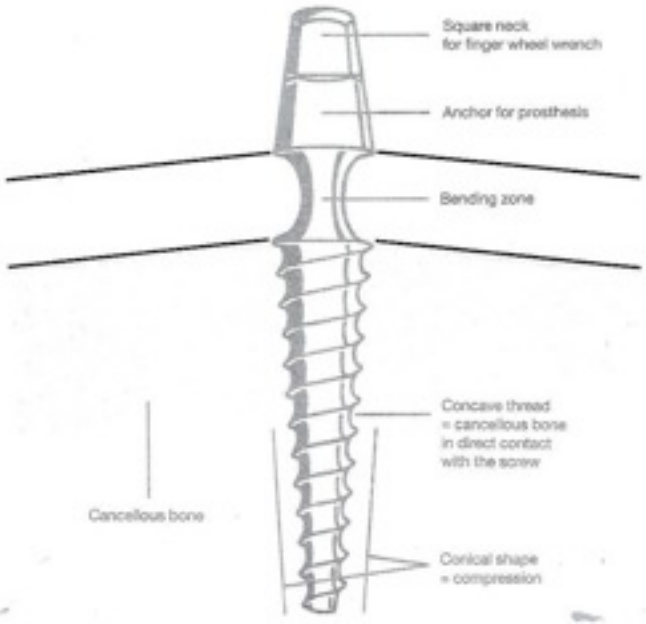
Raphael Cherchève's "sleep-away" implant.



A prosthesis fitted to Cherchève's "sleep-away" implants. (From Cherchève, R.: Les implants endo-osseoux, Paris, 1962, Librairie Maloine.)

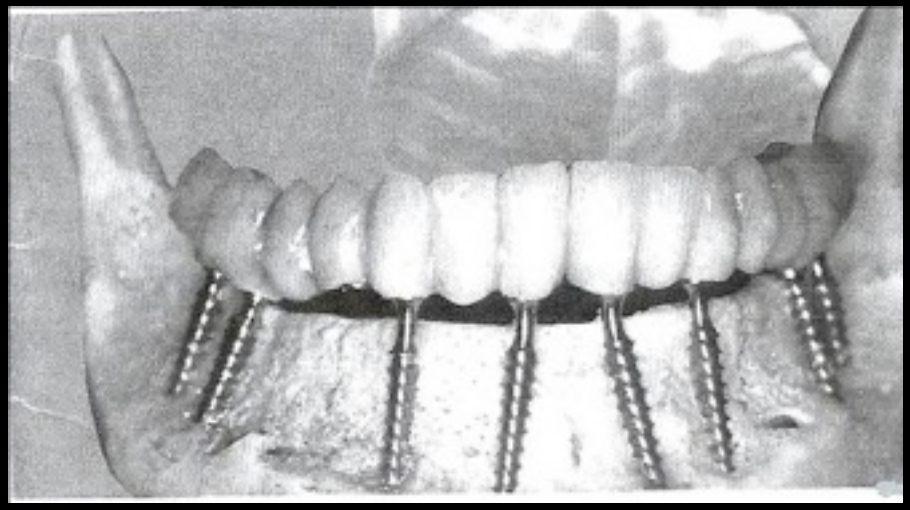
The design of the implant body's compression thread ensures that the bone tissue is displaced within its scope of elasticity but *not destroyed* when the implant is screwed in. The concave thread evenly displaces and compresses the bone substance in radial direction, the concave areas between the helical thread lines are filled with tissue, leaving no empty space that could cause the consequential damage described above. After cutting through the alveolar ridge, the extremely sharp, self-cutting compression thread puts a slowly increasing pressure on the contacting cancellous bone tissue, thus producing an excellent primary implant stability straight after screwing-in. Vertical and deep-drilling does not damage any tissue either. The specially shaped, small drill bits (smaller than the diameter of the implant) scrape but do not cut off the bone tissue.

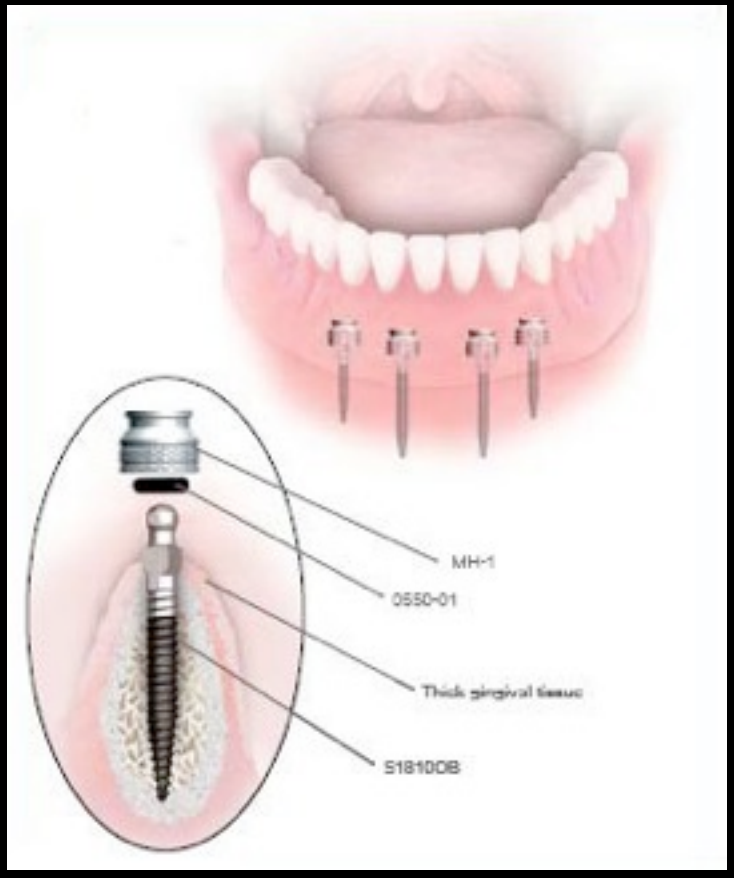
K.S.I. Bauer Screws are made of a titanium alloy that is certified for medical applications. Due to the additional surface treatment, they are highly tissue-compatible which makes for an optimal contact between implant and gingival substance.

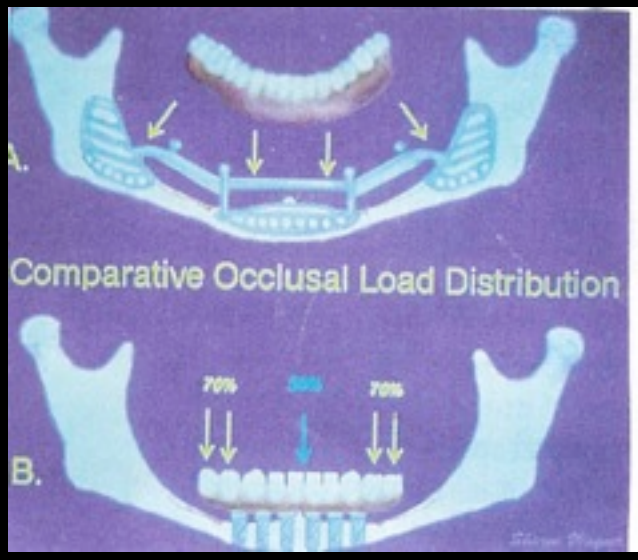


Nobel Direct

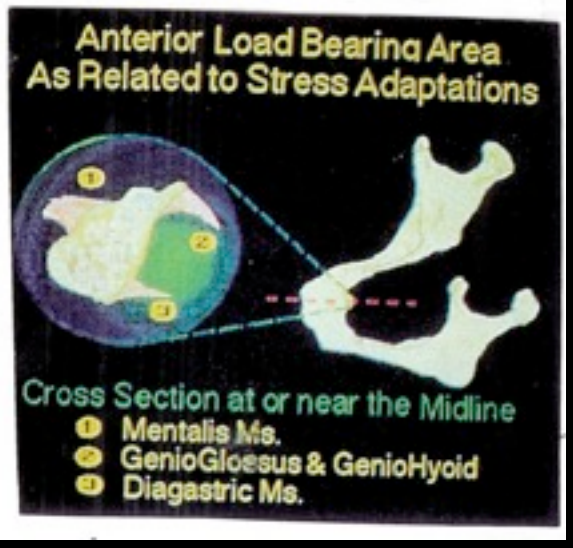
Nobel Active

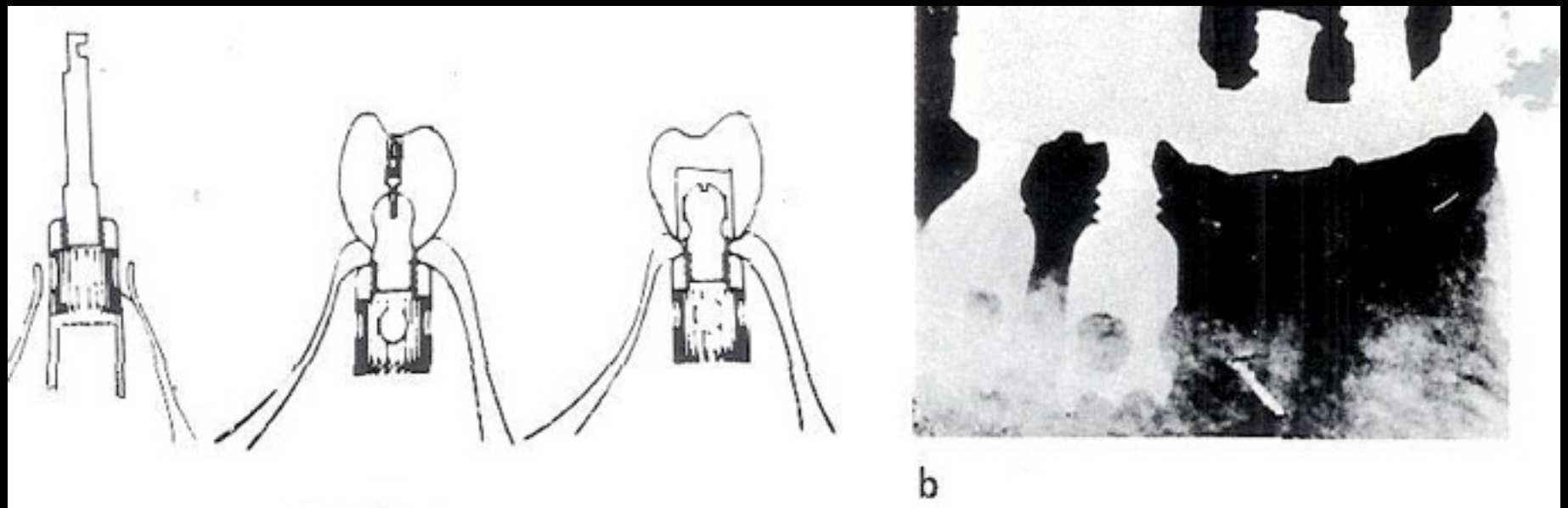



MH-1
0550-01
Thick gingival tissue
S1810DB


A.
Comparative Occlusal Load Distribution
70%
70%
B.


Posterior Load Bearing Area
As Related to Stress Adaptations
Cross Section of the Retro-Molar Triangle
1 Tendon of the Temporal Ms.
2 Mylohyoid Ms.
3 Masseter Ms.


Anterior Load Bearing Area
As Related to Stress Adaptations
Cross Section at or near the Midline
1 Mentalis Ms.
2 GenioGloesus & GenioHyoid
3 Diagastric Ms.

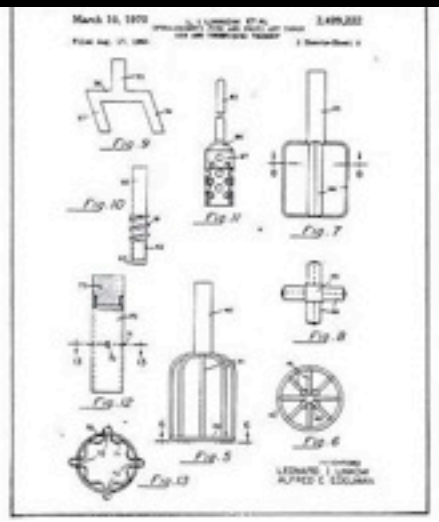


b

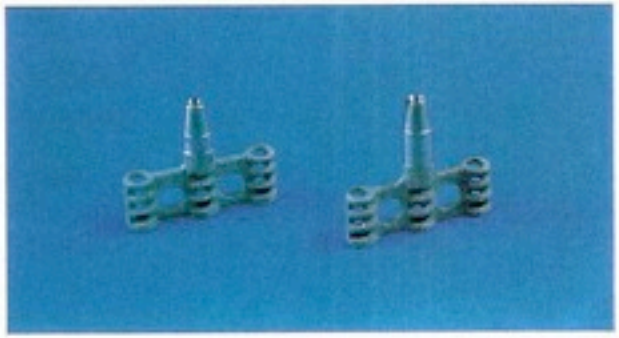
The tubular implant of Archard-Benaim.

Precursor for Corevent and ITI Bone Fit implants

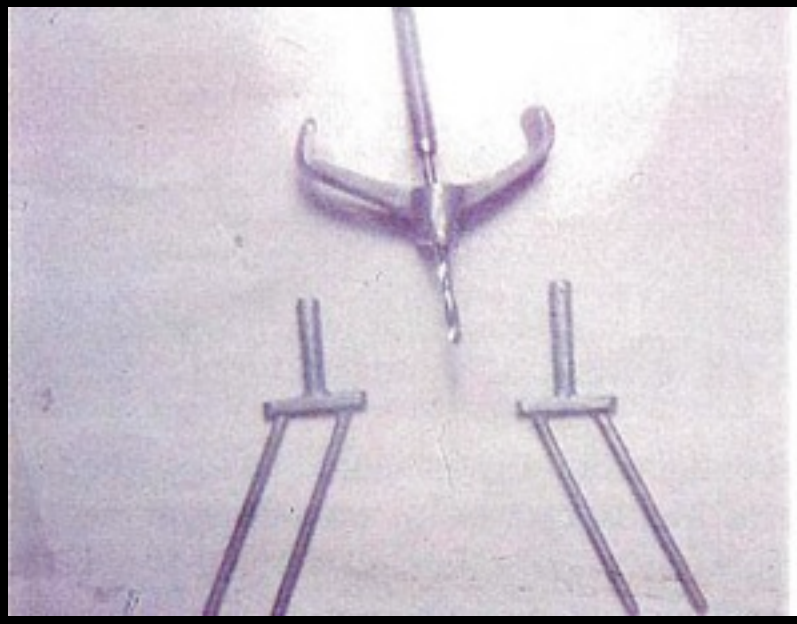
The 1965 Linkow — Edelman patent application (granted in 1970) of the hollow basket implant. Linkow's vent plant was also included in this patent as well as the precursor to the blade implant which was realized two years before the first blade implant was ever inserted.



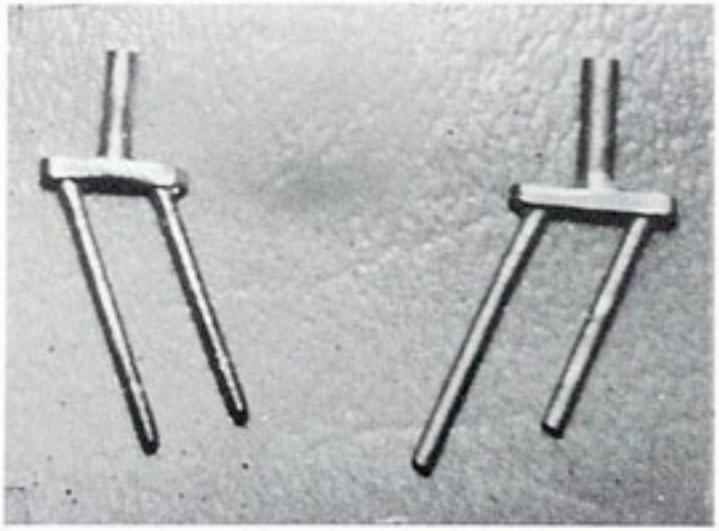
. About twelve years later a near exact duplicate of the author's hollow basket implant by Schroeder and Straumann became popular (1976).



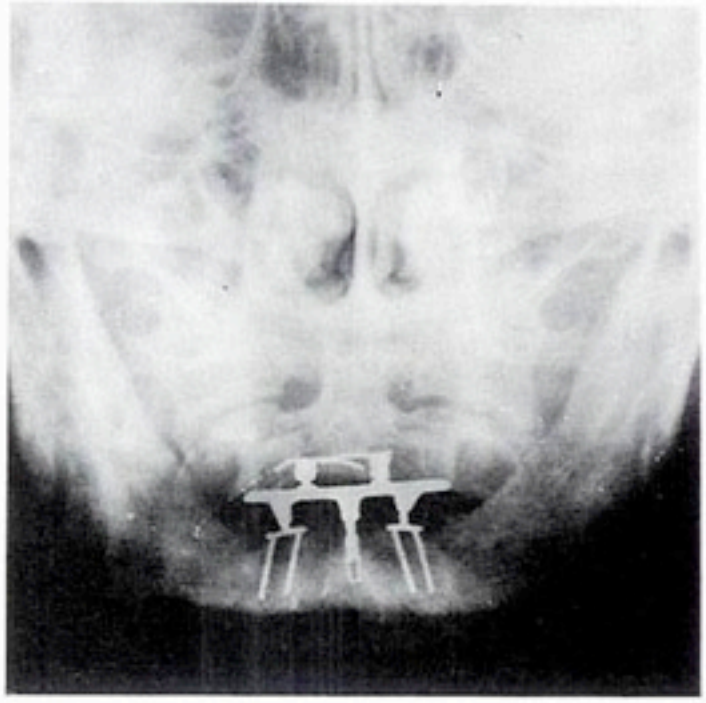
. Schroeder also developed a plasma coated « H » implant system which consisted of a bladelike device which opened up into two hollow cylinders at each end. It was placed into the bone with the use of an exact sized and shaped template.



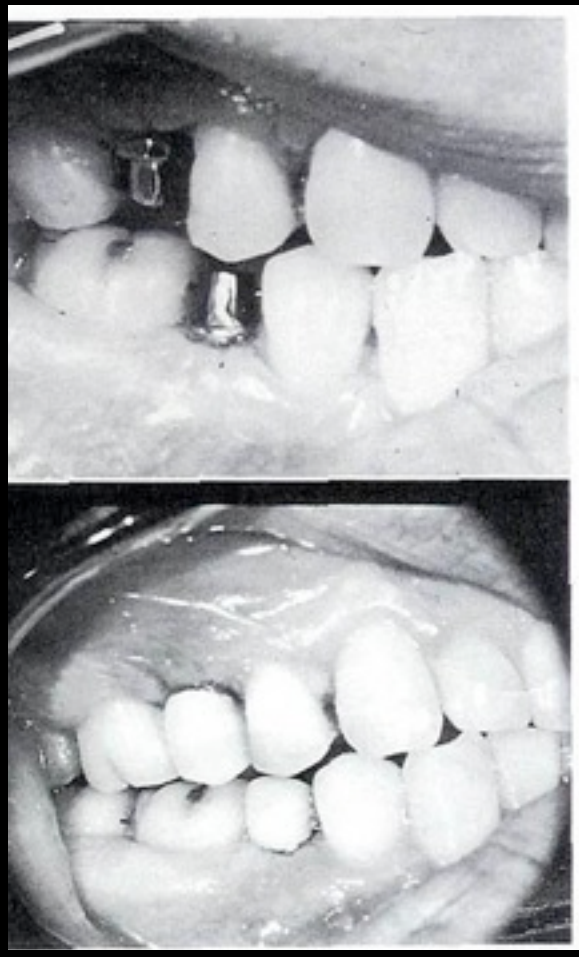
The Bifid implants of Bordon-Azoulay.



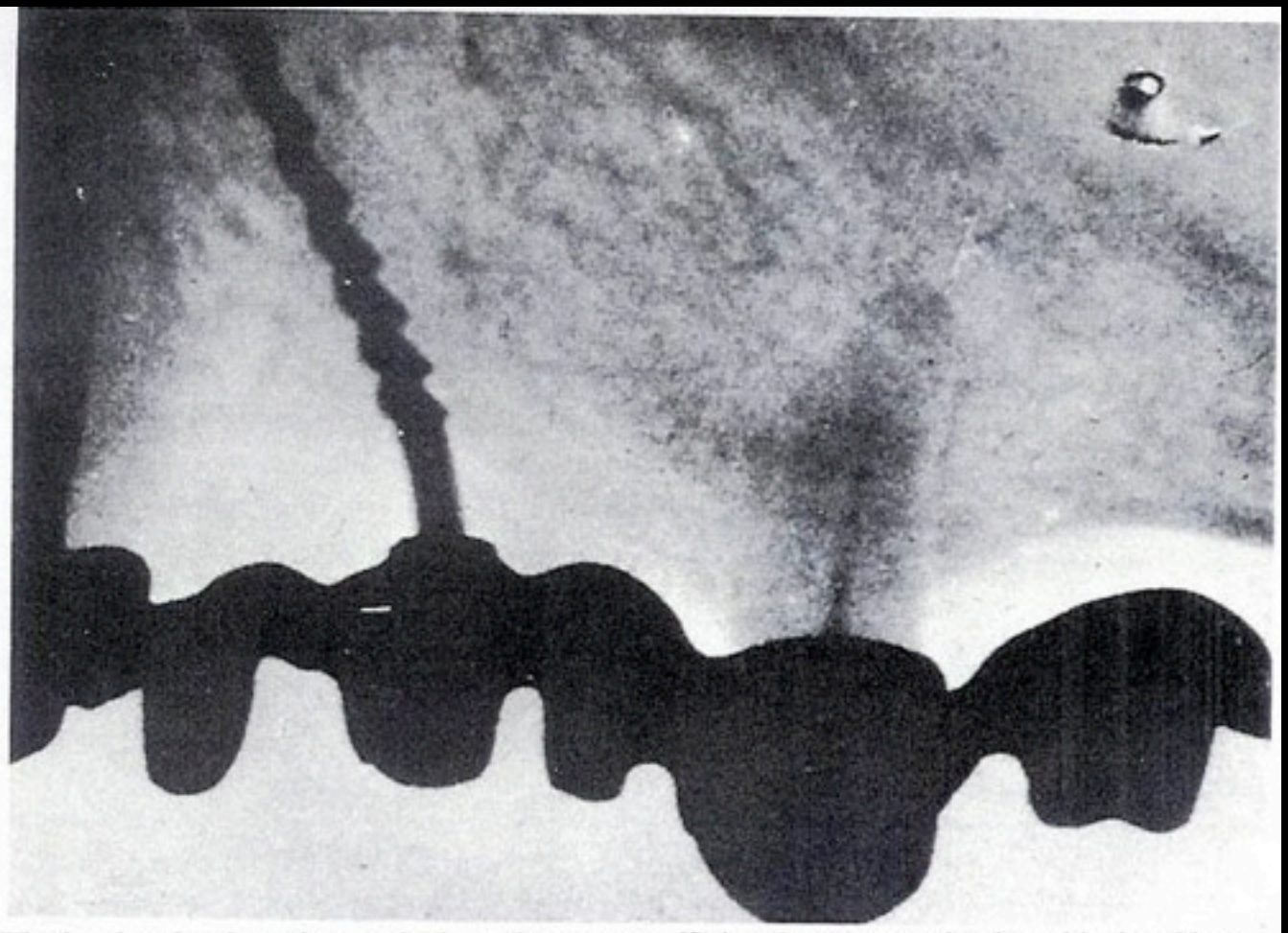
Bordon and Azoulay bifid implants.



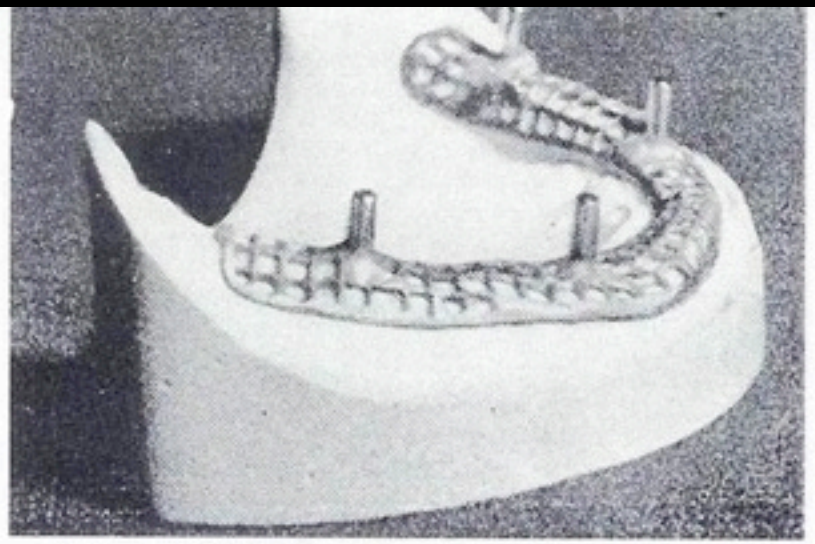
Both implants are in place with the connecting bar bridging them. The prosthesis is fashioned over the bridge. Here Linkow also used a vent-plant to help offset bucco- and labiolingual movements.



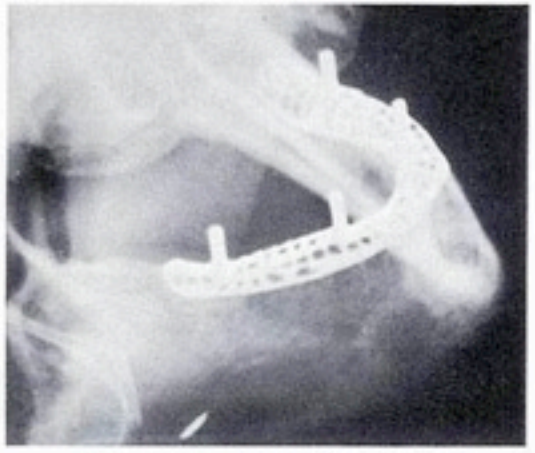
The abutment posts in clinical views of Bodin
butterfly implant. **A**, The posts protrude through nic
healed gums. **B**, The single-unit restorations in place, uns
ported by bridging the teeth. (From Kotch, R. L., a
Bodine, R. L., Jr.: Experimental subperiosteal dental i
plants [extract], U. S. Armed Forces Med. J., Vol. 4, N
3, March, 1953.)



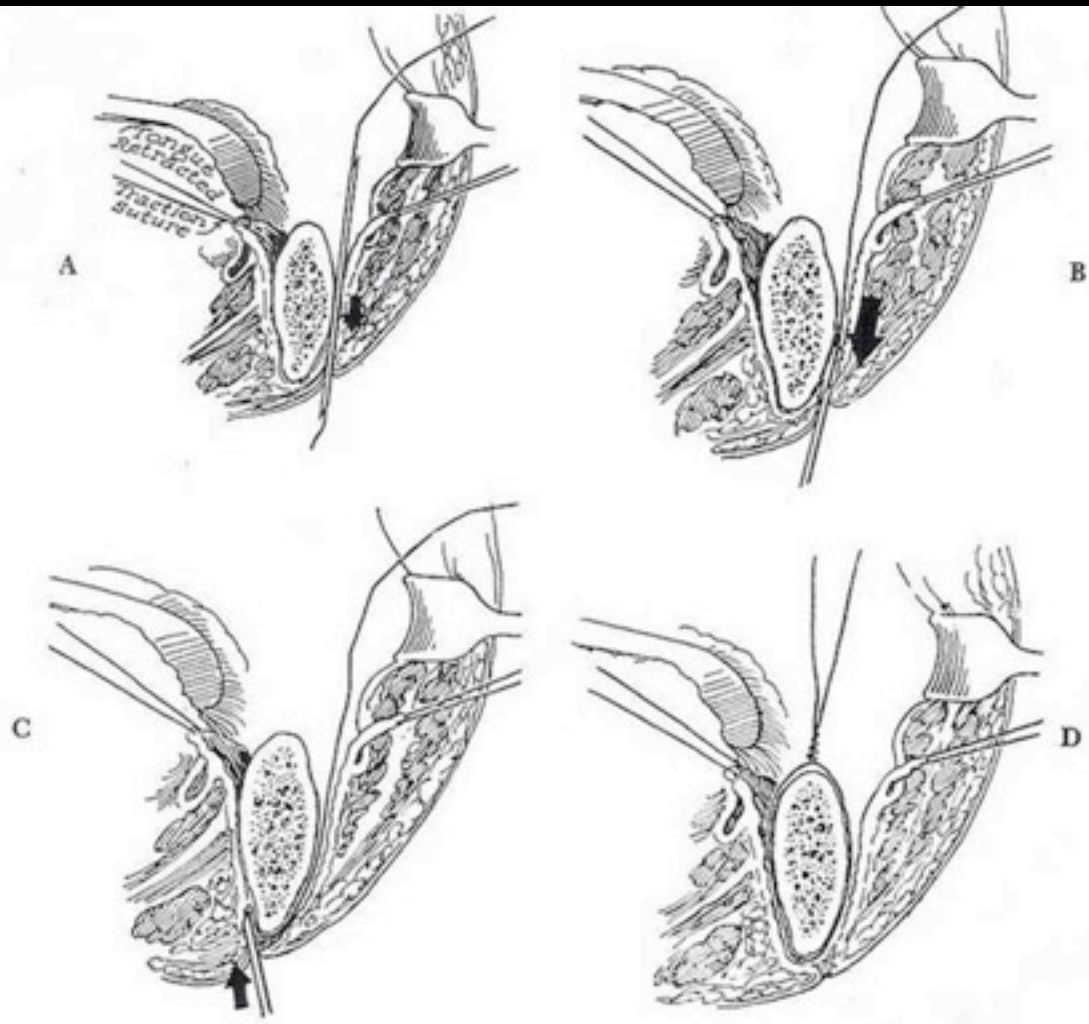
The implant has been inserted where there was sufficient bone to receive it and its head bent parallel to remaining teeth. Done by Linkow. (Courtesy M. Chercheve)



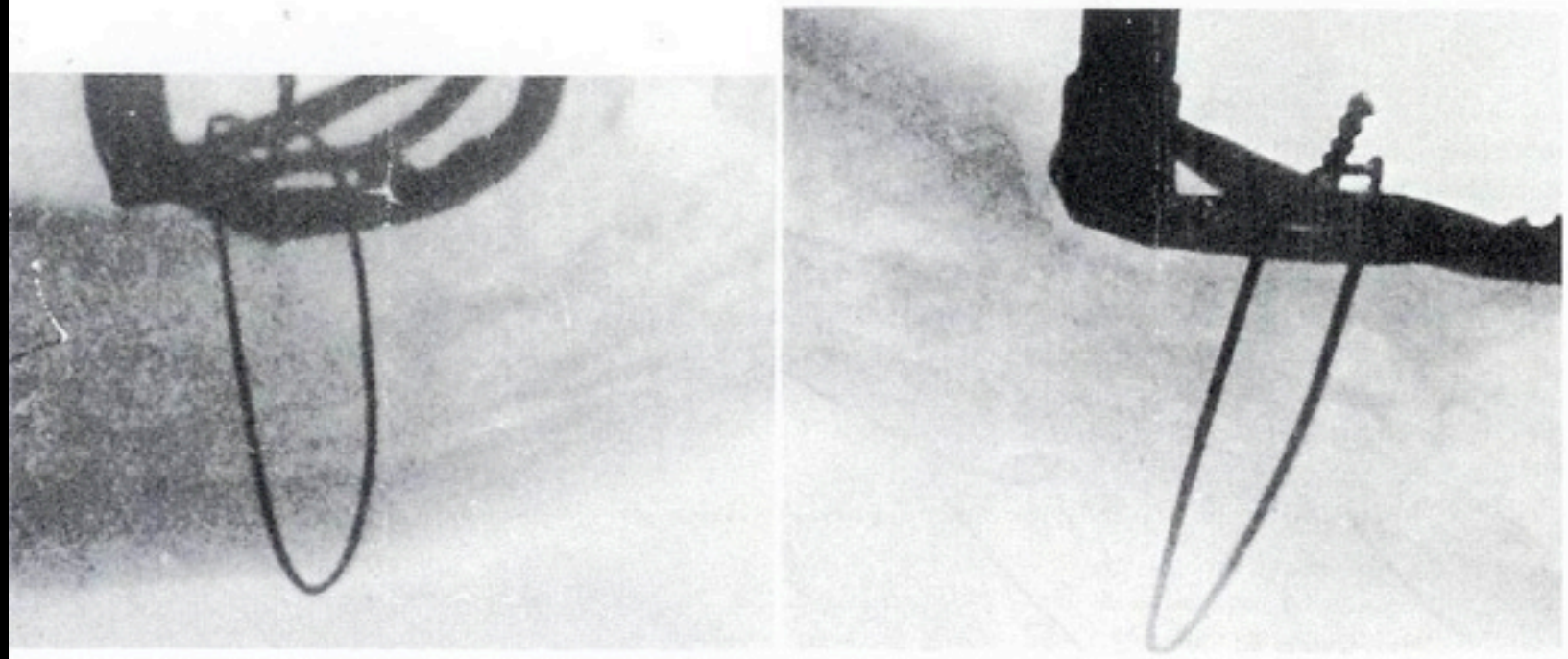
Berman's meshwork subperiosteal implant was fashioned on a stone model prepared from a direct impression of the bone. (From Berman, N.: An implant technique for full lower denture, Dent. Dig. 57[10]:438, 1951.)



Because it was prepared from a direct impression of the bone, Berman's meshwork implant closely fitted the bone. (From Berman, N.: An implant technique for full lower denture, Dent. Dig. 57[10]:438, 1951.)

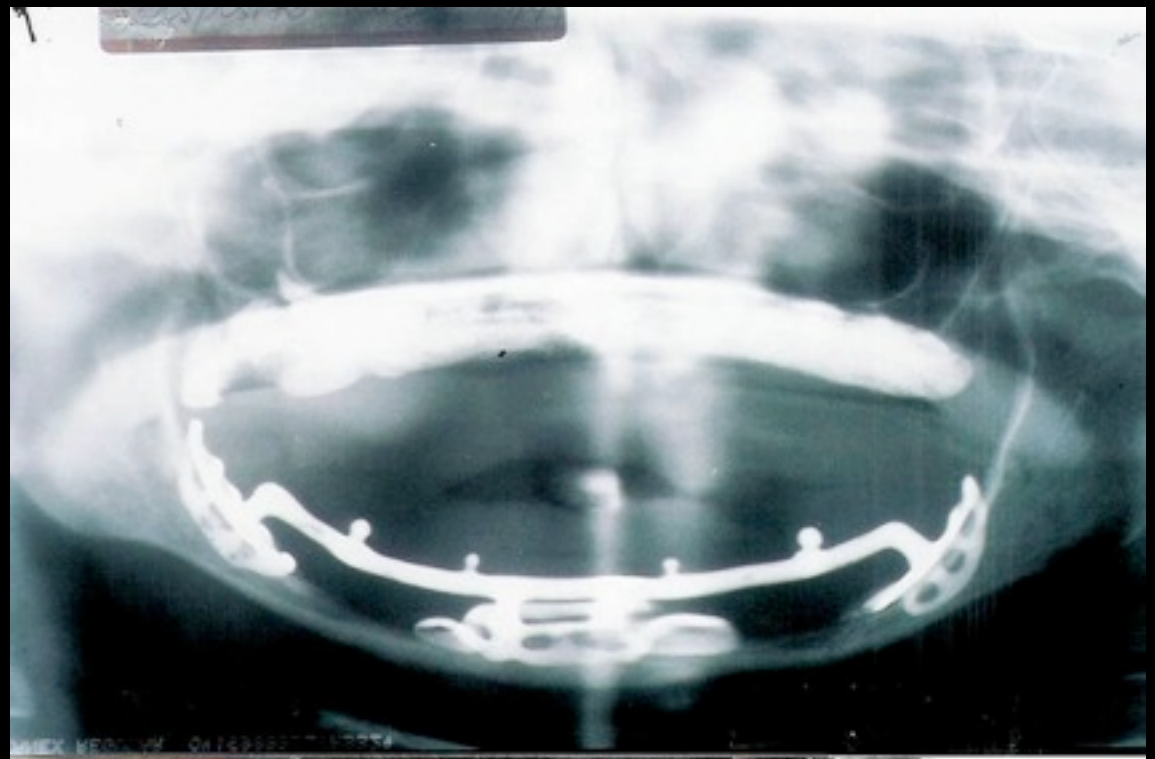


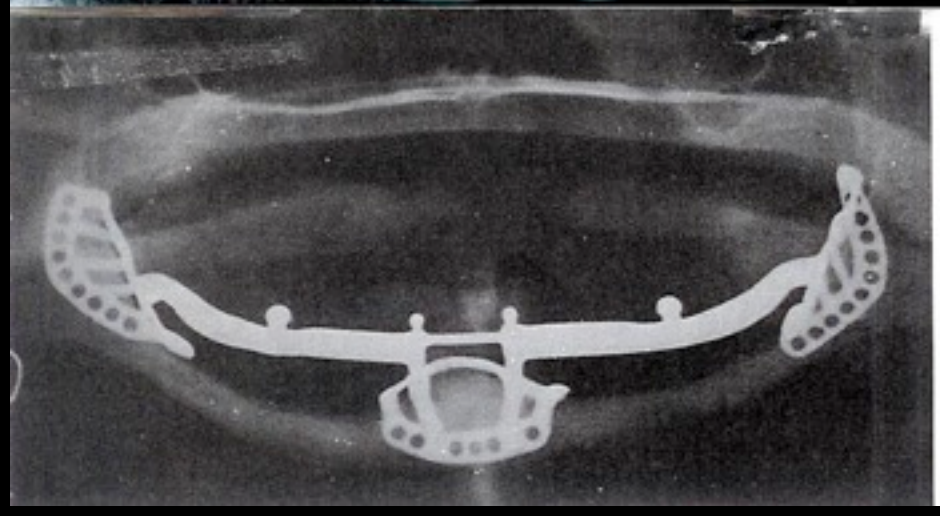
Berman's circumferential wiring technique. A, The wire is passed through a double-tapered needle placed between the periosteum and bone on the buccal side of the mandible. B, The needle at the buccal lower border; C, the needle at the lingual lower border. D, The needle has been pushed along the entire lingual border of the mandible, disengaged from the wire, and the wire twisted. (From Berman, N.: Implant technique for full lower denture, Washington Dent. J. 19:15-17, 1950.)



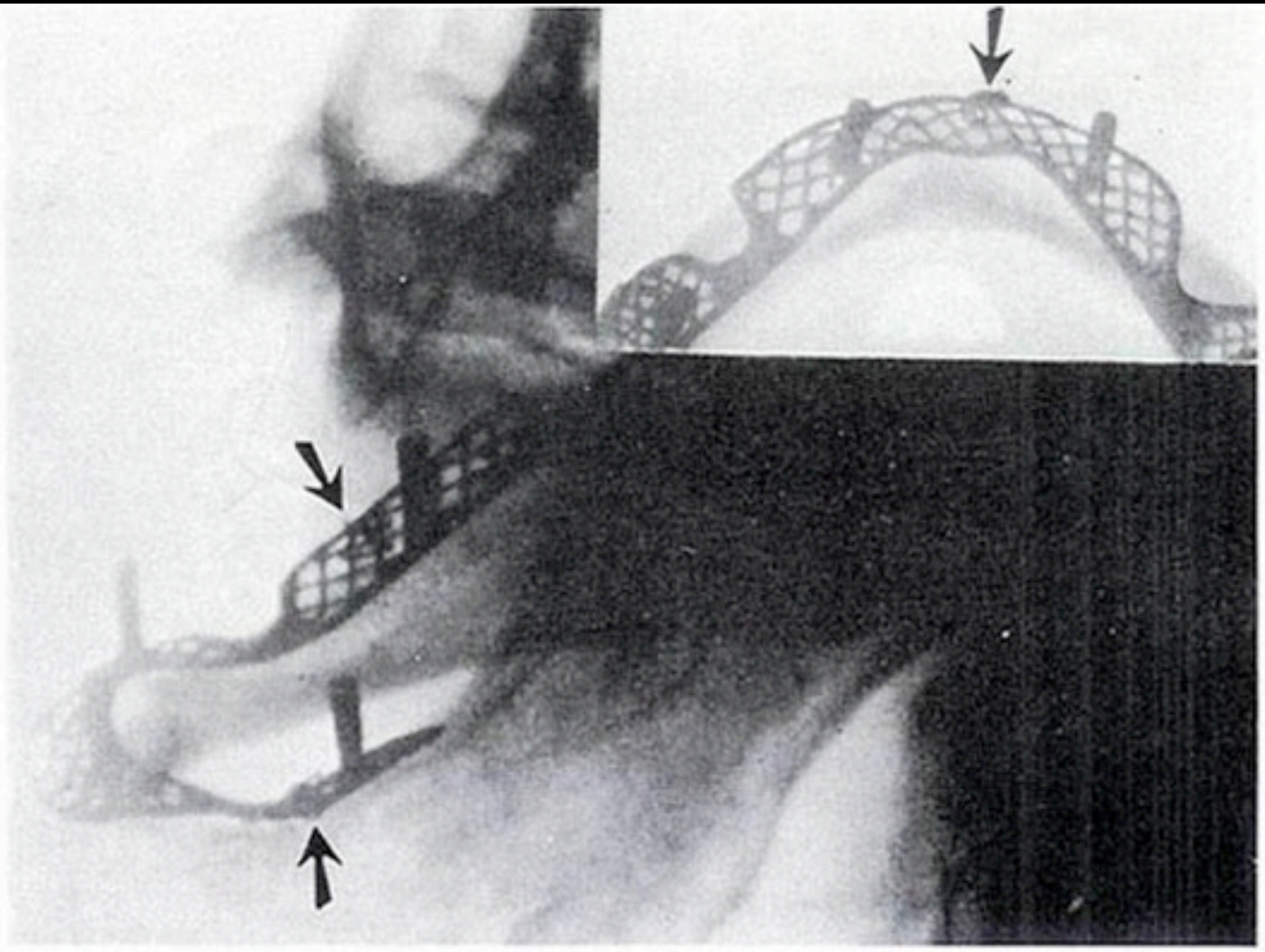
A B

The fate of an implant set either over too much alveolar bone, or loose because of design flaws. **A,** Berman's circumferentially wired implant appears successful 3 months after implantation. **B,** Two years later the implant and wire are loose as a result of bone atrophy. (From Berman, N.: Implant technique for full lower denture, Washington Dent. J. 19:15-17, 1950.)

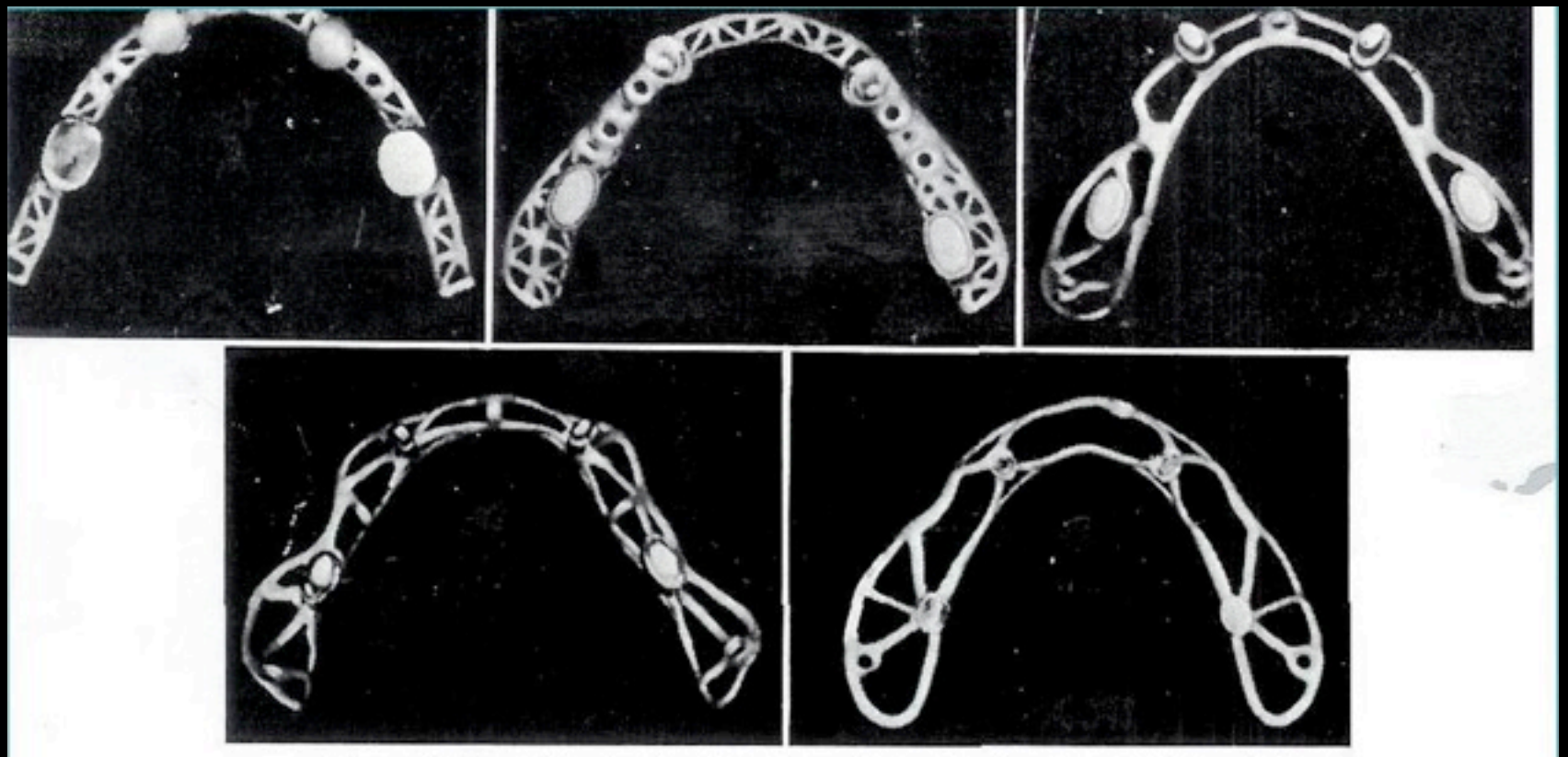




Shows the third
type of ramus hinge

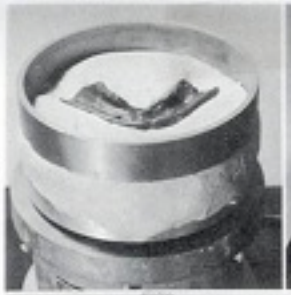


Another type of Berman meshwork implant held in place by transosseous wires *(arrows)* in the molar and incisor areas. (From Berman, N.: Implant technique for full lower denture, Washington Dent. J. 19:15-17, 1950.)



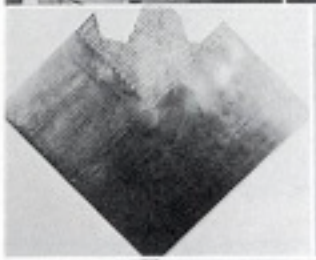
The evolution of Lew's subperiosteal mandibular implant from 1948 (top left) to 1955 (bottom right). Gradually the amount of metal became reduced from a bulky mesh to strategically placed bars and struts with simple, tapered abutment posts. (From Lew, I.: Progress in implant dentistry—an evaluation, J.A.D.A. 59:478-492, 1959. Copyright American Dental Association. Reprinted by permission.)

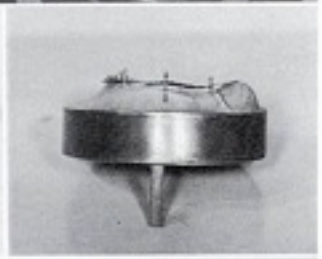
A



B

C, D



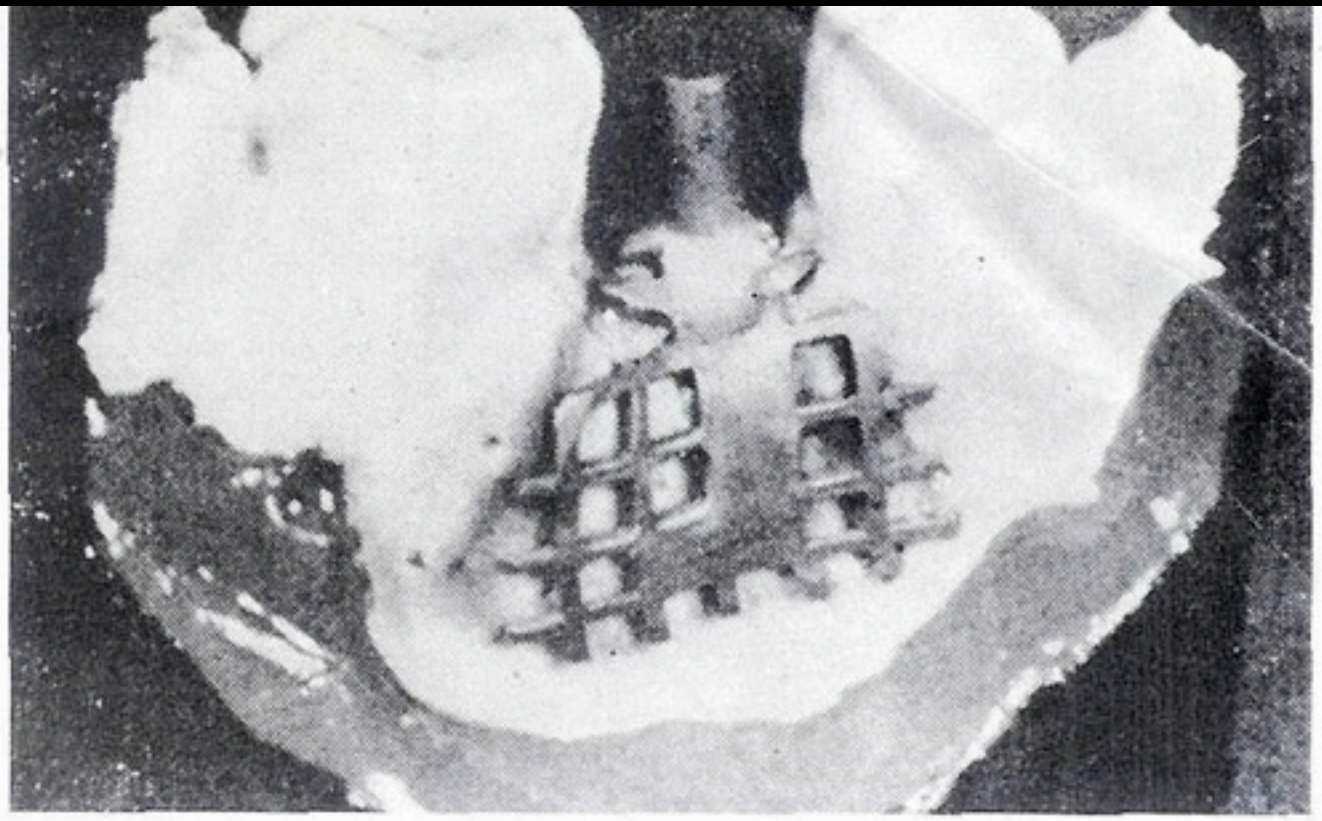


E

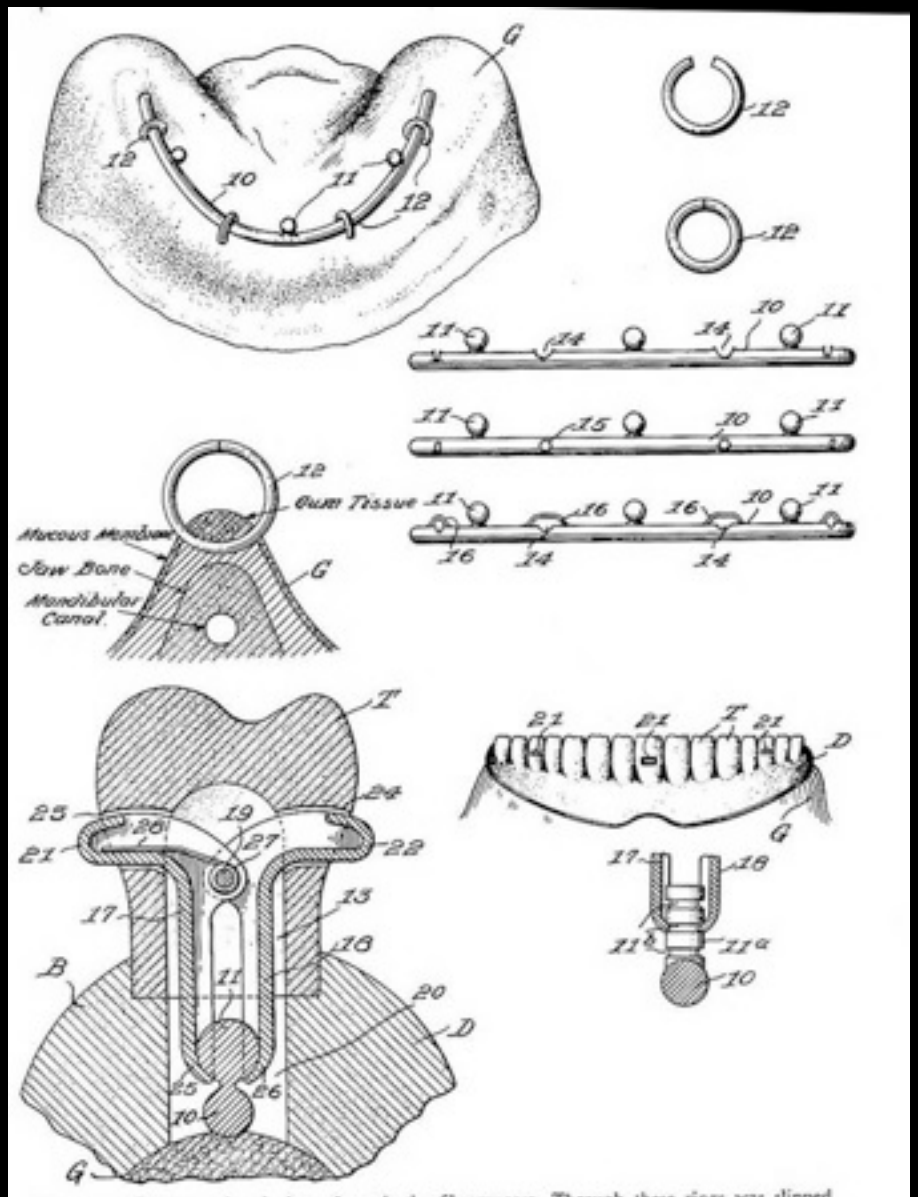
F

Marziani's method of making an implant. A, A model was made from an impression of exposed bone. B, Posts were stuck in the model. C, A piece of tantalum mesh was cut to appropriate size. D, The mesh was fitted to the model over the posts. E, The model and its opposing half were vised to swedge the implant to the shape of the bone. F, The implant before insertion. (From Marziani, L.: Case report: tantalum implant dentures, Int. Dent. J. 8:255-257, 1958.)

Full subperiosteal restorations by Marziani. The posts are connected by a bar and the prosthesis fitted over them. (Courtesy L. Marziani.)



Bodine's subperiosteal single-tooth butterfly implant for a fixed crown between two natural teeth. (From Kotch, R. L., and Bodine, R. L., Jr.: Experimental subperiosteal dental implants [extract], U. S. Armed Forces Med. J., Vol. 4, No. 3, March, 1953.)



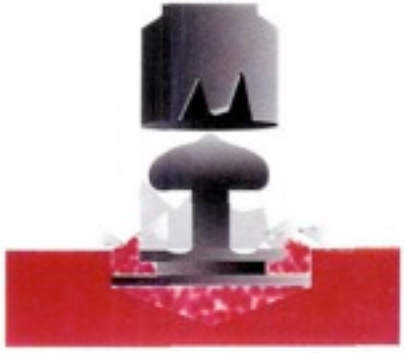
Brennan placed rings through the fibromucosa. Through these rings was slipped a full spanned arched bar over which the denture was attached. (U. S. patent application No. 2,599,044, filed January 3, 1949.)

An intramucosal insert, or button implant. The base is permanently embedded in the denture, with only the head and neck protruding. These buttons fit into slots made in the mucosa. (From Cranin, N.: The intramucosal insert—review and progress report, J.A.D.A. 62:658-665, 1961. Copyright American Dental Association. Reprinted by permission.)

An acrylic receptor site bur is used to prepare sites within the denture for placement and fixation of twelve to fourteen insert bases. One row of three to four insert preparations are made inside the denture opposing the crest of the patient's ridge, from the canine to the tuberosity areas on both sides. Another row of three inserts are placed along the junction of the palate and the alveolar ridge in a staggered fashion, on both sides.

Each intramucosal insert is placed into each receptor site inside the denture individually with its protective plastic housing covering its mushroom and neck portion. Using acrylic powder and liquid individually the top of the base of the insert is carefully covered with a fine paint brush. The protective housing prevents the acrylic from oozing into the undercut area of the insert. The procedure is repeated until all of the inserts are processed to the denture base.

A specially designed hollow mill trephine is then rotated over the insert head and neck to remove any acrylic flashing along its base. This is accomplished after the plastic protective housing is removed.



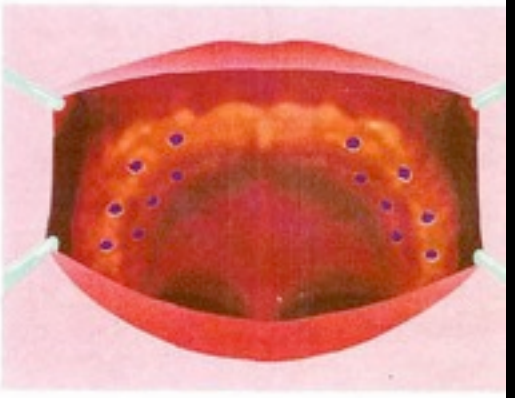
The palatal surface of the denture is carefully checked for any remaining acrylic residues.

A finishing disc brush is then used with pumice to finely polish away any remaining acrylic.

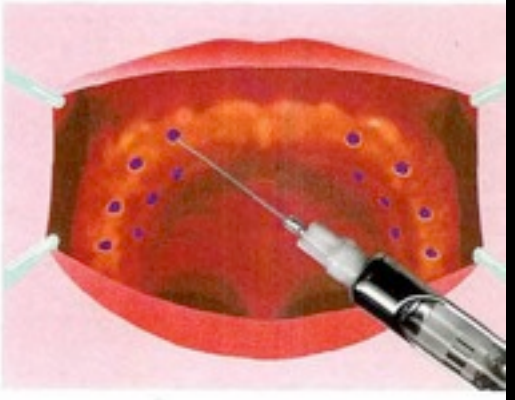
The prepared insert bases are checked once again.

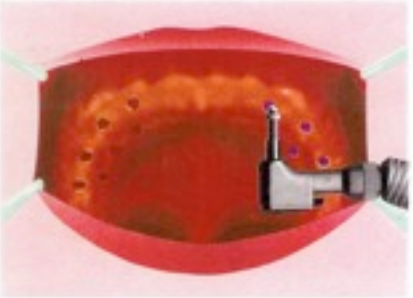
The apical perimeter of the mushroom portion of each prepared insert base location is coated with dye from a purple denture transfer stick.

The patient's palate is dried with gauze and coated with tincture of myrrh and benzoin and is then instructed to close hard with the denture in place. The dye around each base site provides exact transfer of crest and palatal slope sites. Twelve to fourteen circles representing the snapinsert locations in the denture should be outlined in purple on the patients palate.

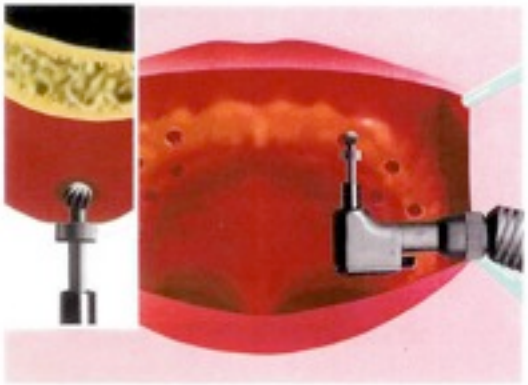


A few drops of a local anesthetic with 1:100,000 epinephrine can be injected into each site which creates good hemostasis.



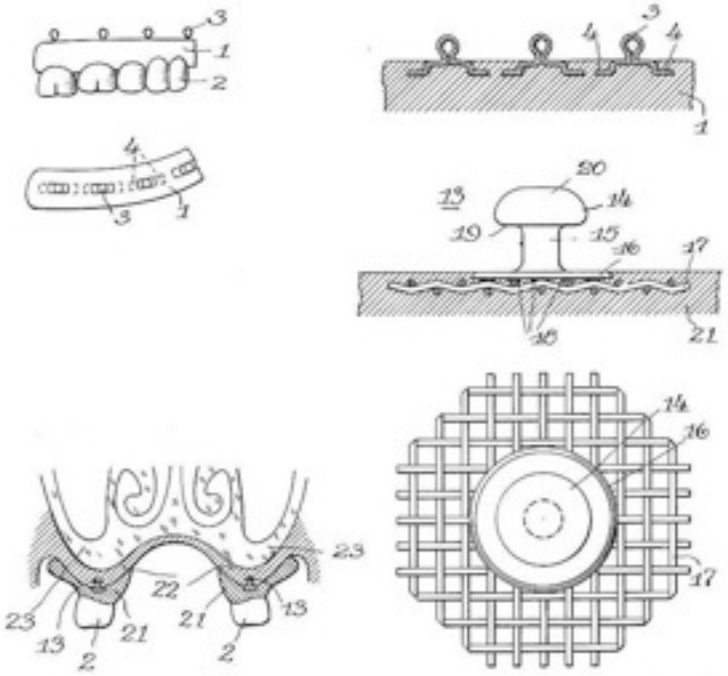


A sterile tissue receptor site bur is used at ngnt angles to the markings to prepare a tissue channel in the center of each tissue site. A broad flange at the base prevents over penetration of the bur. If the palatal tissue is too thin at any given implant receptor site the procedure in that area should be aborted as the patient will experience pain when chewing or occluding.



A sterile tissue undercut bur is used to create an undercut in the tissues at the top of each insert channel. This undercut corresponds to each head of the insert. A broad flange again prevents overpenetration of the bur. This bur is rotated only after it is placed deeply into the tissue receptor site. This will create a female mushroom shaped tissue receptor site which will retain the male mushroom shaped implant. If the denture is unable to be reseated properly with the inserts in place the path of draw should be examined. Some divergence of the snapinserts between those on the ridge crest and those on the palatal junction is desired for maximum retention but if it is too great it will keep the denture from reseating. The clinician should remove the offending snapinsert and adjust the angulation before replacing it.

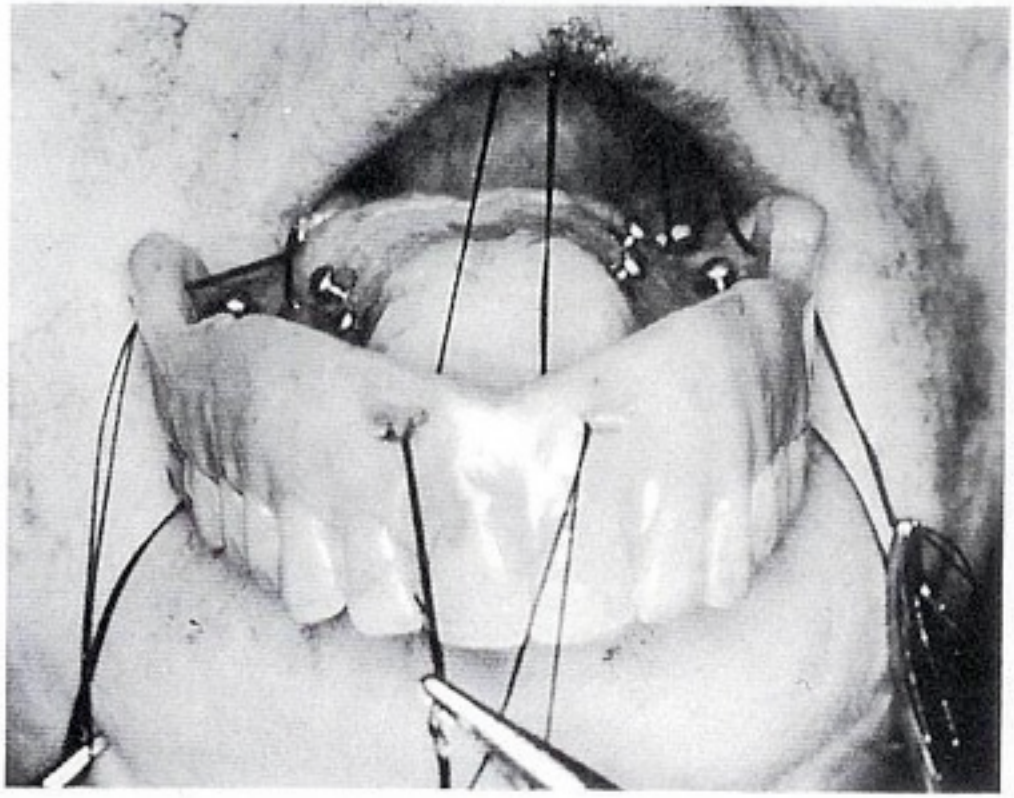
Where snapinserts are to be placed into a metallic based denture the twelve to fourteen holes should first be made in the wax prior to casting the base.



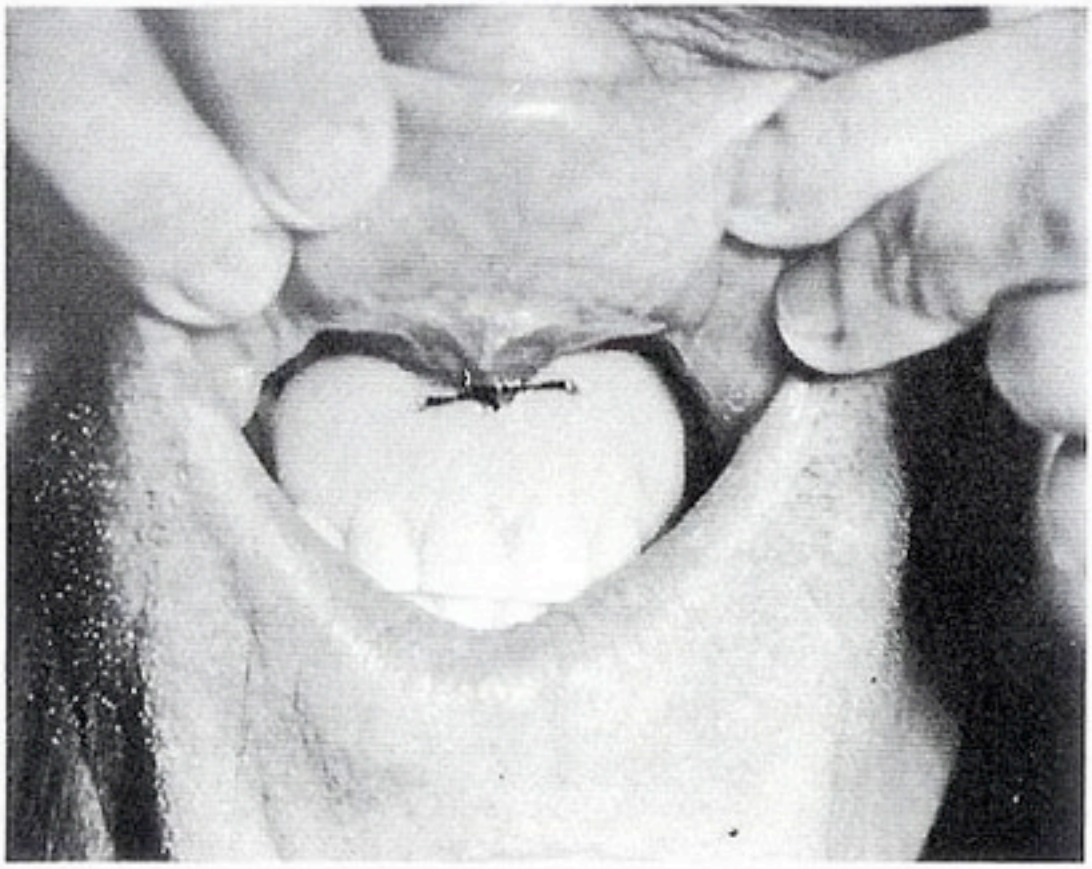
Dahl's mucosal inserts shown in U. S. Patent Application No. 2,374,422, filed in 1943.

Exploring possible button implant sites with a sharp probe. (Courtesy N. Cranin.)

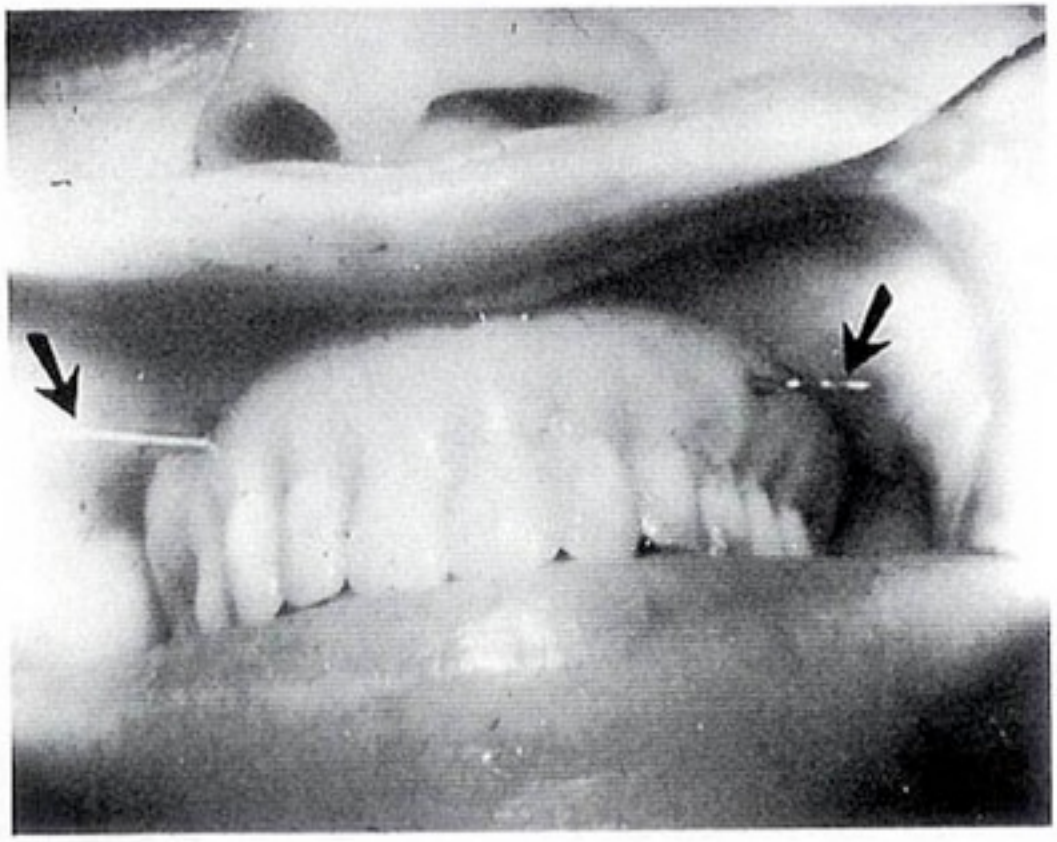
Intramucosal implant sites marked with indelible pencil. (From Cranin, N.: Intramucosal insert—a method of maxillary denture stabilization, J.A.D.A. 57:188, 1958. Copyright American Dental Association. Reprinted by permission.)



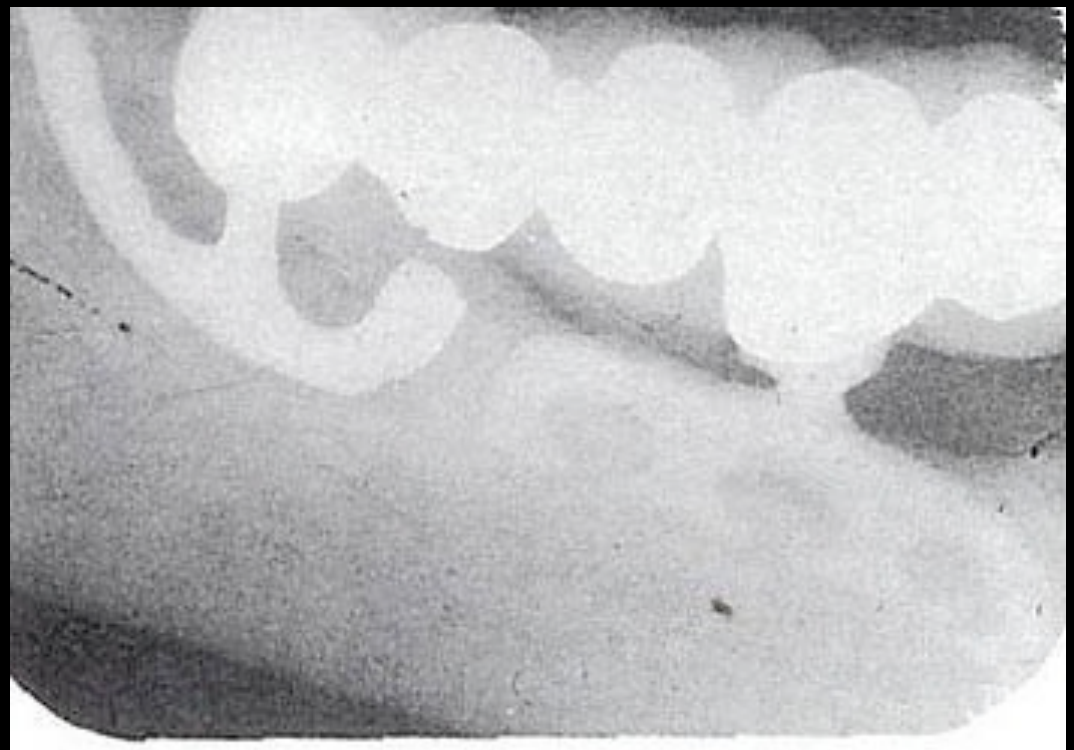
To make sure that the denture does not move and disturb the healing tissues, it is sutured in place. (From Cranin, N.: Intramucosal insert—a method of maxillary denture stabilization, J.A.D.A. 57:188, 1958. Copyright American Dental Association. Reprinted by permission.)



The denture sutured in place. (From Cranin, N.: Intramucosal insert—a method of maxillary denture stabilization, J.A.D.A. 57:188, 1958. Copyright American Dental Association. Reprinted by permission.)



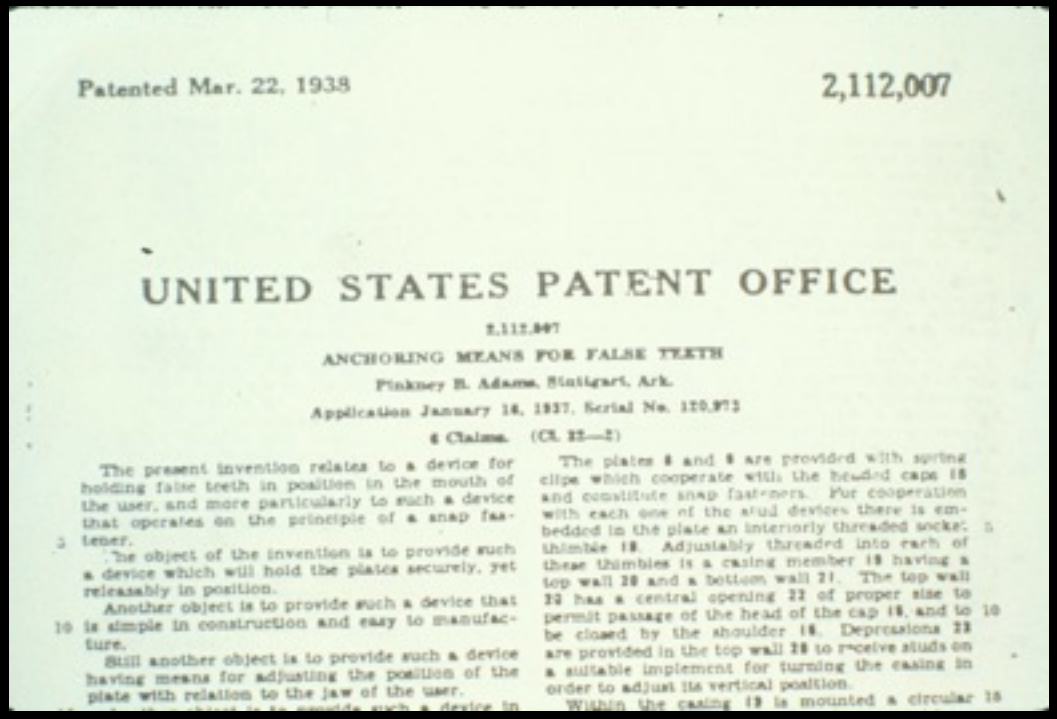
. Another method of stabilizing a button implant denture until the sites heal, according to Linkow, is to drive pin implants horizontally into the bone *(arrows)*, carefully avoiding the sinus. The protruding ends of the pins are cut flush with the pink acrylic and fastened to it with a drop of resin material. This gives the denture immediate stabilization.



Cranin anchor implant. In the late 1960s introduced his vitallium anchor implant

The Time Machine

- 1937 –



Patented Mar. 22, 1938 2,112,007

UNITED STATES PATENT OFFICE

2,112,007

ANCHORING MEANS FOR FALSE TEETH

Pinkney B. Adams, Stuttgart, Ark.

Application January 16, 1937, Serial No. 120,973

6 Claims. (Cl. 32—2)

The present invention relates to a device for holding false teeth in position in the mouth of the user, and more particularly to such a device that operates on the principle of a snap fastener.

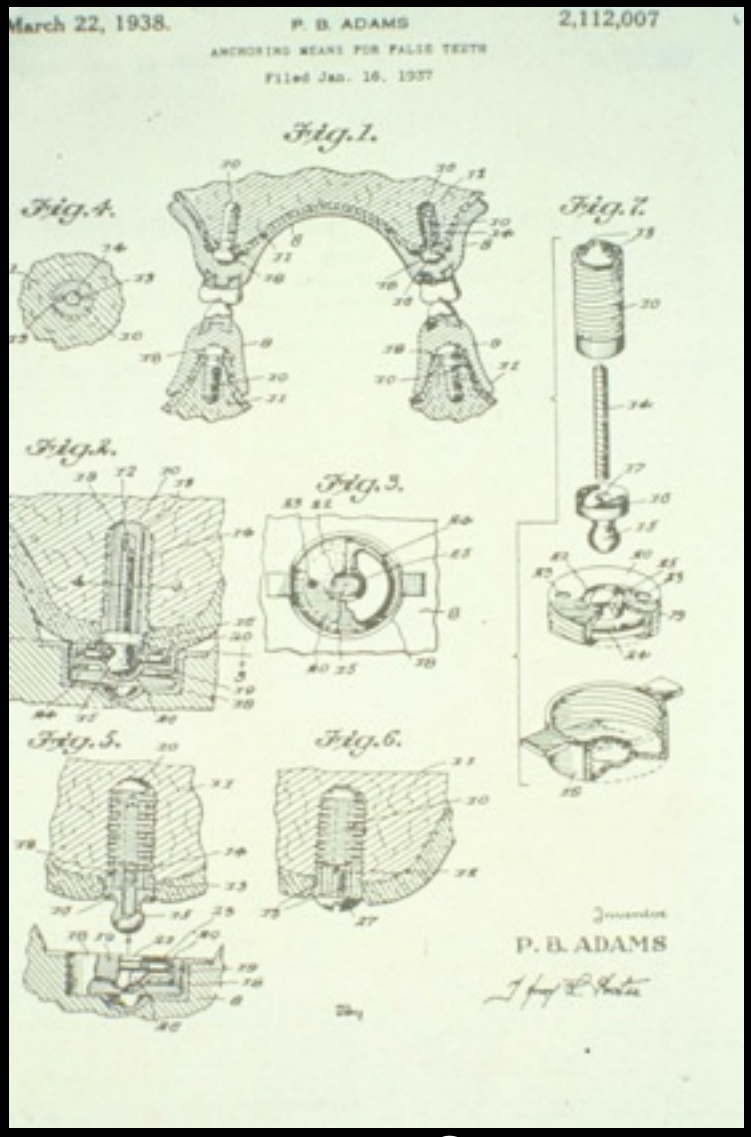
The object of the invention is to provide such a device which will hold the plates securely, yet releasably in position.

Another object is to provide such a device that is simple in construction and easy to manufacture.

Still another object is to provide such a device having means for adjusting the position of the plate with relation to the jaw of the user.

The plates 8 and 9 are provided with spring clips which cooperate with the headed caps 18 and constitute snap fasteners. For cooperation with each one of the stud devices there is embedded in the plate an interiorly threaded socket thimble 19. Adjustably threaded into each of these thimbles is a casing member 19 having a top wall 20 and a bottom wall 21. The top wall 20 has a central opening 22 of proper size to permit passage of the head of the cap 18, and to be closed by the shoulder 16. Depressions 23 are provided in the top wall 20 to receive studs on a suitable implement for turning the casing in order to adjust its vertical position.

Within the casing 19 is mounted a circular



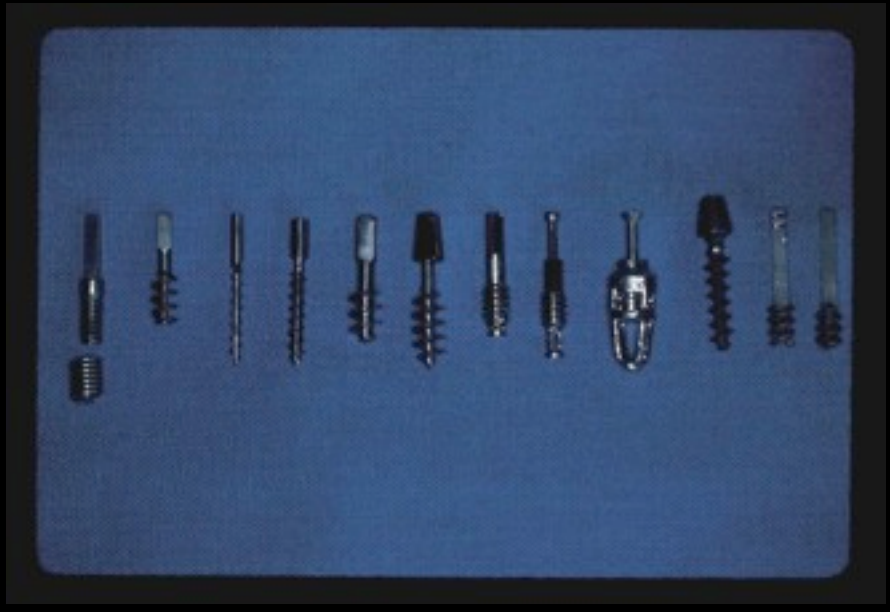
Courtesty: root lab

Two-Stage Single Tooth Approach

- 1948

The Immediate Load Era

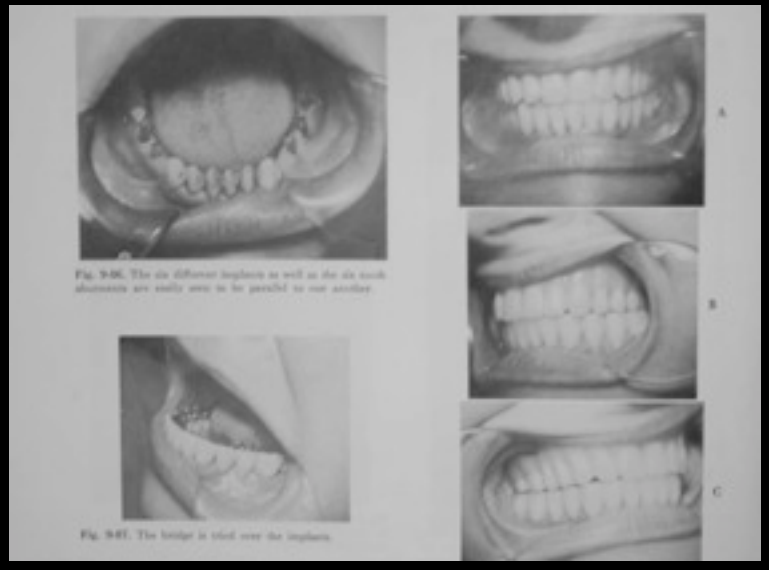
- 1950s and 1960s
  - One stage surgery and immediate load



The Immediate Load Era

- 1950s and 1960s

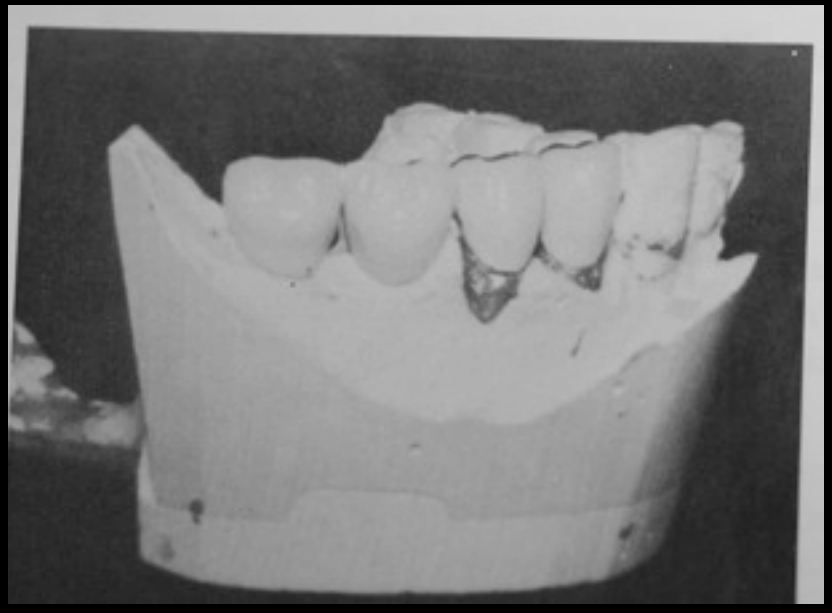
"Teeth in an appointment?"



Linkow Chercheve eds. Theory and Techniques of Oral Implantology 1970, CV Mosby

The Immediate Load Era

- 1950s and 1960s
  - The completed final prostheses



The Immediate Load Era

- 1950s and 1960s
  - The final prosthesis as the template

Fig. 9-39. A, The fixed partial denture is tried in the mouth prior to implant insertions. B, The prosthesis in place prior to implant insertions.

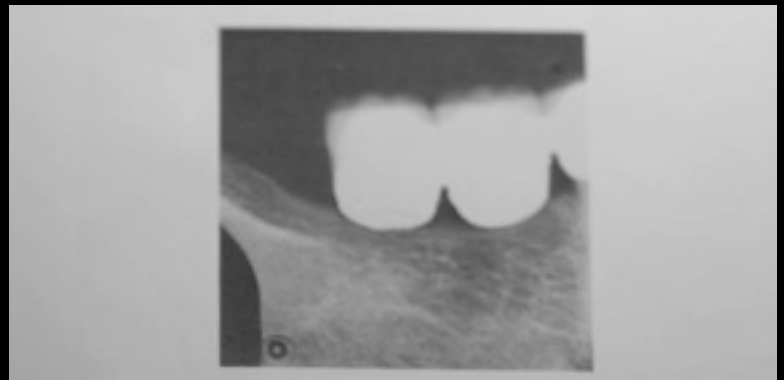
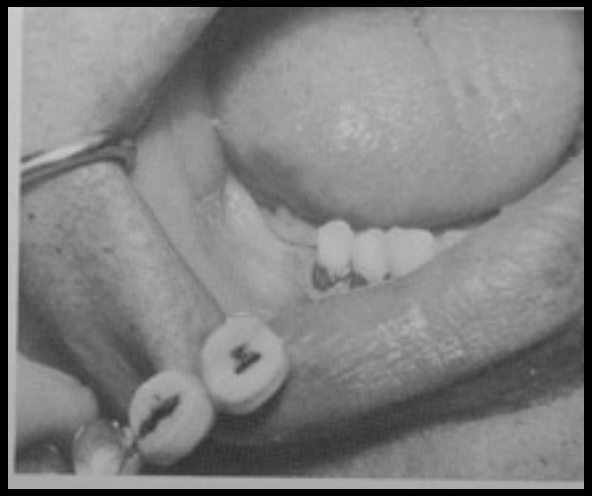


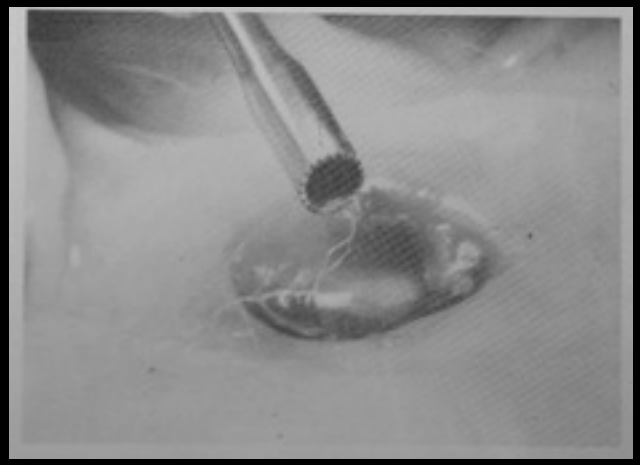
Fig. 9-40. The prefabricated bridge is radiographed for the final determination of the implant sites.

Linkow LI: The radiographic role in endosseous implant interventions,
Chron Omaha Dent Soc 29:304–311, 1966

The Immediate Load Era

- 1950s and 1960s
  - The flapless, bone trephine osteotomy

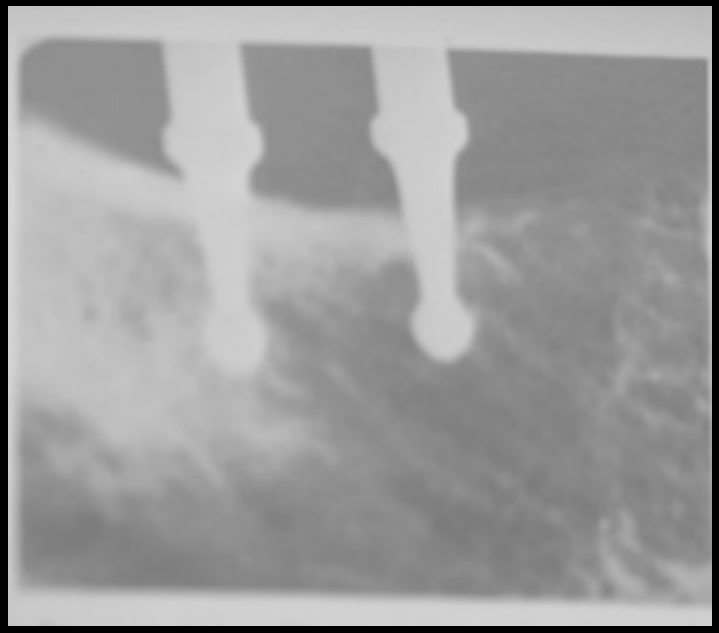


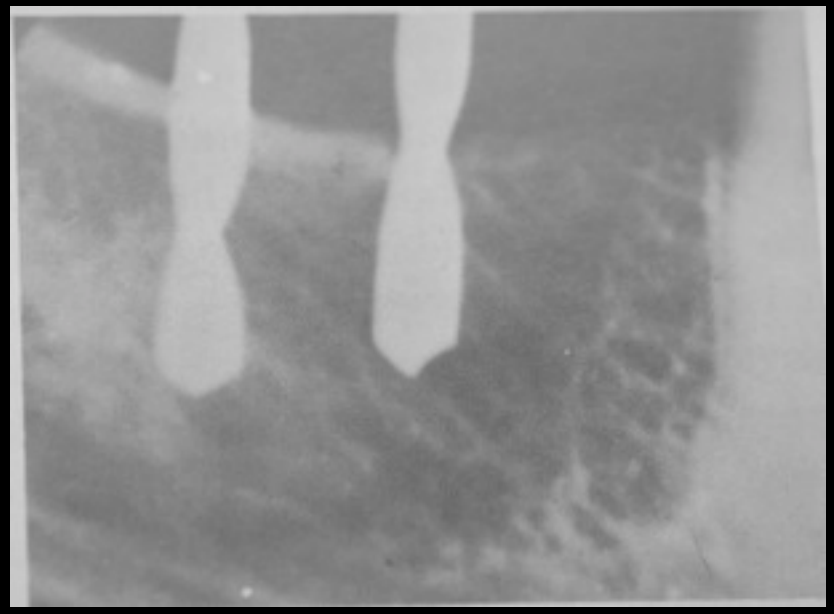


The prefabricated mandibular prostheses for intraosseous implants, Linkow LI
J Prosthet Dent 20: 365-375,1968

The Immediate Load Era

- 1950s and 1960s
  - Radiographic Verification



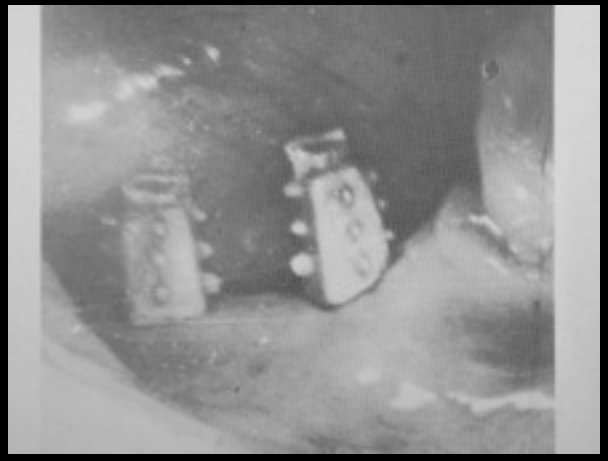


Linkow LI: The radiographic role in endosseous implant interventions,
Chron Omaha Dent Soc 29:304-311, 1966

The Immediate Load Era

- 1950s and 1960s
  - Autogenous cortico-cancellous graft with Intra-implant growth factors?
  - Pick-up/transfer copings?

Fig. 9-57. The plug of bone is removed and then placed inside the vent-plant. (From Linkow, L. I.: Prosthodontic



Linkow LI: The radiographic role in endosseous implant interventions,
Chron Omaha Dent Soc 29:304-311, 1966

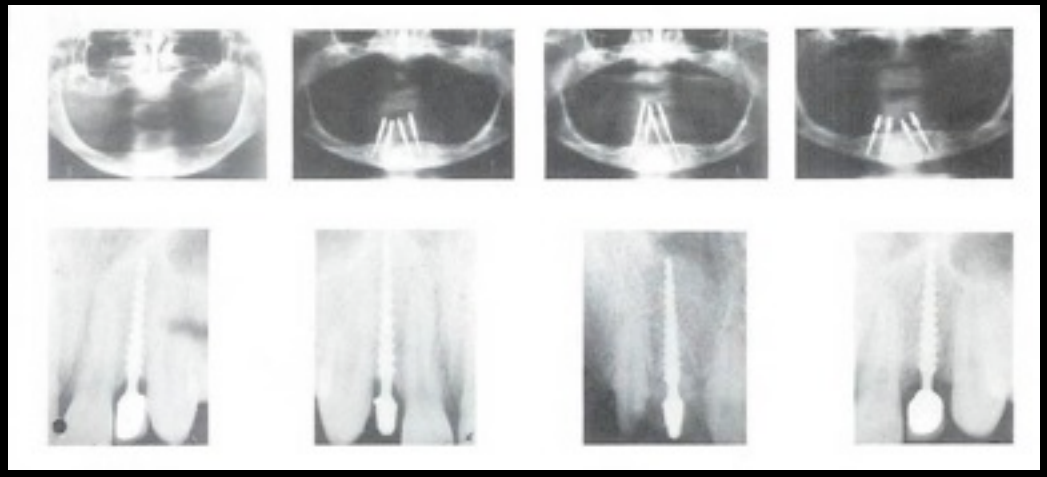
The Immediate Load Era

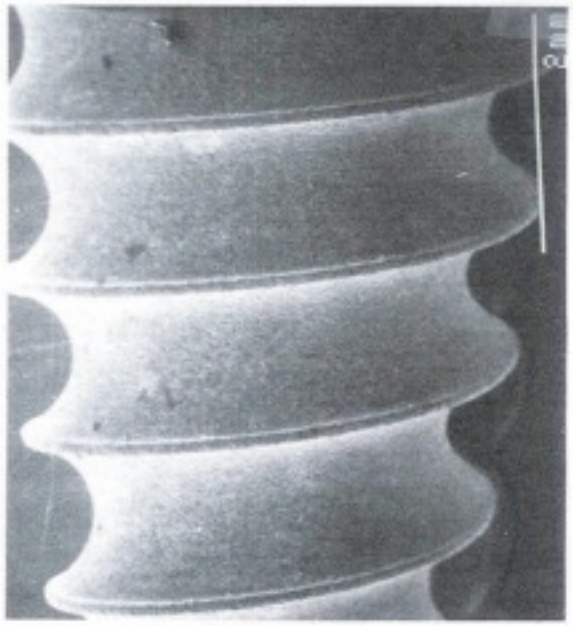
- 1950s and 1960s
  - The immediate load, definitive

"Teeth In An Appointment"

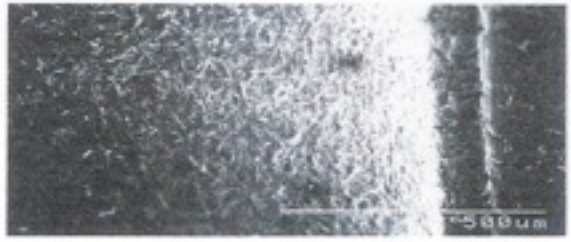
Linkow LI: The radiographic role in endosseous implant interventions, Chron Omaha Dent Soc 29:304-311, 1966

On All Four





Helical thread of a surface-treated implant screw



REM view of the surface topography of an implant screw's thread. As opposed to coated or polished screws, surface treatment allows the bone tissue to grow into the top surface layers, thus providing a perfect anchor.

Set of compression screws in 7 different sizes

Biolok

The Immediate Load Era

- 1950s and 1960s
  - The internal connection retrievable prosthesis

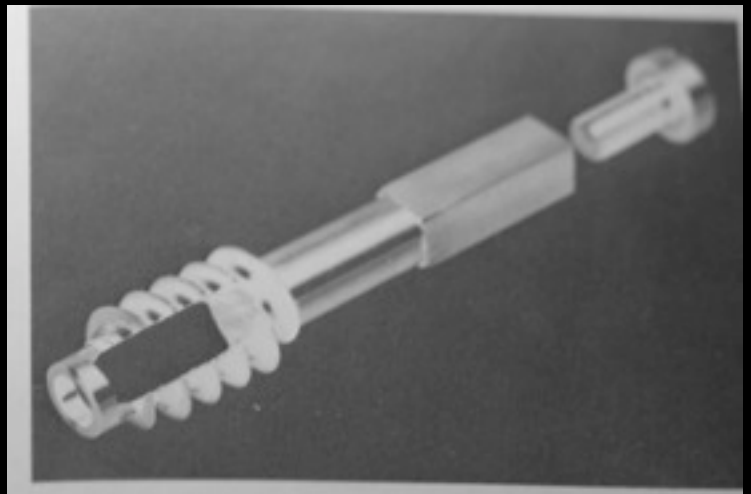
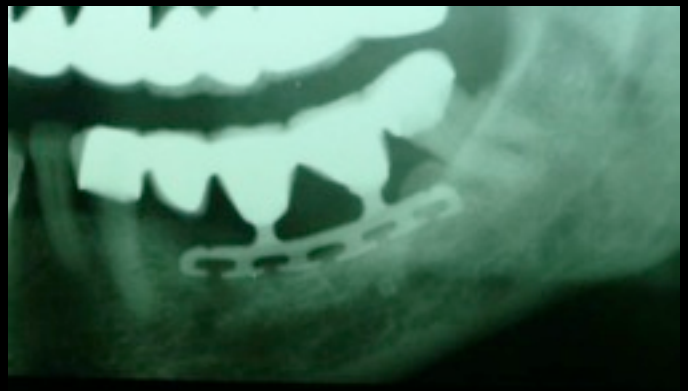


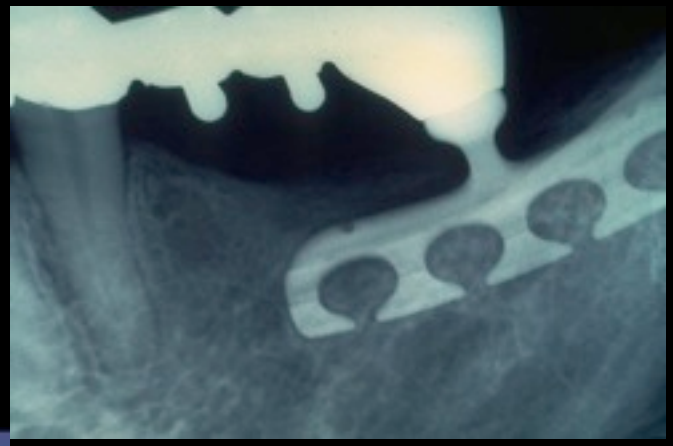
Fig. 9-62. The internally threaded vent-plant.

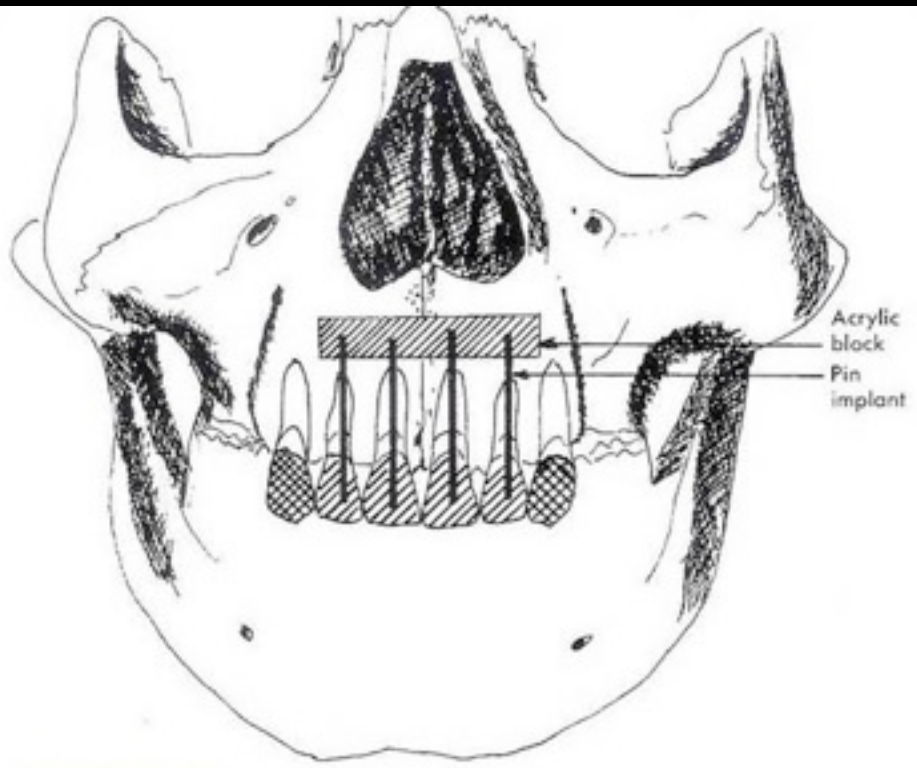
Linkow Chercheve eds. Theory and Techniques of Oral Implantology 1970, CV M

The Immediate Load Era

- The 1970s
- Blades – The Revolution
  - “Fibro-osseous” mode of integration!

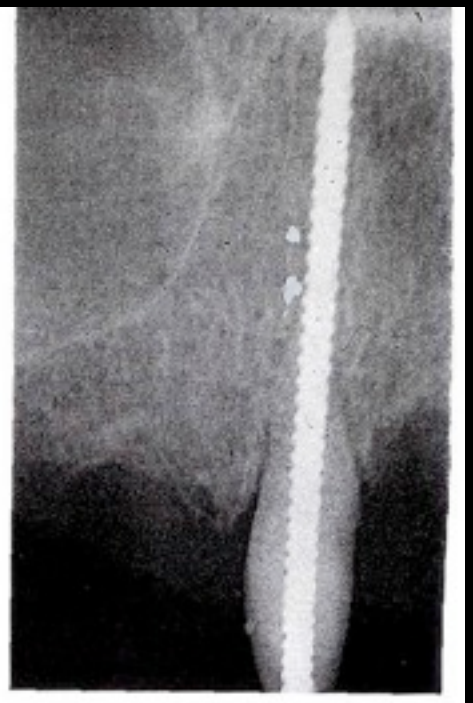




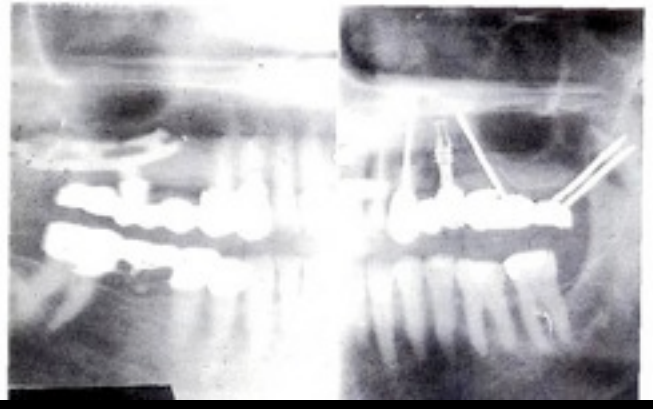


Raphael Cherchève placed an acrylic block over the anterior teeth and drove pins through the canals into the block. Since it was difficult to execute, the procedure has been discarded. (From Linkow, L. I.: Clinical evaluation of the various designed endosseous implants, J. Oral Implant Transplant Surg. 12:42, 1966.)

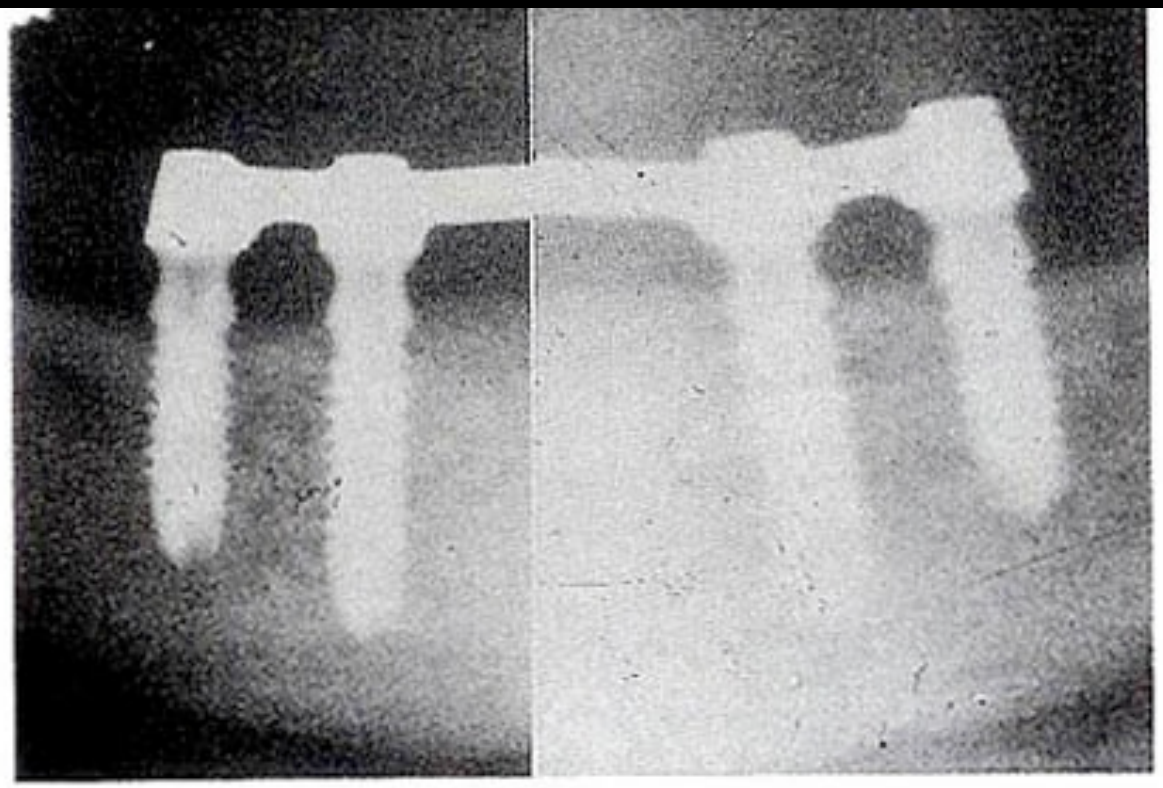
Endodontic stabilizers of Hans Orlay



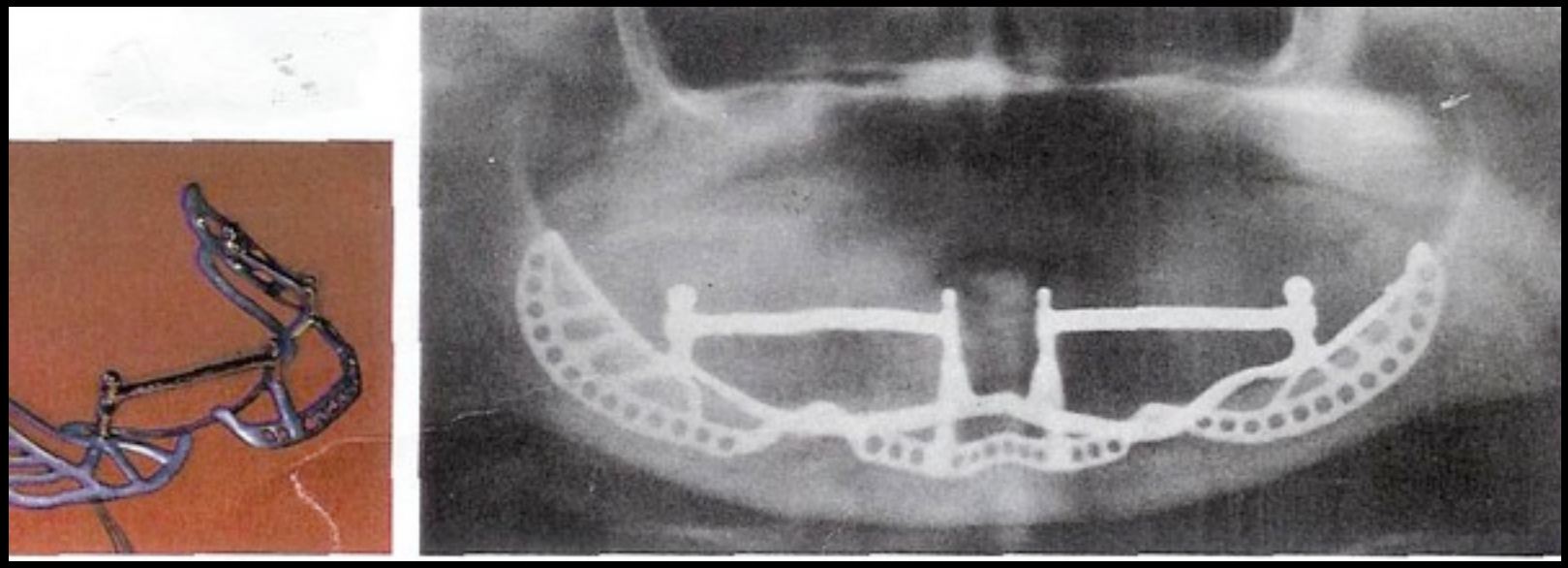
A case done by the author in 1965 using an endodontic stabilizer through the left bicuspid, a vent-plant in the second bicuspid region and a tripodial support system posteriorly.

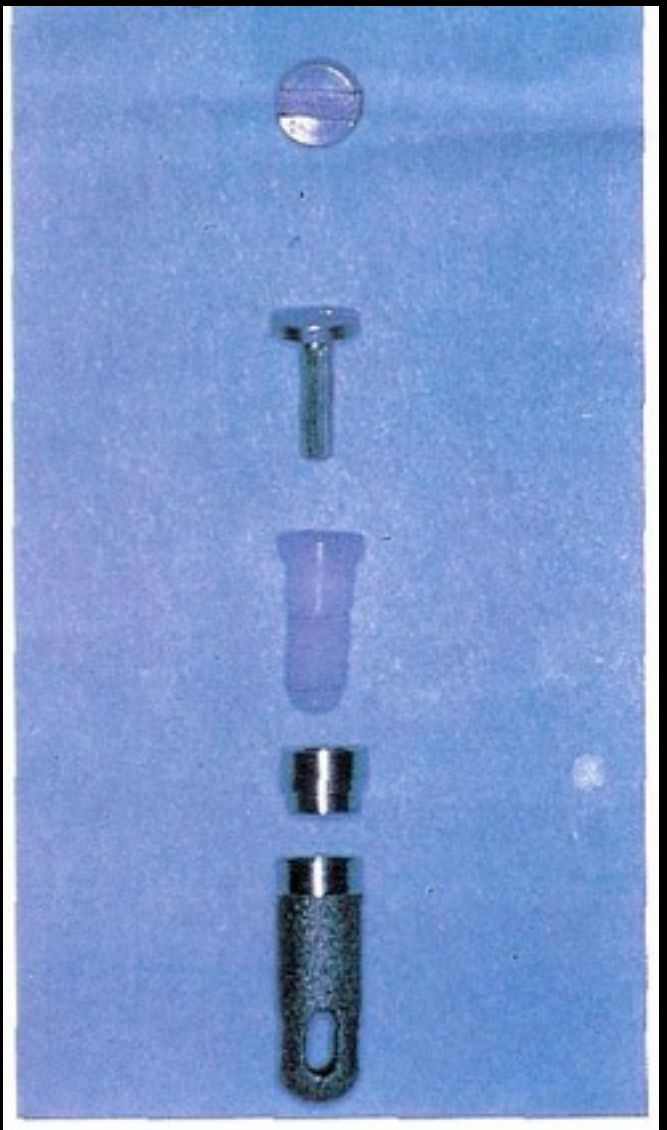


Above, a threaded endodontic stabilizer supporting a bicuspid tooth. (Courtesy of ICOI.)



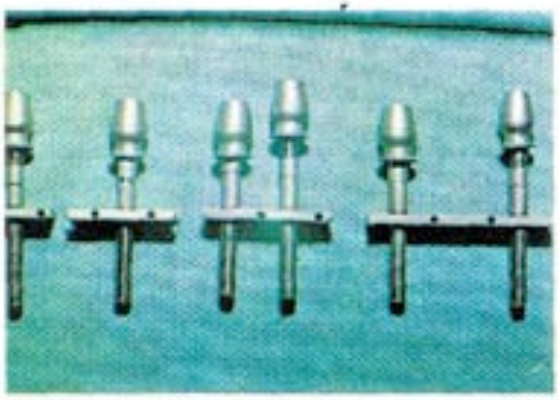
. They were designed for a horizontal meso-structure.

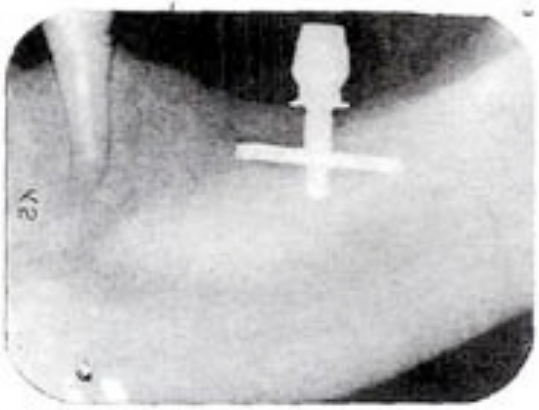




. The IMZ tap in implant by Axel Kirch.

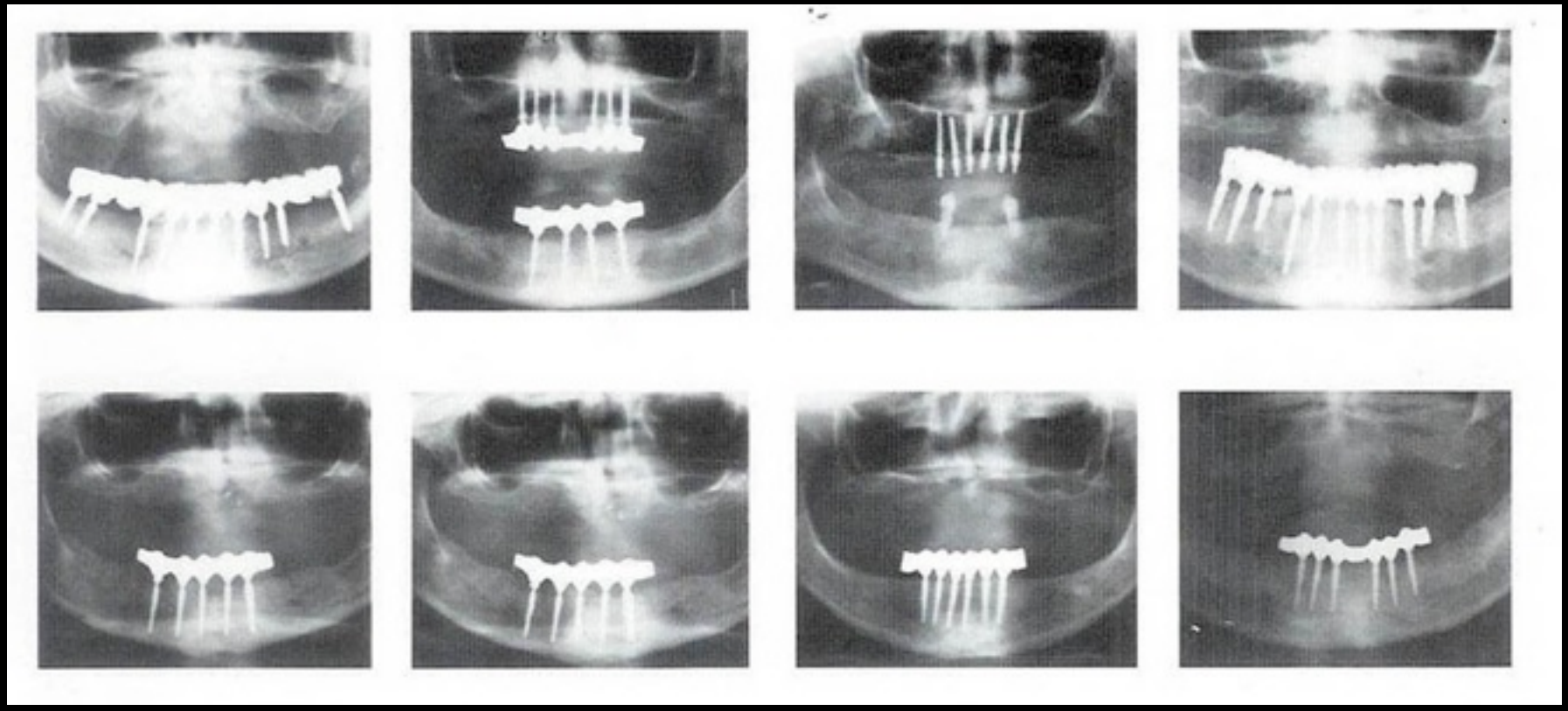
Shows the tri-dimensional implant of Juillet.

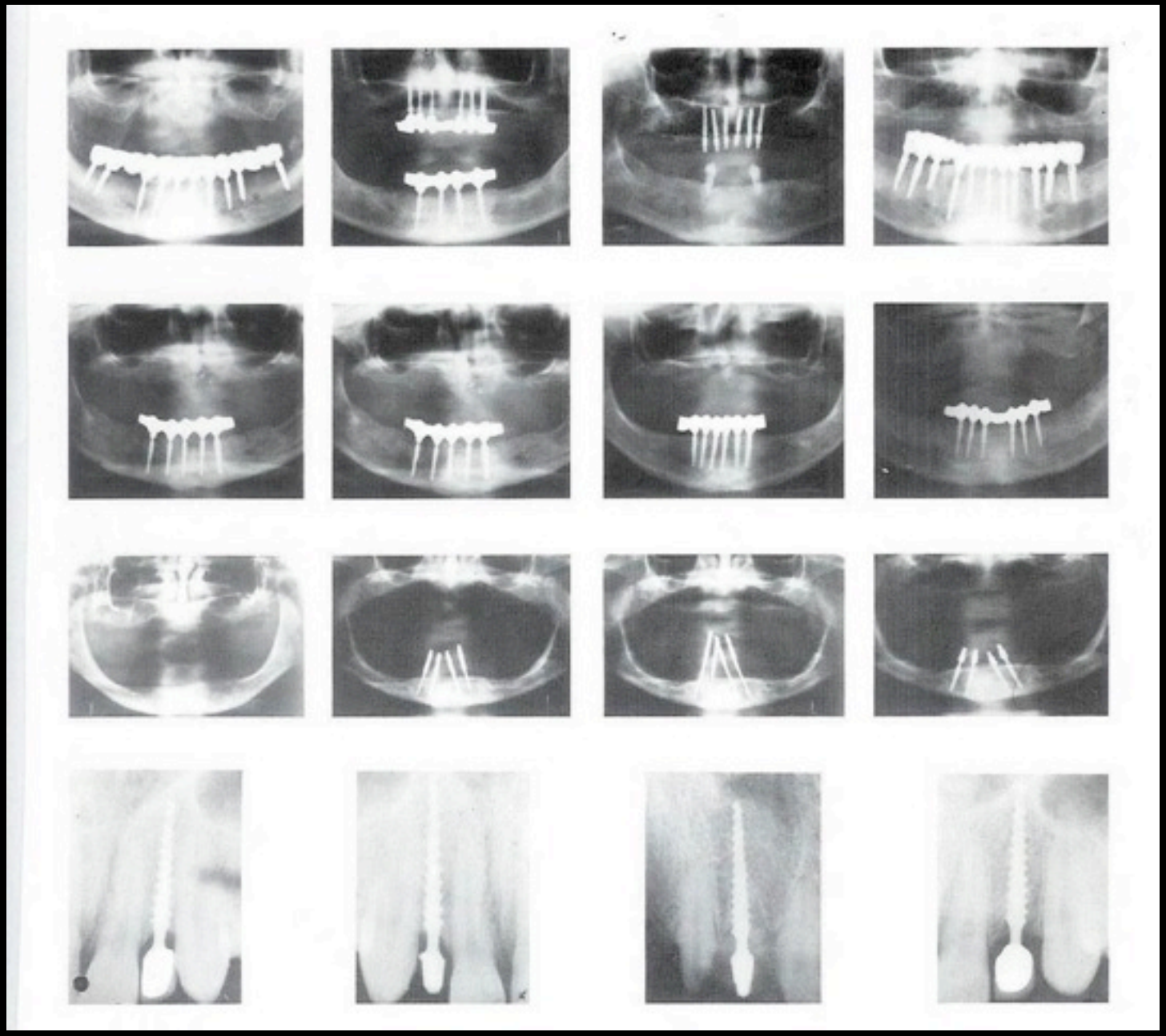




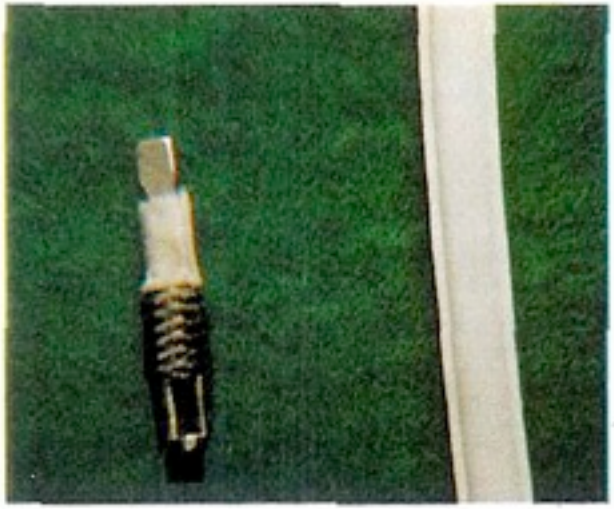
Lobello developed a similar implant at about the same time as Juillet.

Scortecci developed the disc implant.



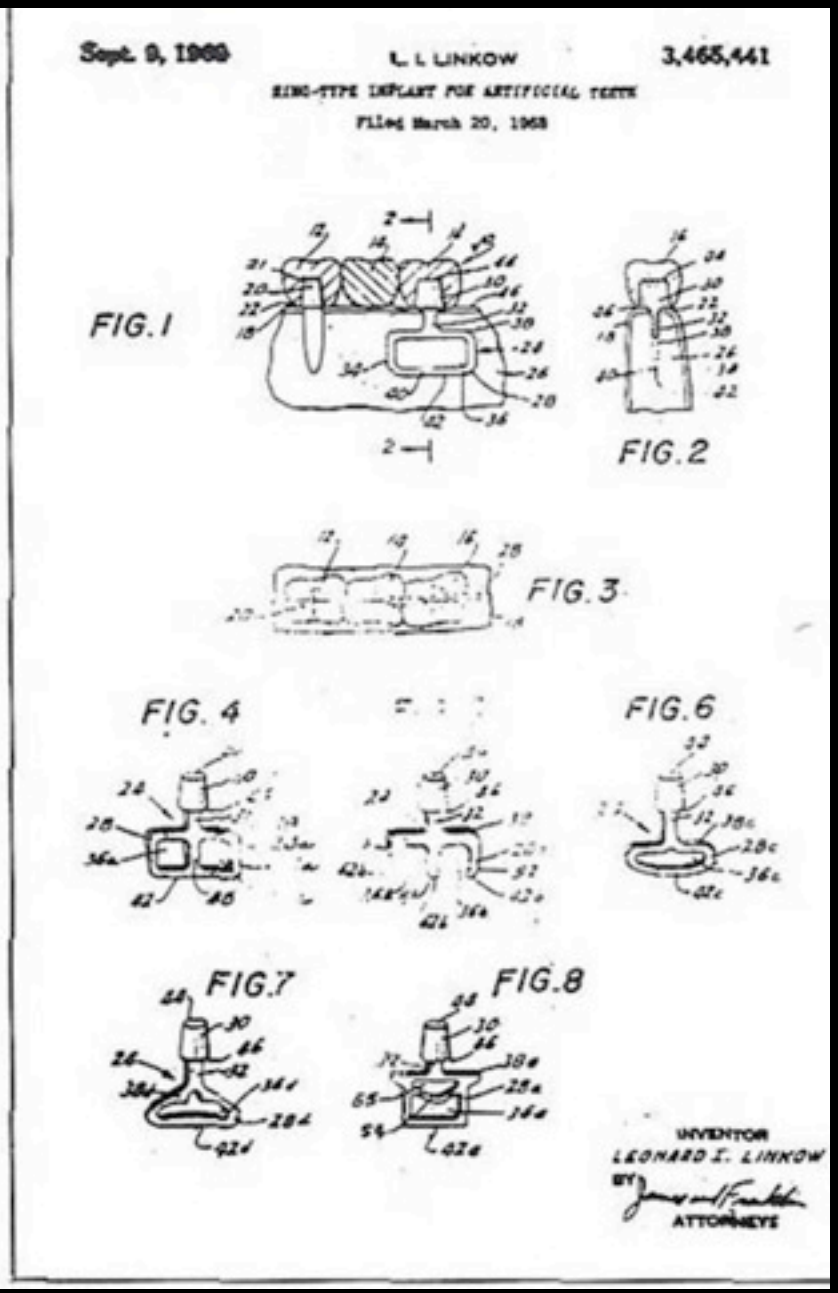


Isaih Lew introduced a solid vitallium screw implant to the profession in the *late 1960's. Next to it on the right is a Lin*kow vent-plant.

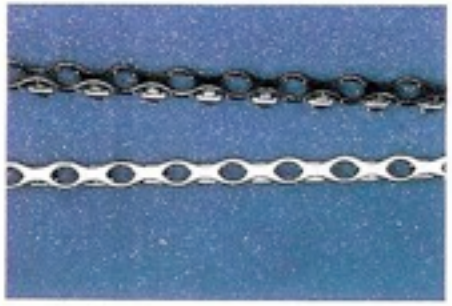


In the late 1960's the author had placed Dacron sleeves over some *of his implants to try to obtain a clo*ser adaptation of the tissues with the implant itself.

The patent application and acceptance granted to the author for the bladevent implant.



The corregated snake like implant.



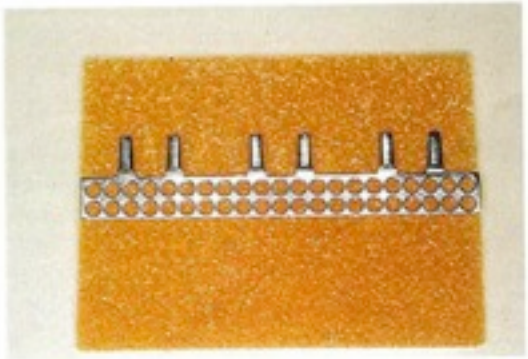
The DNA interlaced of figure « eight » re-entry implant.

The biblade implant.

The re-entry ring type stabilizing implant.

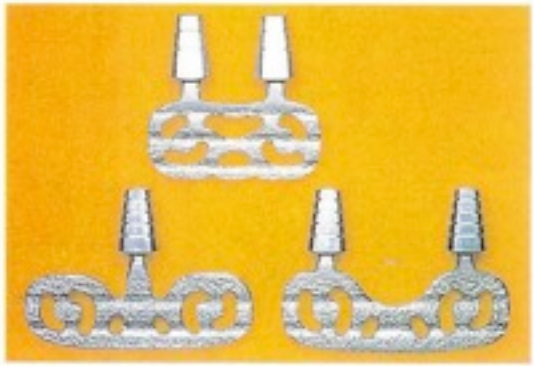
In 1970 the author applied for a submergible postless bladevent. The patent was granted in 1972.

. Edelman was one of the earliest pioneers to develop the submergible bladevent system in the early to middle 70's.



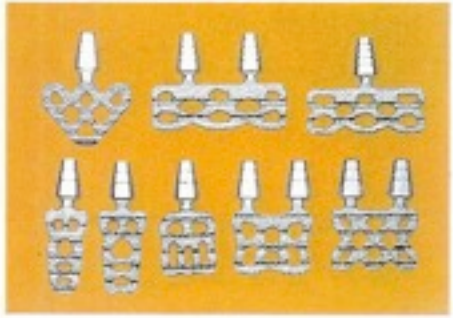
Shows the Binderman blade strip.

Submergible bladevents (startaneous) by Park Dental Research.

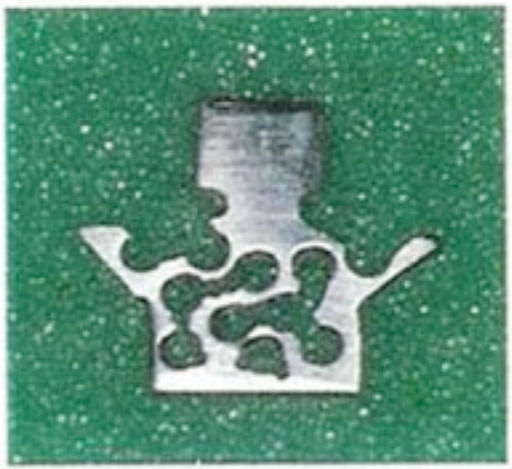


Shows the author's newest bladevent implants *.

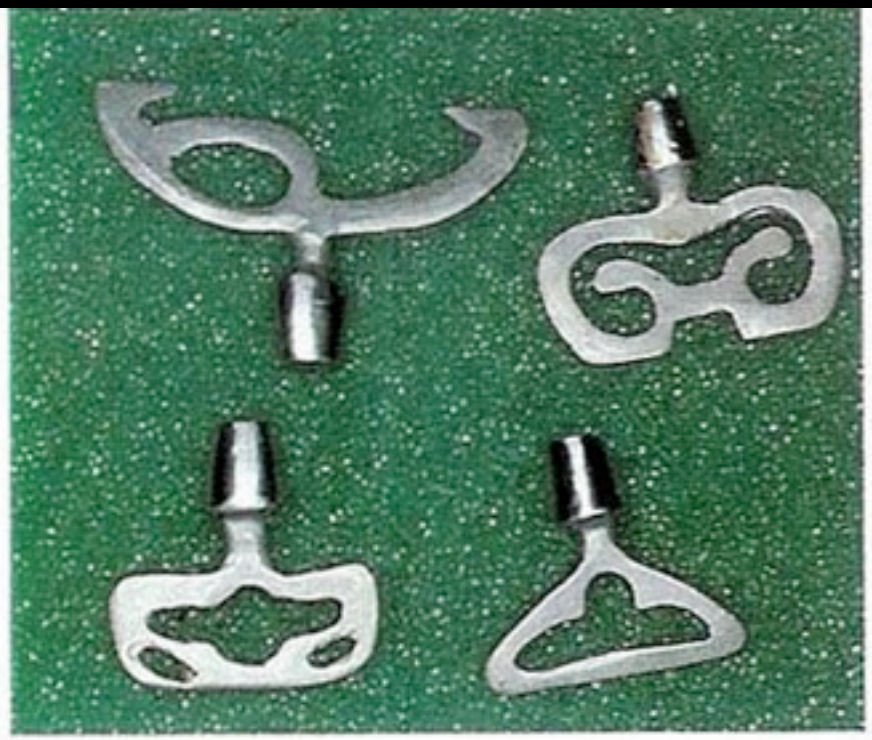
Oraltronics,
Bremen, Germany



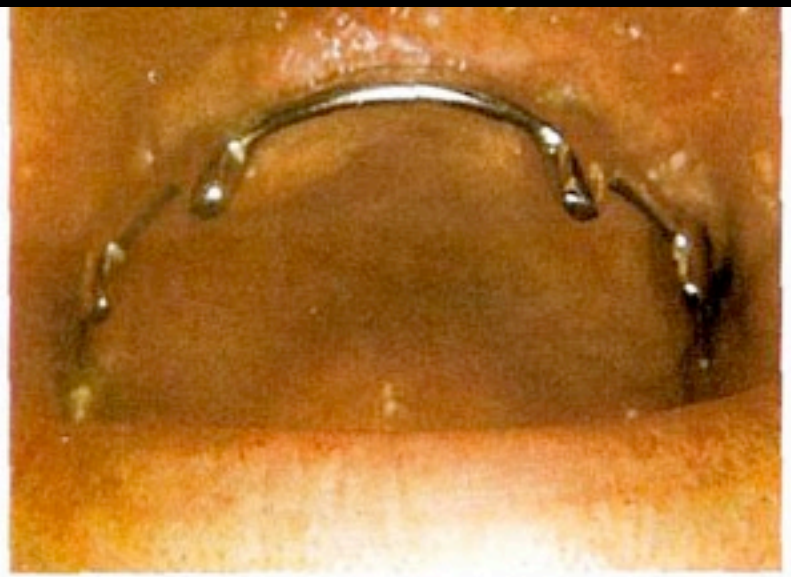
The author had greatly improved the bladevent designs and their interfaces over the past 20 years *.

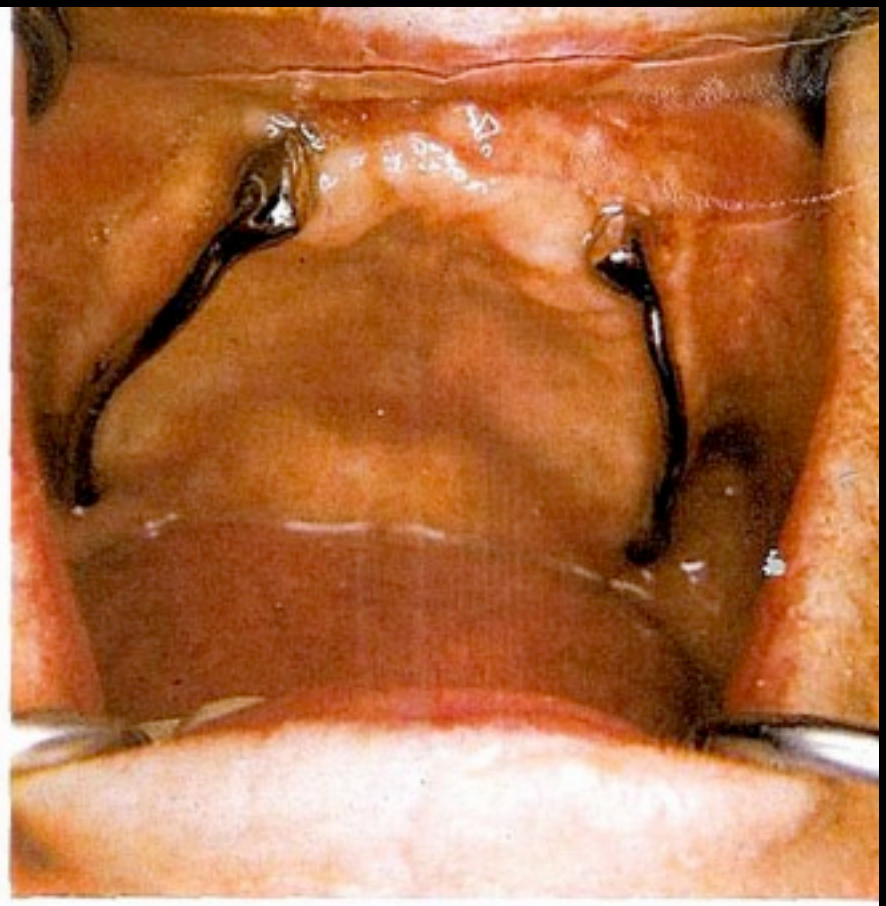


. The Roberts disk-like implant.



Early Linkow bladevents.





The author was the first one to incorporate a continuous bar and split bar in his maxillary pterygoid extension implants in 1970.

U.S. Patent Aug. 30, 1977 4,044,467

FIG. 1

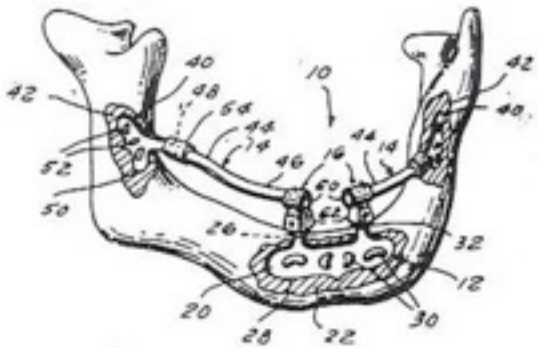
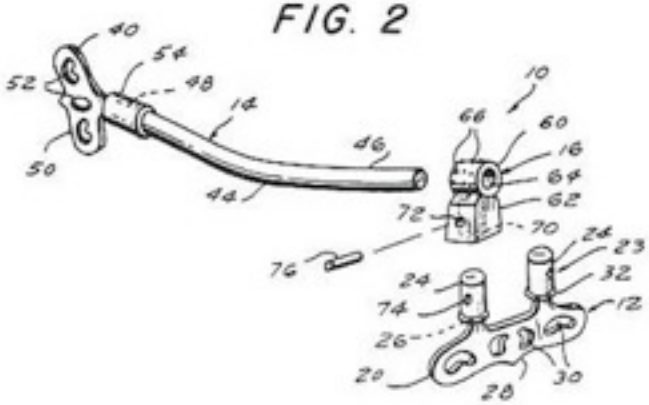
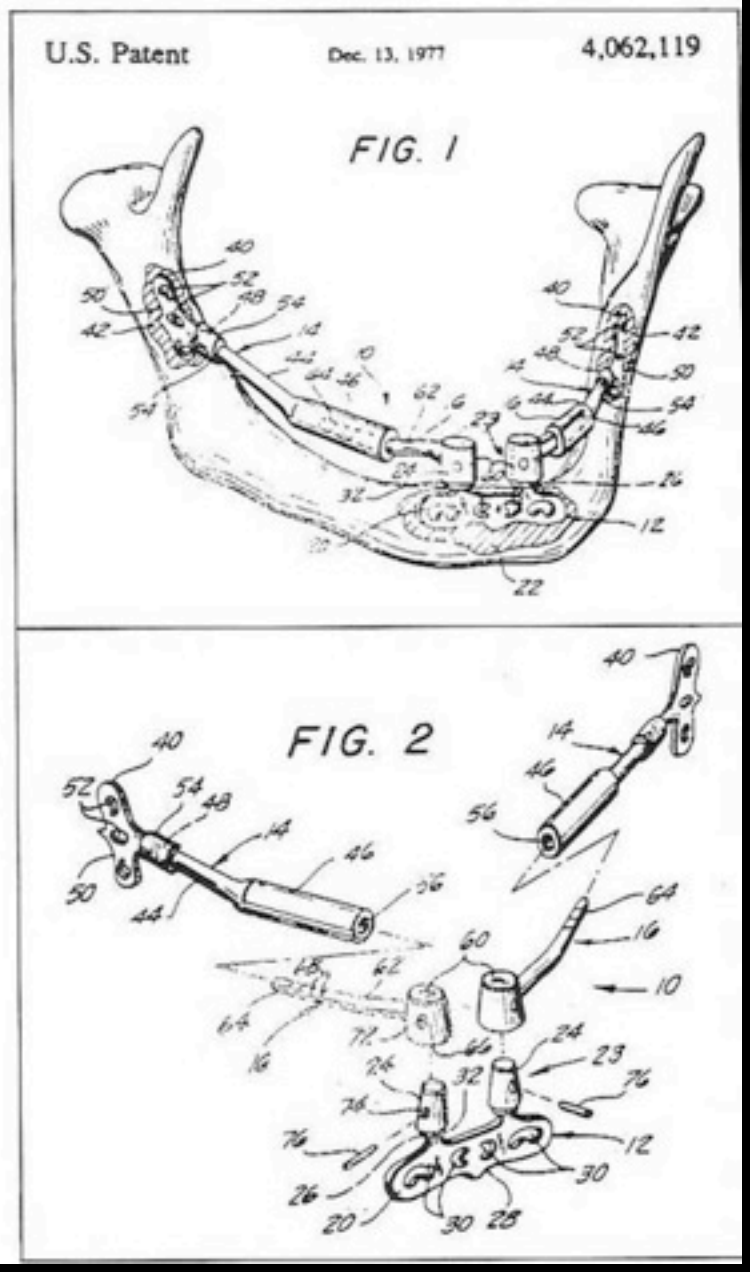


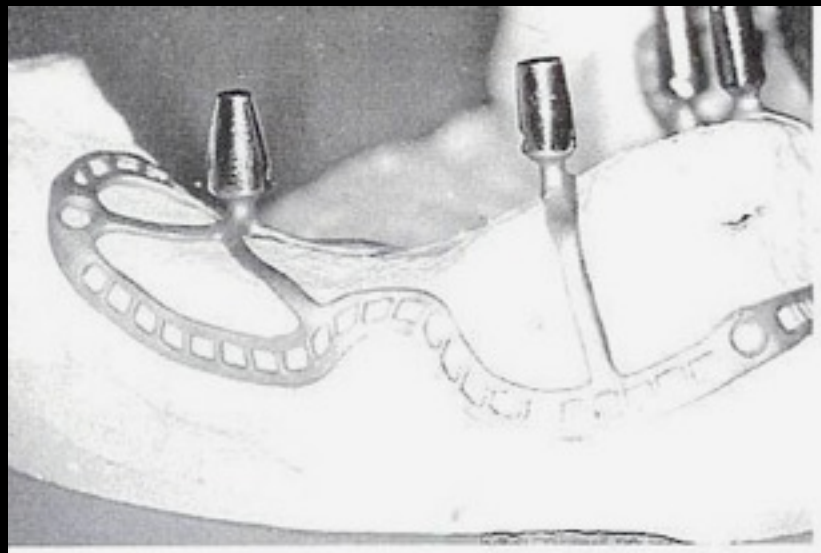
FIG. 2



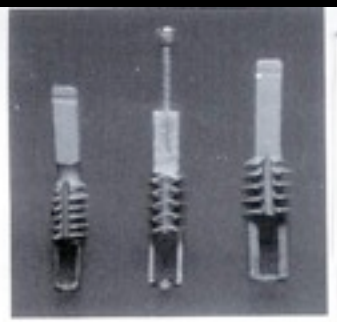
Linkow five piece $R^2S^{(5)}$ granted in 1977.

. The finalized patent of the R^2S[5] system looked like this.





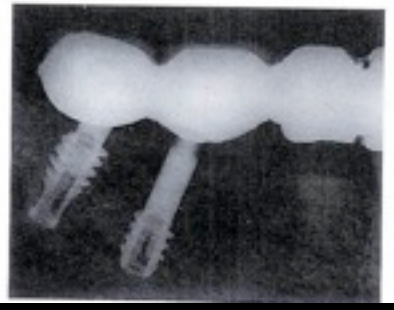
The author in the early 1960's lengthened the posts to nearly twice their original sizes and fenestrated the labial and buccal peripheral struts to make them play a more dynamic active role in the overall retention of the implant and also to prevent sinking in some cases.



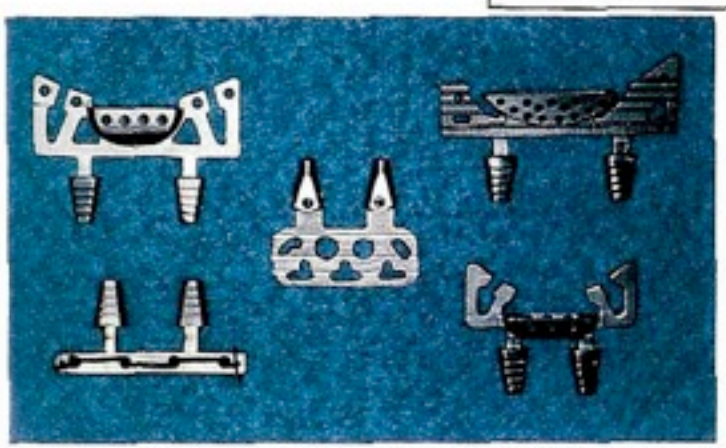
Some very early vitalium castings of Linkow self tapping vent plants; the middle one having an internal screw system 1963.

The Linkow vent plant took on many shapes and sizes.

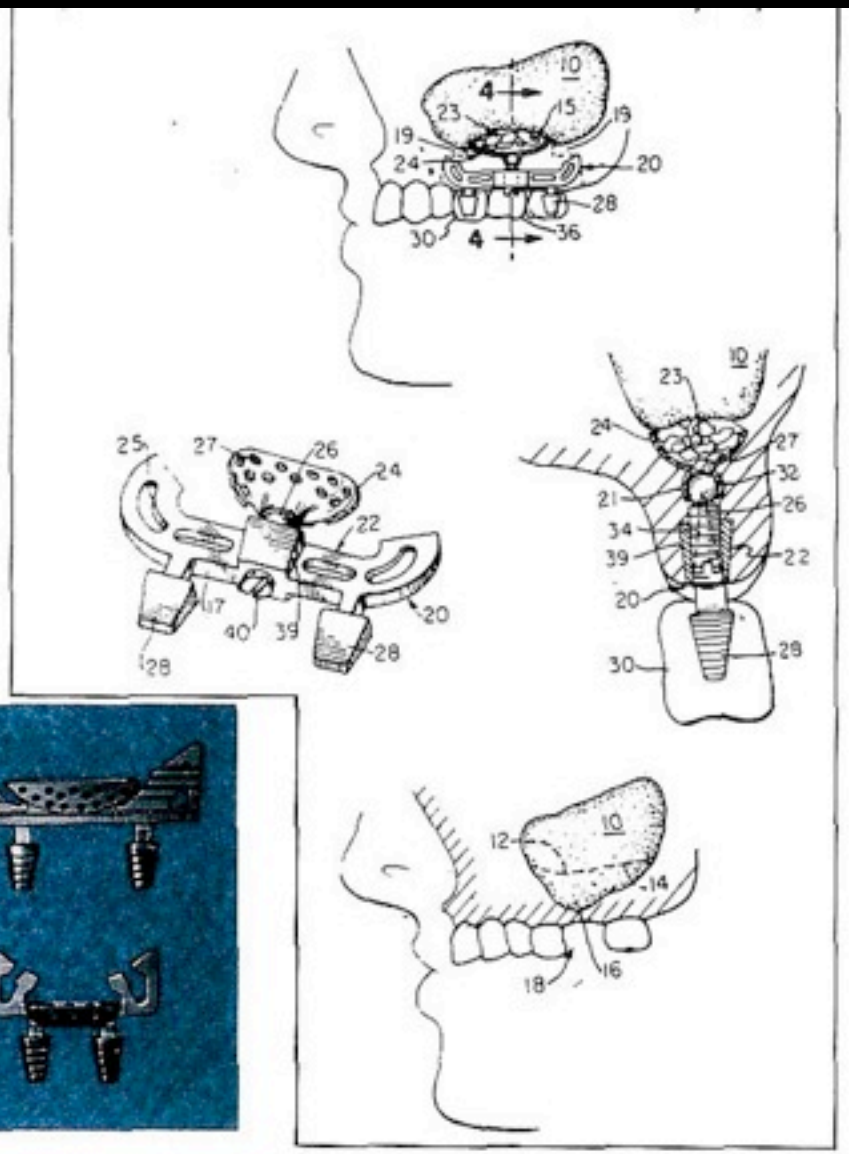
. The finalized version of the Linkow self tapping implant made of titanium; on the far left is a narrow ridge Michael Chercheve implant.



. A periapical x-ray showing the posterior titanium alloy vent plants that functioned from the first day of insertion (2 year postoperative).

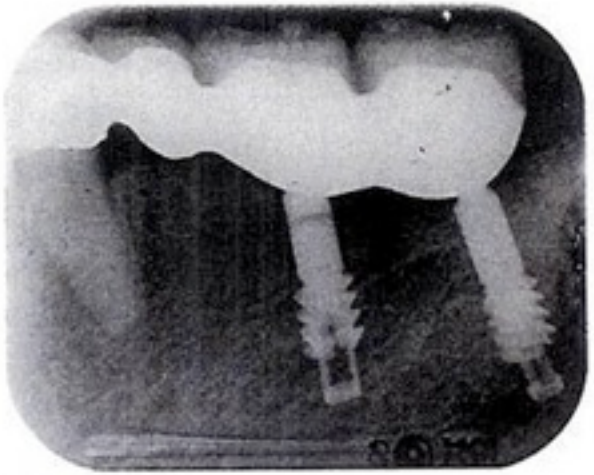


Linkow's sinus lift implant. Also seen in center of picture is a bladevent implant with removable posts. On bottom left is one of many re-entry type implants.

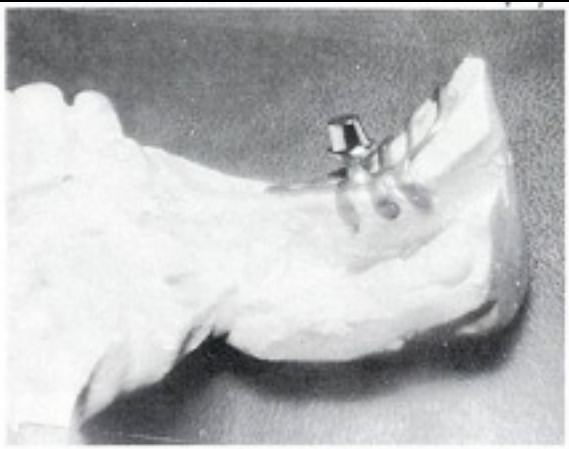


A movable basket sinus lift implant was later developed by the author.

. The Linkow vent plant implo-
ved with synthetic sapphire.



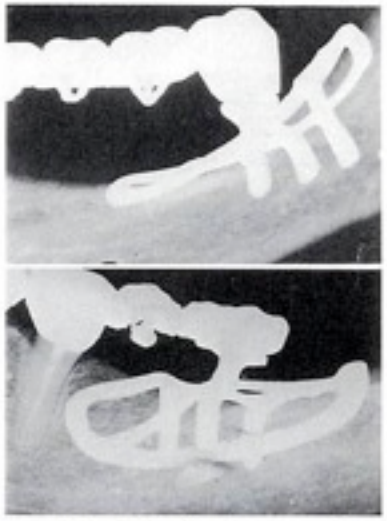
A periapical x-ray showing
close adaptation of the bone to the
vent-plant screws.



Linkow's unilateral lingual finger implant, shown on a model prepared from a direct impression of the bone. The fingers follow the contours of the jaw and keep the implant immobile. (From Linkow, L. I.: Re-evaluation of mandibular unilateral subperiosteal implants: a 12 year report, J. Prosth. Dent. 17[5]:512, 1967.)

A

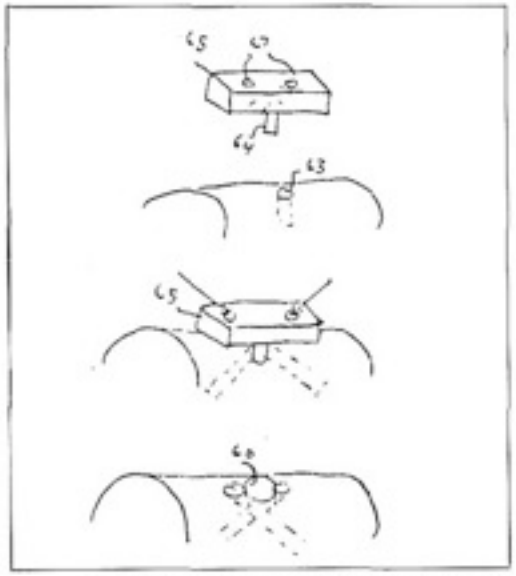
B



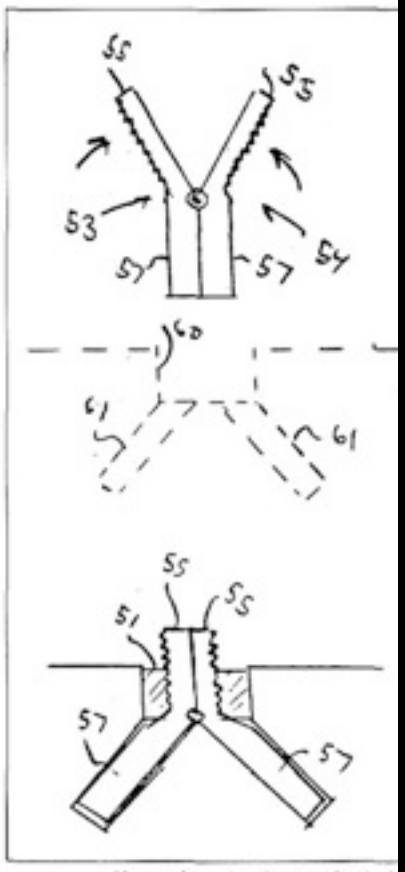
A, The mylohyoid ridge, a problem area for shaping an overall superiosteal implant, is gripped by the finger extensions. B, The implant straddles the site and is closely adapted to variations of the jawbone. (From Linkow, L. I.: Re-evaluation of mandibular unilateral subperiosteal implants: a 12 year report, J. Prosth. Dent. 17[5]:512, 1967.

a

The Linkow vent plant has been recently made into a two piece submergib
useointegrated compatible implant with a rotating robutment (TM) (Linkow-Rinaldi).

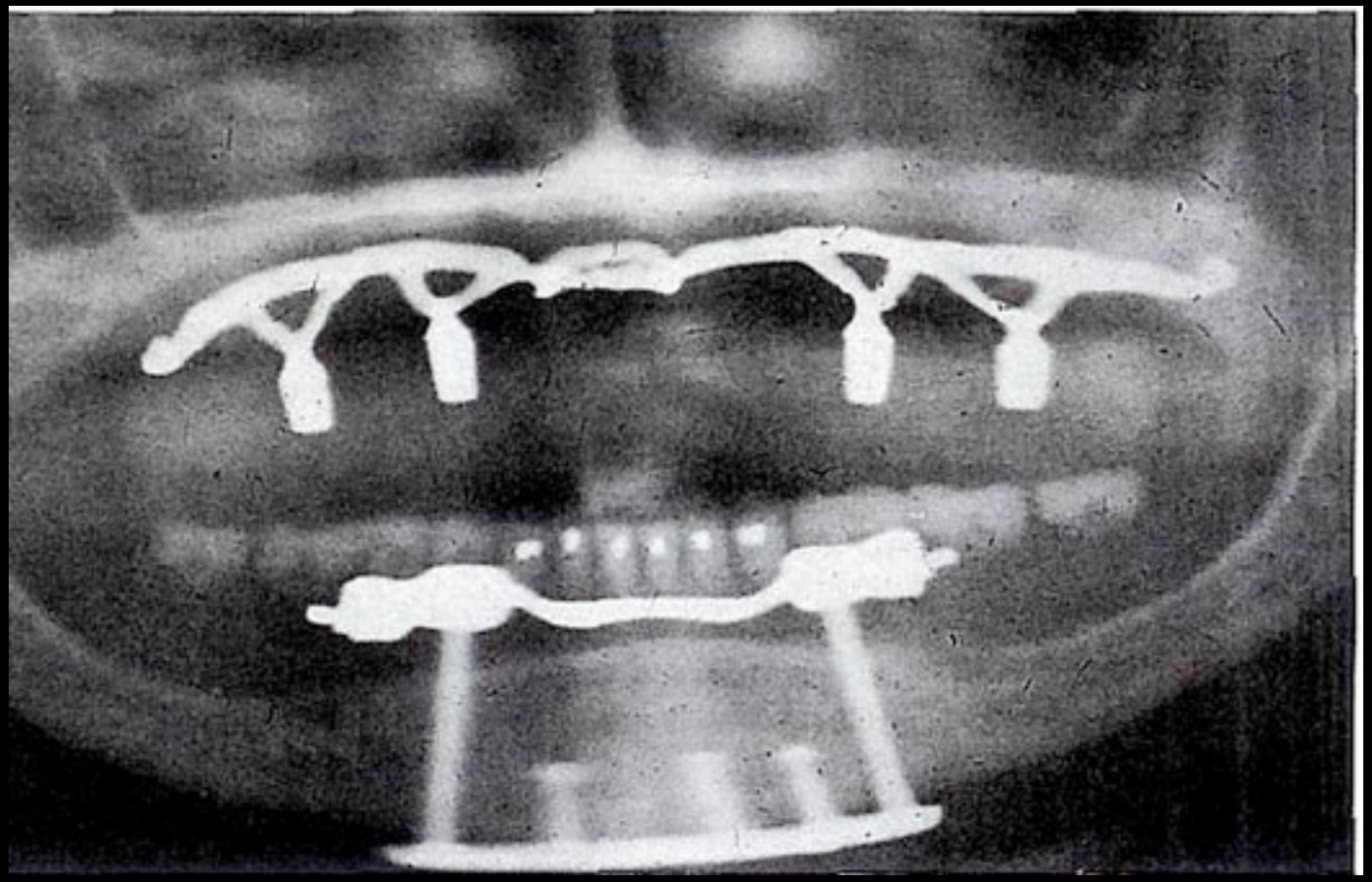


Shows drawing of template to be used with the scizor implant.

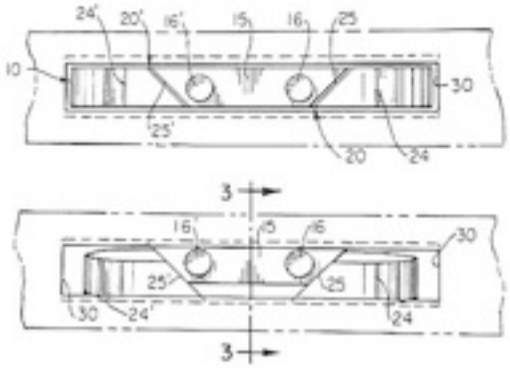


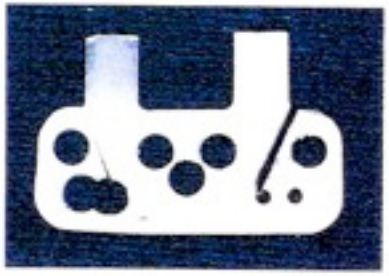
Shows how implant is buried
position.

The author's scissor implant.



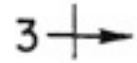
. The beginning of an idea first conceived by Linkow and Hoffman (squeeze-blade).

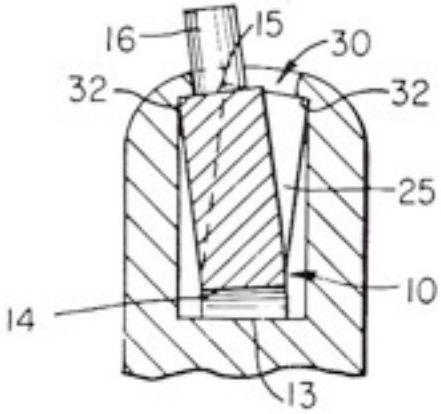




A later prototype.

A more refinement of the prototype.





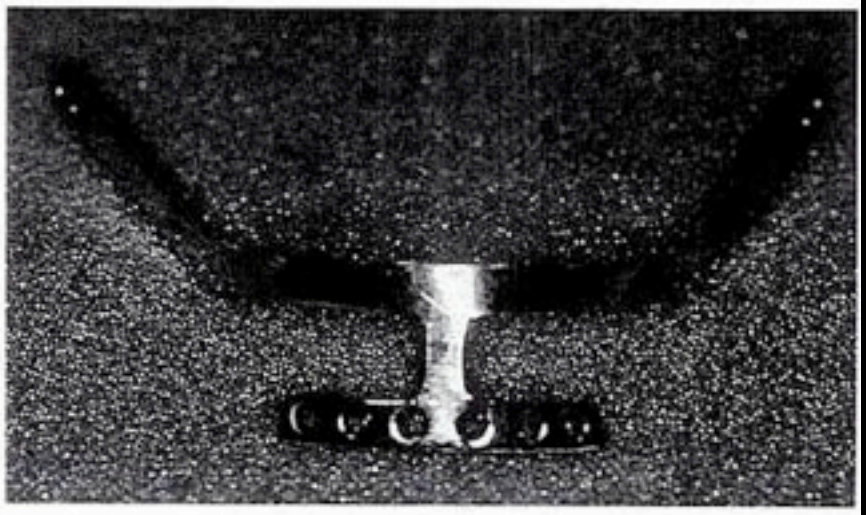
. Shows part of the author's patent and the working mechanism.

The « squeeze blade » implant type for immediate widening in a wider groove.

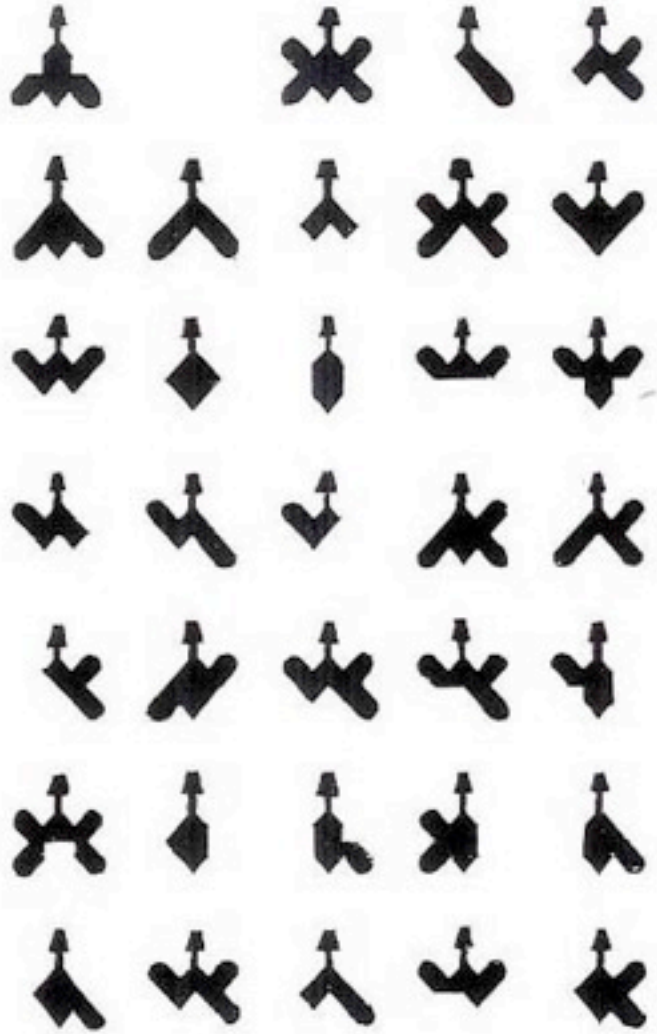
Pasqualini developed a uni-type blade in about 1970.

The author introduced vertical and horizontal screw threads directly thru the posts of the bladevents to allow for vertical and horizontal (1969) screwing in of the prosthesis.

The ramus blade implant of Roberts introduced in 1970 **.

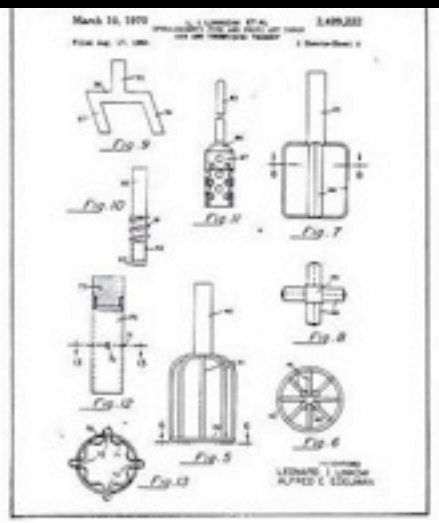


The ramus frame implant introduced in 1972 by Roberts ***.

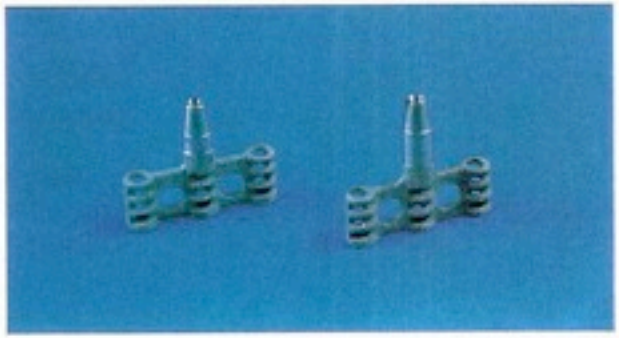


The author introduced in 1981 his multipurpose blade allowing 34 different designs to be fashioned from the one basic prototype * **.

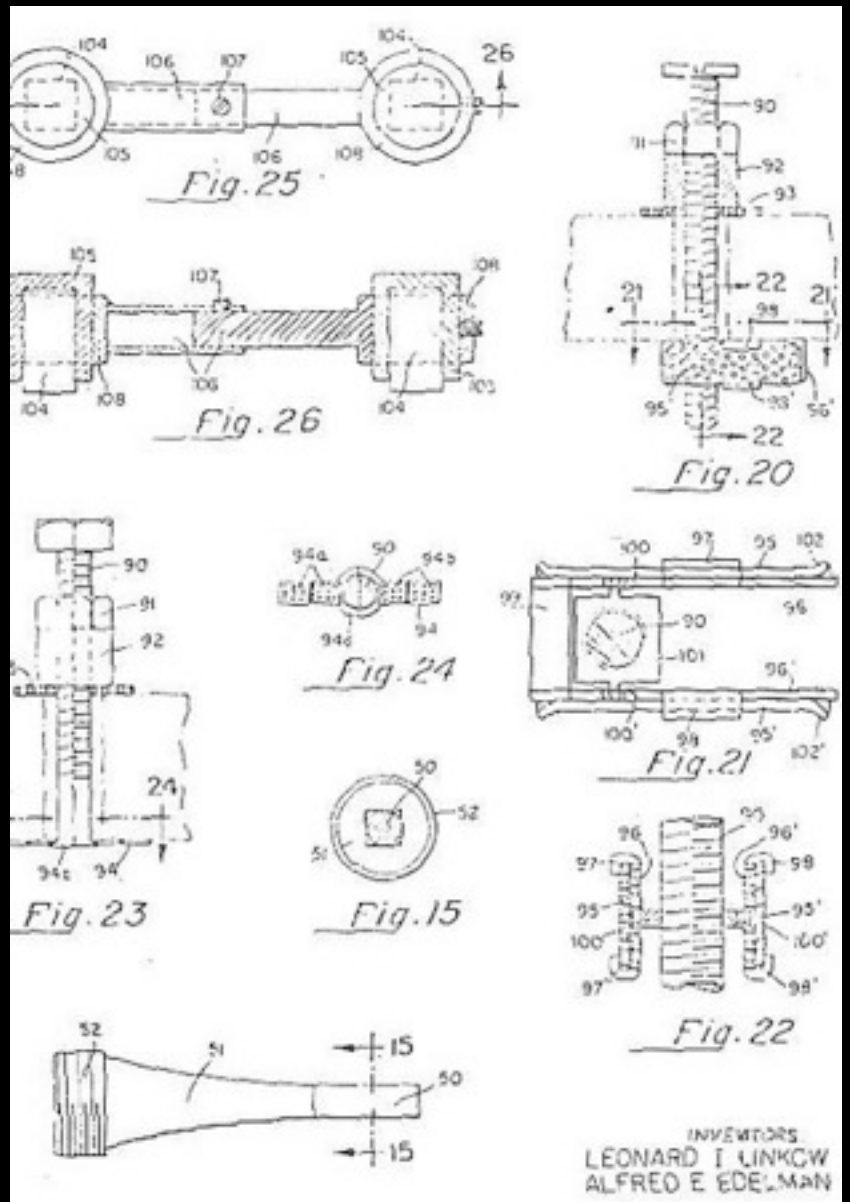
The 1965 Linkow — Edelman patent application (granted in 1970) of the hollow basket implant. Linkow's vent plant was also included in this patent as well as the precursor to the blade implant which was realized two years before the first blade implant was ever inserted.



. About twelve years later a near exact duplicate of the author's hollow basket implant by Schroeder and Straumann became popular (1976).



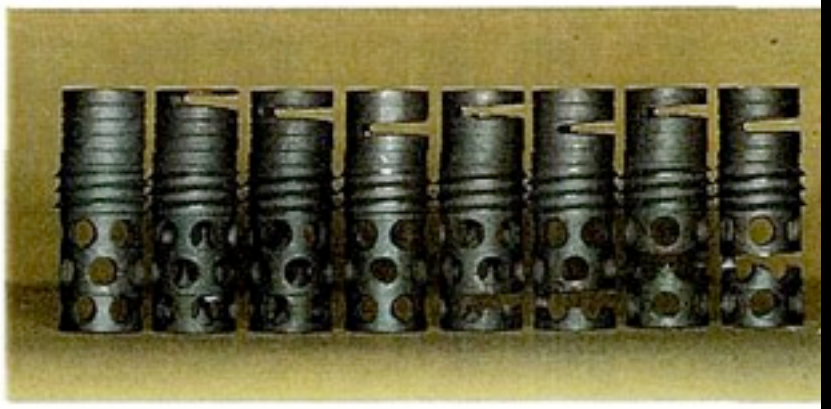
. Schroeder also developed a plasma coated « H » implant system which consisted of a bladelike device which opened up into two hollow cylinders at each end. It was placed into the bone with the use of an exact sized and shaped template.



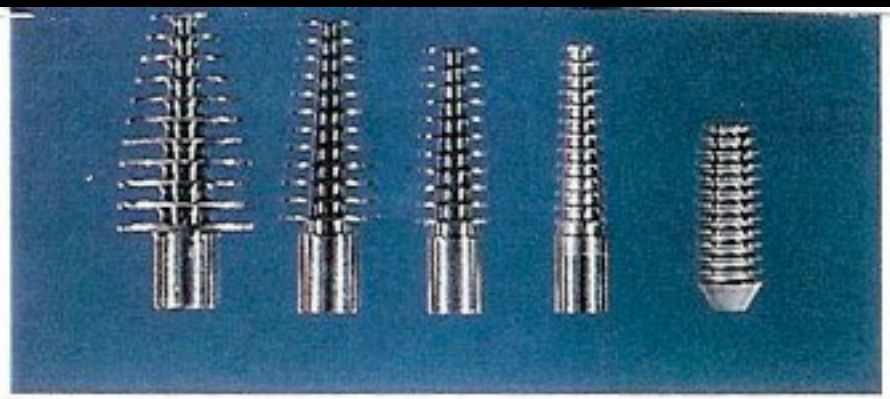
The Linkow-Edelman staple implant paten
hat was applied for in 1965 and granted in 1970.

. Crystalline bone screws of Sandhaus (CBS).

The Muratori screw implant.

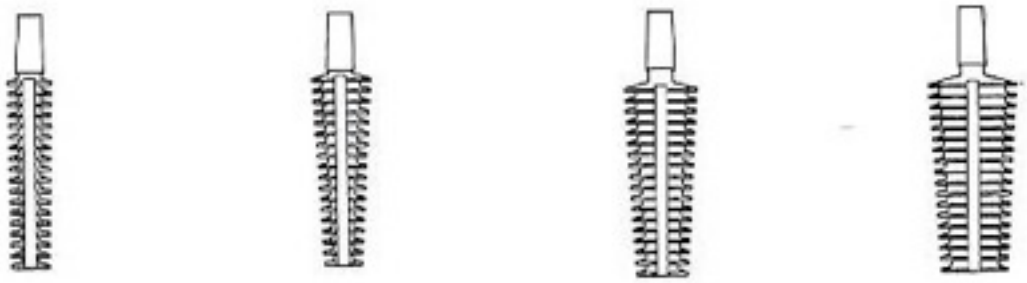


In 1983 Niznick introduced the corevent implant to the profession.

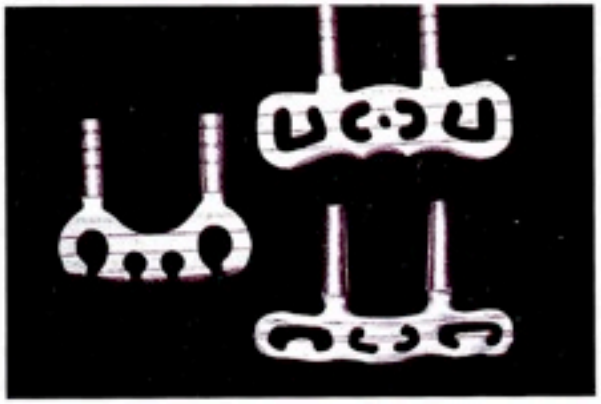


. The Omni system; on top are the tap in implants of Tatum.

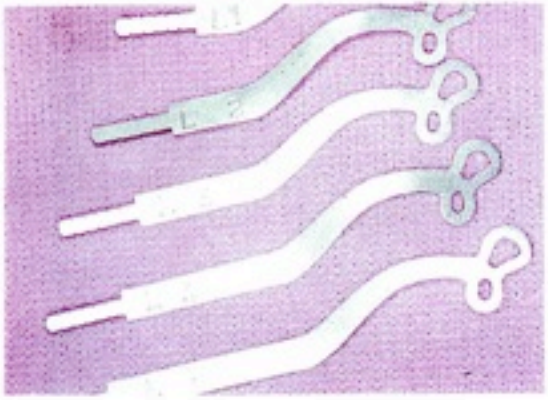
TITANODONT™† Subcortical Implant System



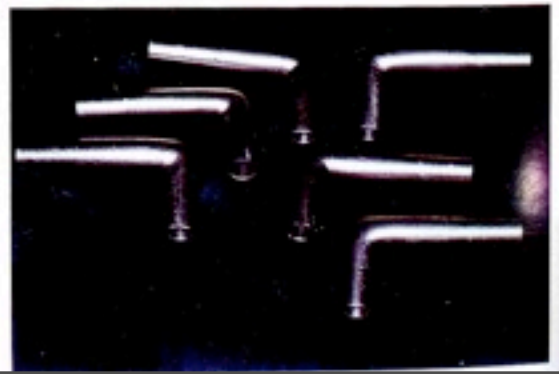
Shows many of the author's original implants, some custom made in vitallium and others stamped and forged in titanium by Park Dental in 1968.



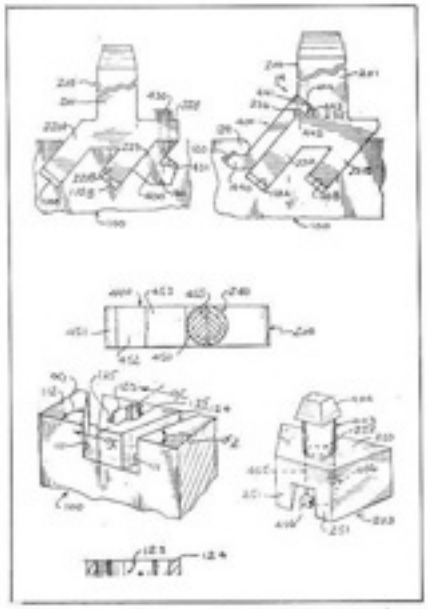
In 1976 the author upgraded the armamentarium. Everything was fabricated in pure titanium. Here is seen the three different symphyseal bladevents which contained rounded posts for passivity of fit of the entire system.

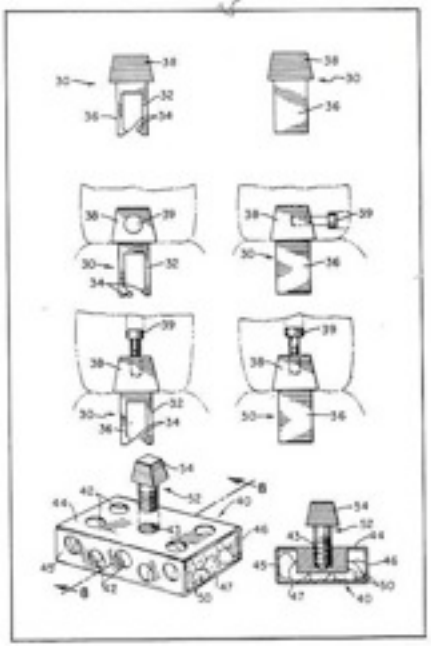


The ramus implants were fabricated in five lengths for each side of the arch. Also, the anterior extensions from the ramus blades no longer exhibited hollow tubes but instead were rectangularly shaped. The anterior extensions were narrower than the rest of the bars in order to slide into the hollow anterior elbow components.

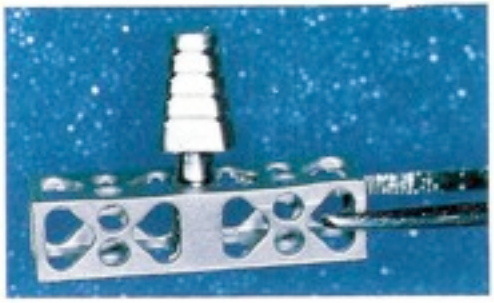


The antero/posterior hollow tube elbow attachments which joined the ramus implants to the anterior bladevent implant posts.

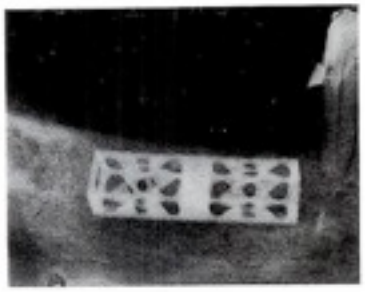




Submergible bladevent implants with new concept of snap-on post systems.



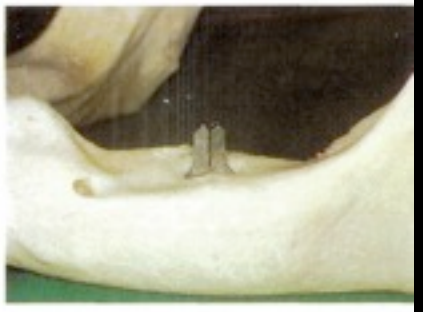
The re-entry series of implants: the horizontal hollow basket implant.



A periapical x-ray of a buried horizontal basket implant.

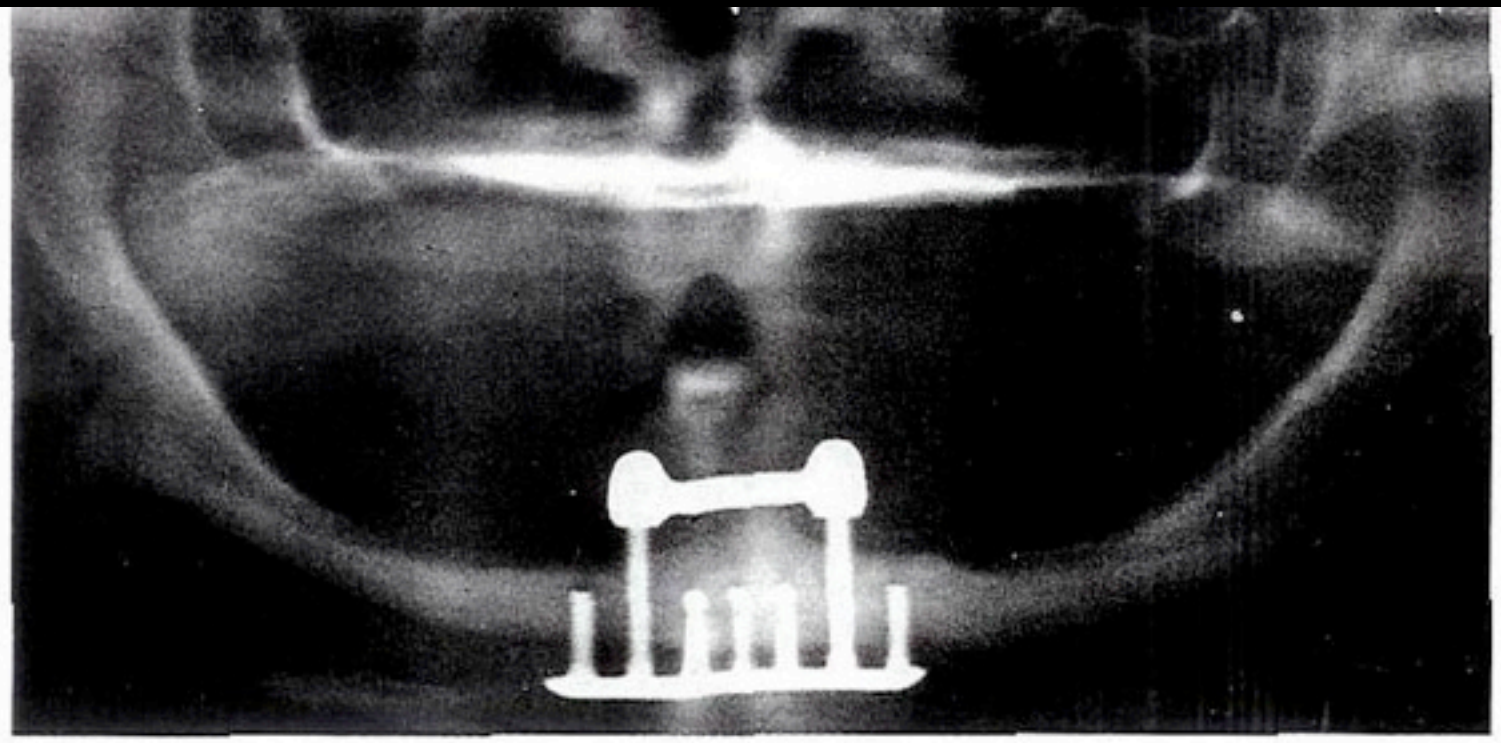
The narrow portion is placed into a prepared hole done with a specially designed template which also guides the implantologist into making two obliquely directed grooves on each side of the center hole.

As the scissor implant is squeezed the two buried portions open up and are guided through the two internal oblique grooves, thus locking them in position with untouched bone above and below them.



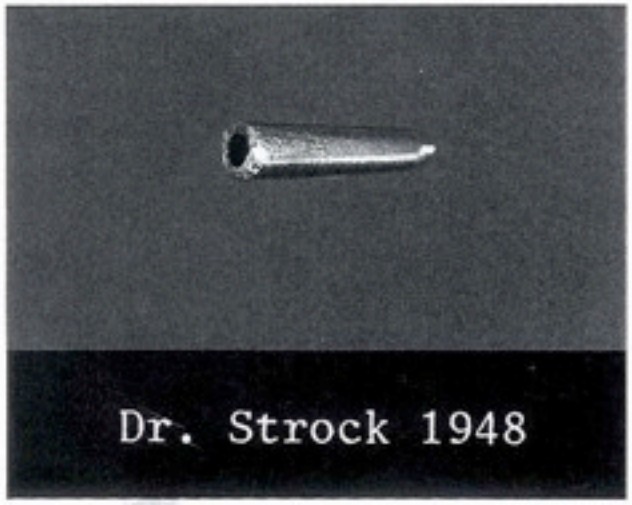
A gold coping or crown is fitted over it.

The « scissor handles » are brought together.

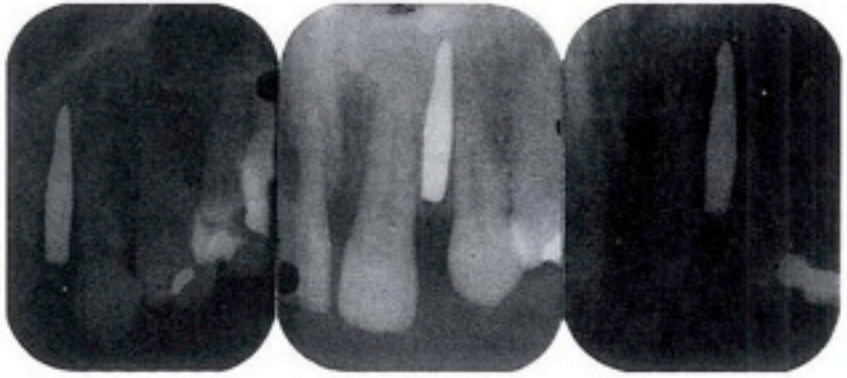


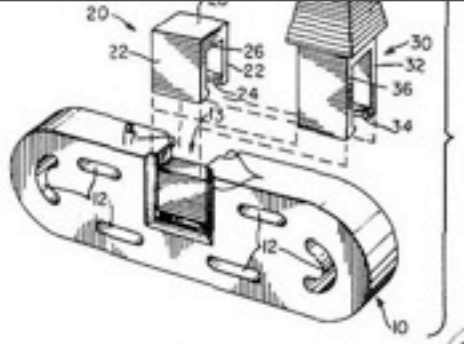
The staple implant developed by Small and Metz. This one was one of the few failures.

The Strock brothers from Boston inserted some of earliest endosseous screw-type implants into animals and humans in 1938, as well as the earliest endodontic stabilizer and internally threaded submergible implant.

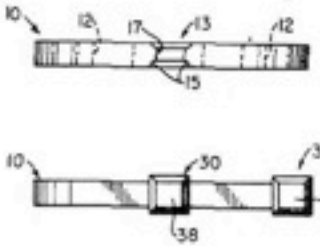


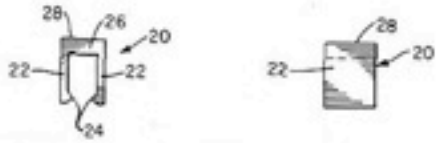
The early submergible root-form implant of the Strock brothers.





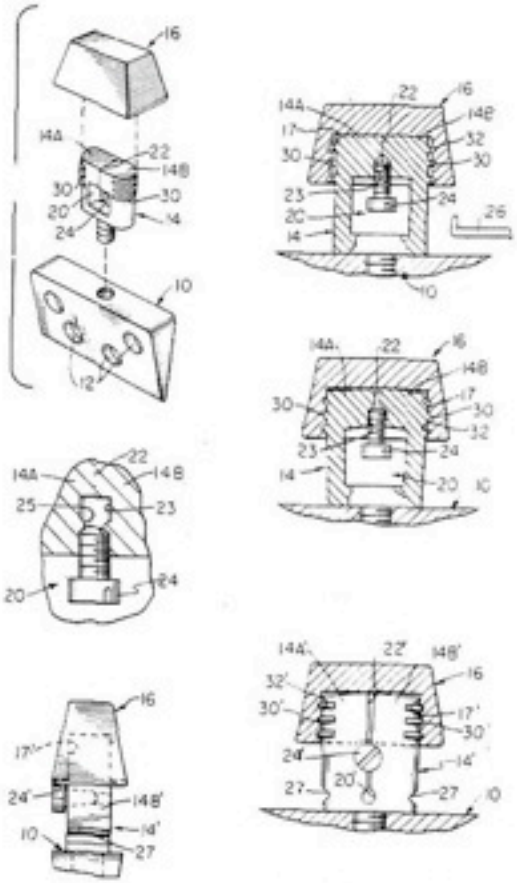
U.S. Patent Jul. 30, 1985 Sheet 1 of 2 4,531,917



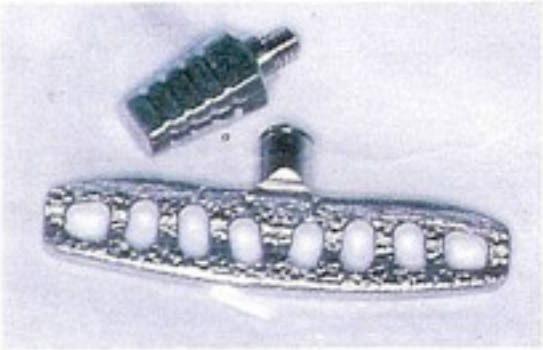


. A submergible bladevent developed by the author with a straddling post.

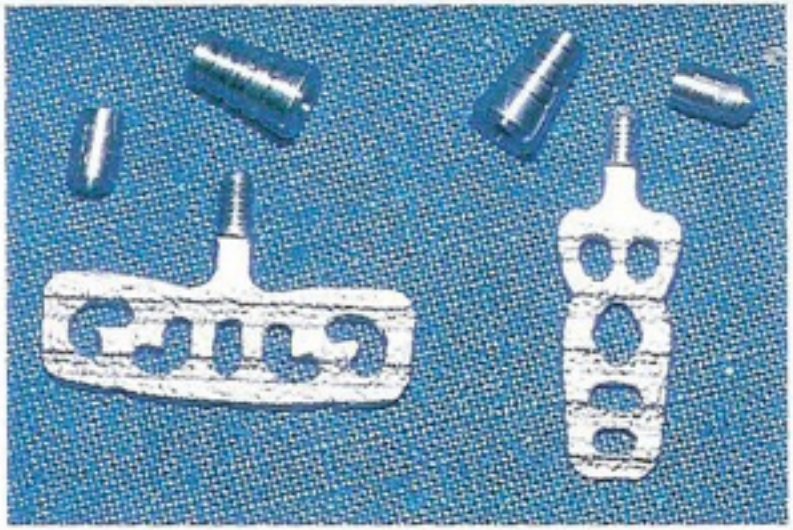
. Shows an early prototype of the straddling post system.



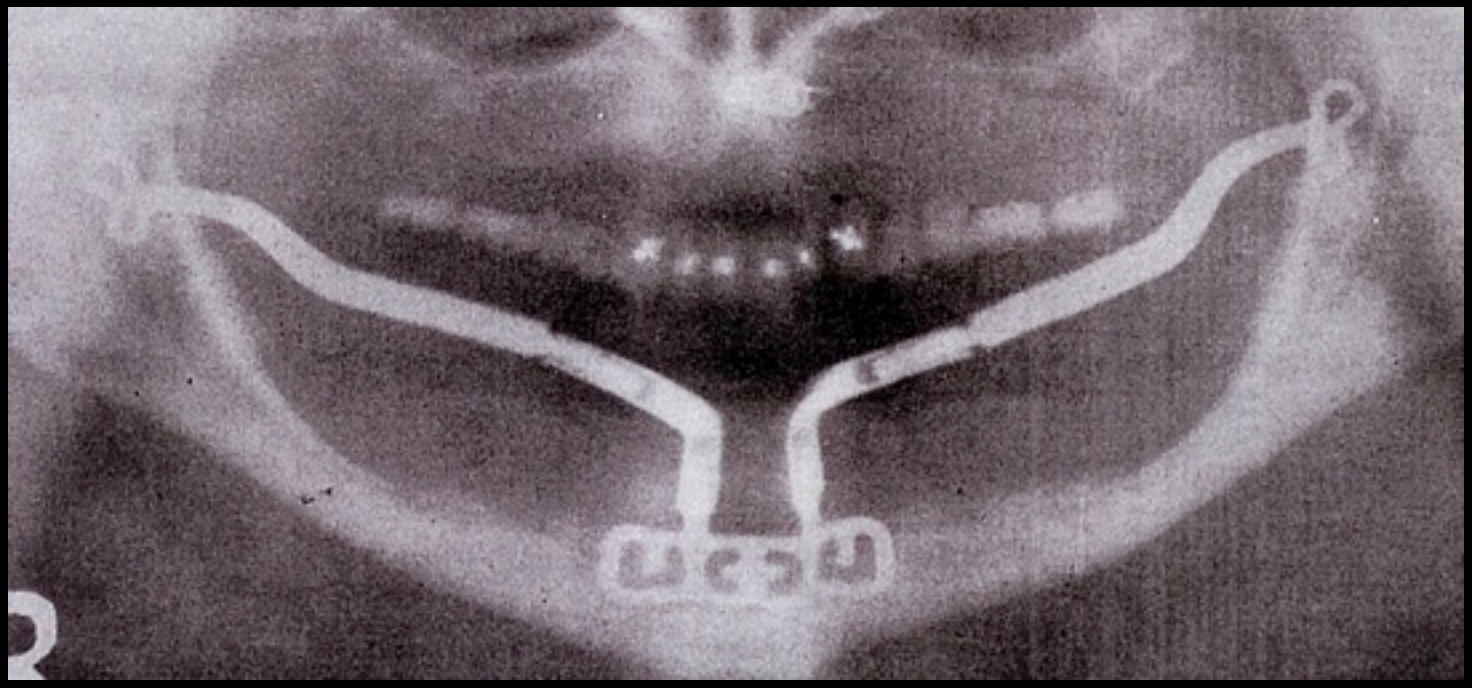
. The most recent system developed by the author and Hoffman, can allow a cemented prosthesis to be easily removed from the bladevent itself.



A submergible bladevent implant (type A). This blade implant had an internally threaded hollow neck into which the post is screwed into.

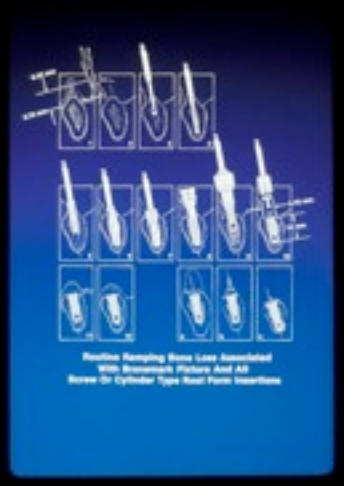


. A submergible blade with an externally threaded neck onto which the post is screwed over (type B).



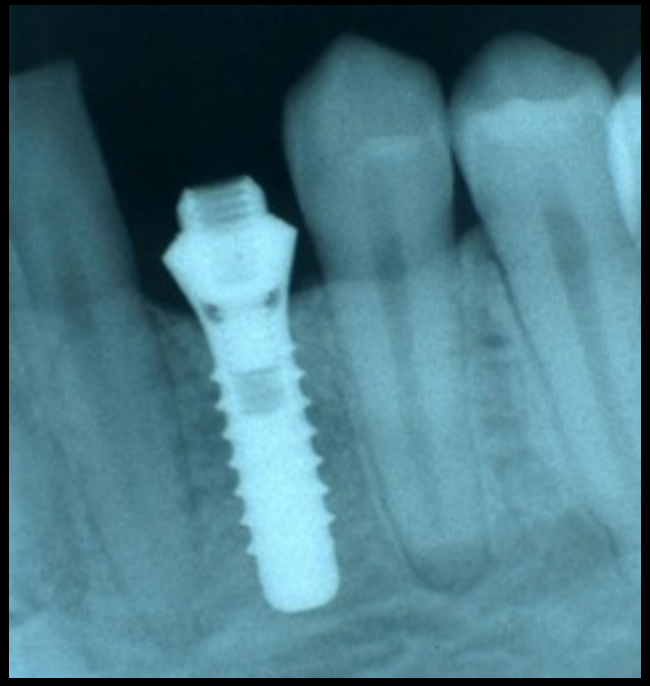
Back To Two Stage

- The 1980s
- The Two Stage Ad Modum Branemark
  - Osseointegration
  - Afunctional, protected healing, smooth machined implants



Back to Single Stage
Growth of Impatience

- The 1990s
  - Development of single stage implants



Back to Immediate Loading

- Late 1990s and 2000s
  - "Teeth in a Day"
  - "Teeth in an hour!"

  Coming very soon "Teeth While You Tan!"