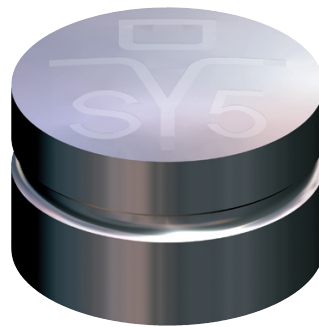
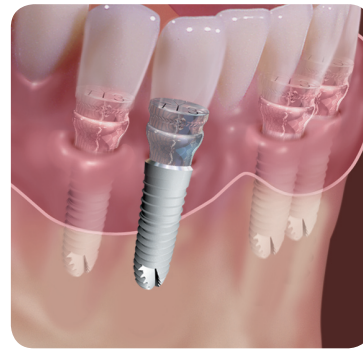


MANUAL

Dyna magnet system



your comfort is our goal!



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1. Dyna concept



1.1 Introduction

Dyna Dental Engineering BV produces four different types of magnets:

- 300g* 1.7mm height Ø4,8mm
- 500g* 2.7mm height Ø4,8mm
- WR 300g* 1,7mm height Ø4,5mm
- WR 500g* 2,7mm height Ø4,5mm



All of them belong to the above mentioned group of so called rare-earth or permanent magnets. Dental attachments retaining overdenture have to have two major features:

- adequate size
- adequate “connecting” force

Conventional Ferrite (Iron) or Alnico (aluminium, nickel, cobalt) are too weak to be used as mini-magnets as they have only 5g to 10g brake-away force when machined to the size of 3 to 5 mm in diameter (which makes them impossible to use in the mouth). Only applying new alloys gives the chance to achieve good attachment force in combination with small dimensions.

Therefore all Dyna magnets are made of Neodymium/Boron/Iron alloy. The invention of permanent alloys made a breakthrough in possible applications of magnets. The name rare earth derives from the fact that they are made by alloying a transitional element (cobalt, iron) with a class of elements known as the Lanthanum Series that though abundant in nature are extremely hard to isolate in pure form (the Rare Earth elements). Sm/Co magnets were first to be commercially produced. Further developments in this field led to production of the new alloy Ne/Bo/Fe that is around 20% stronger per unit volume than Sm/Co alloy.

Rare earth magnets have the additional advantage of having a very high intrinsic coercivity, a measure of magnetic permanence. Soft iron, which has a low coercivity, is easily magnetised and demagnetised, while cobalt-samarium, with a very high coercivity requires a very strong magnetic field to magnetise it, but once magnetised, is very resistant to demagnetisation.

* Retentive force of the magnet without encapsulation on normal steel

All Dyna magnets are open field magnets meaning that the magnetic flux field radiate into the surroundings. The reason for choosing such a design is the fact that open field magnets, in contrary to the closed field magnets, do not have to be in close contact with an object to attract it. This has naturally clinical consequences. An overdenture placed in the mouth of the patient during its functional life has a certain degree of mobility meaning that the magnets are not always in contact with the keeper or abutments. It is by using open field magnets that the magnetic attraction may be retained even in such situations.

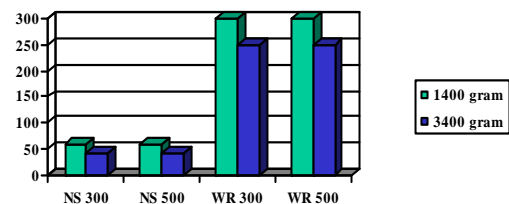


1.2 Wear resistance

Two problems are in general associated with the use of modern magnets. First the magnets are found to be bio-degradable, loosing magnetic energy as they dissolve; and second that the magnetic field might be harmful to the oral tissue. The Magnets of Dyna Dental Engineering BV are coated with a biocompatible sealing first and then encapsulated in surgical steel 316L that has the following advantages:

- It's slightly elastic therefore minute deformation are possible
- It's biocompatible therefore no adverse effect to the tissue
- It's completely sealed therefore there is no contact of the magnets with the body fluids or tissues

By applying entirely new design and manufacturing method to the production process of Dyna magnets it has finally become possible to apply the magnetic attachment idea to patients experiencing relatively high risk of magnet wear. The so called Dyna WR (wear resistant) magnets are made of surgical stainless steel. Machined metal housing is relatively stronger than the deep drawn encapsulation of magnets produced in a traditional way. Simulation studies* have shown that in comparison to standard Dyna Magnets, Dyna WR Magnets may function up to 6 times longer under higher load. In clinical terms it means that WR magnets have the potential to function for more than 10 years.



WEAR RESISTANCE TEST DYNA MAGNETS
*Dr. Ahmed Assad University of Alexandria, Egypt



1.3 Influence of the magnetic fields

It has been reported that some magnetic fields may cause unusual reactions on mammalian tissues including brain damage in rabbits and cats. Since the introduction of rare-earth magnets into dentistry the use of new alloys raised concerns about their safeness. The use of new alloys in the oral cavity and exposure of tissue to magnetic

fields require careful consideration. However, the research on influence of the magnetic fields on mammalian tissues shows that using permanent mini-magnets for dental purposes poses no threat to the patients. R. Cerny (Austr. orth. journal vol.6 no2, 1980) investigated the effect of Sm-Co magnets on the dental tissue of dogs and found no histological changes in the tissue of the regions in close proximity to the magnetic discs. In his other research he concluded that magnetic fields from implanted magnets of the order of 95 milliteslas or less had no observable harmful effects on the surroundings tissues or on the development and well-being of the rats. The results of others seem to confirm these results.

As far as encapsulating metals are concerned, according to Kroone, alloys containing Nickel which is currently a controversial alloy for biological use, but well used commonly in our environment have caused very few negative reactions.

The changes in the technique for using the magnets should be also noticed. The first trials with magnets used the inter-poling magnets mounted in both dentures stabilizing each other. Later implanting of the magnets in the bone was tried. Consequently studies by Cerny and others investigated reactions of the tissues on implanted magnets. Nowadays, the idea of using the magnets is based on mounting them in the denture. This means that magnets have no direct contact with tissues which makes the claimed adverse effects even less possible.

1.3.1 Magnetic Resonance Imaging

On the other hand, magnets may interfere with some mechanical devices. Concerns have been raised about using MRI (Magnetic Resonance Imaging) with patients wearing dentures with magnets (Prof. Dr. PF van der Stelt, University of Amsterdam 1987) . It is evident that patients have to remove the denture before such examination. In most of the cases it is a sufficient contra measure, though when examining the area of head and neck it is a must to remove the rootcaps, the Direct Keepers and or the Medical abutments, especially when no distortion of the image is allowed. Leaving the magnets in the mouth should not pose a direct danger for the patient but the images achieved as a result of such examination will be greatly distorted and the magnets will be destroyed!

1.3.2 Pacemakers

The other important group is patients with pacemakers. Research have been made to estimate potential danger of Dyna magnets interfering with these devices. In theirs study Hiller et al. (J Prosthetic Dent 1995; 74:420-1.) examined patients in whom permanent cardiac pacemakers had been implanted (average patients age 71). In 75% of the cases no influence of the magnets on the pacemaker was detected. In 25% an influence identical to that obtained when the large magnets were used was detected when three Dyna magnets placed together at a specific point on the skin overlying the pacemaker whereas at the same patients no influence was detected when one or two magnets were placed on the same place. Removal of the magnets even 1cm away from that point cancelled the influence.

2.

Product catalogue.



2.1 Dyna magnets



T

here are two standard Dyna magnets available for clinical use. They have the same diameter Ø 4,8mm and two heights 1,7mm and 2,7mm.

Dyna Magnet 300g h 1,7mm (NSS red label)

1102



Dyna Magnet 500g h 2,7mm (ES black label)

1106



New **Dyna WR** (Wear Resistant) magnets are available in two versions – S3 stainless steel 300g, S5 stainless steel 500g. They have the same diameter Ø 5,0 mm and two heights 1,8mm and 2,8mm.

Dyna WR Magnet 300g h 1,8 S3

01MS1



Dyna WR Magnet 500g h 2,8 S5

02MS2





2.2 Dyna EFM alloy

The idea of magnetic attraction is based on mutual reaction between two magnets or a magnet and ferromagnetic material. A magnetic attachment can be defined as a retention magnetic unit consisting of two parts that attract each other by means of magnetic flux field. The breakaway load (that is the load required to separate the magnetic unit) depends to a great extent on the type of those parts and should be the highest when using two magnets. However, though rare-earth magnets proved to be suitable (in dimensions) to be used in dentistry, making a magnetic attachment requires two elements where one of them would be fixed on a root or an implant and the other in the denture.

Magnets can not easily be made in a form suitable for individual cases, as the material used in the production can not be casted. Therefore using two magnets (that would give maximum of breakaway load) to make a magnetic unit presents considerable problems. To overcome these problems, there has been a search for ferromagnetic alloys which could replace one of the magnets and have required properties. Ferromagnetic alloys exhibit magnetic characteristics like those of soft iron. It is important that the alloys should be castable. Ferromagnetic properties and castability can solve the above mentioned problems. The magnet in the root can be replaced by a cast root cap or so called keeper. In addition the alloy should also have physical and chemical properties which render it suitable use in the mouth.

Almost all conventional dental alloys apart from a few like cobalt-chromium or nickel-chromium are non ferromagnetic. Those that do have this property are usually too weak ferromagnetic to be used for magnetic retention of dental prostheses.

Constant search for new materials led to the development of Palladium/Cobalt based alloys that would match the requirements for castable dental alloy for use in magnetic attachments.

Dyna EFM alloy belongs to this group and is indicated as a castable alloy for making individual rootcaps and both pre-fabricated keepers and implant abutments for magnetic attachments. Unique properties of this alloy give a dentist possibility to achieve the best possible results when using magnets.

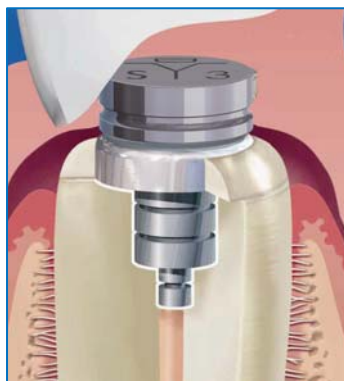
EFM alloy is supplied in a form of small metal blocks of approximately two grams to be casted by the technician.

DYNA EFM ALLOY (Pd/Pt/Co) (per gram) **art.nr. 2120**
Only available in ingots of approx. 2 grams

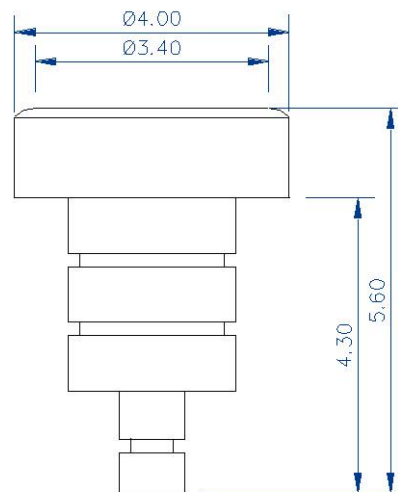
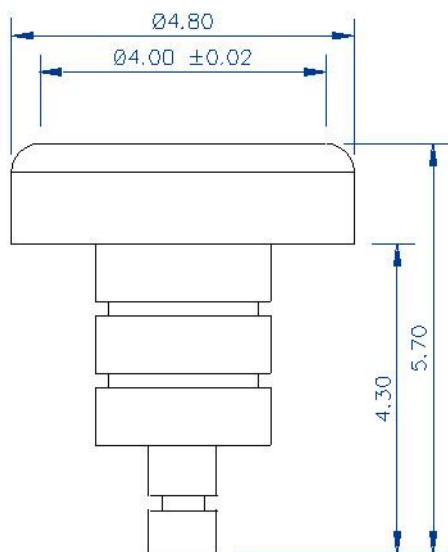




2.3 Dyna Direct System



The Dyna Direct System is a chair-side magnetic attachment for both partial and full overdentures. This system consists of prefabricated keepers made of a precious alloy susceptible to magnetism, Dyna magnets and two drills enabling precise root preparation. Keepers are fabricated of EFM alloy and supplied in two sizes to broaden clinical use of the system. Excellent corrosion-resistance and lack of any toxic or for the patient.



*All DYNA DIRECT INTRODUCTION CASSETTES also include
1 DYNA Spiral Drill + 1 DYNA Seat Drill + 1 DYNA Application instrument*

DYNA DIRECT INTRODUCTION CASSETTE **02DS10**
2 DYNA **WR** Magnets. 300gr h.1,8mm
2 DYNA EFM Alloy Keepers

DYNA DIRECT INTRODUCTION CASSETTE **02DS20**
2 DYNA **WR** Magnets 500gr h.2,8mm
2 DYNA EFM Alloy Keepers

DYNA EFM ALLOY KEEPER Ø 4,8mm **3200**



DYNA EFM ALLOY KEEPER small Ø 4mm **3210**



DYNA SPIRALDRILL (stainless steel) **3240**



DYNA SEATDRILL (stainless steel) **3241**



DYNA magnetic application-instrument **3250**





2.4 Dyna System.

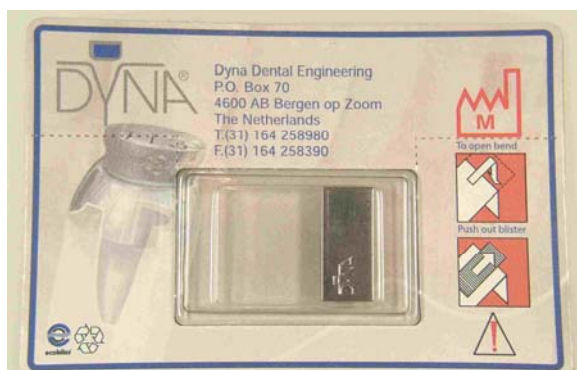
for different types of overdentures. It consists of a precious alloy susceptible to magnetism (EFM alloy) and Dyna magnets. Likewise the Dyna Direct System it is indicated for and it can be used almost in all those clinical situations where Dyna Direct is contraindicated.

Advantages of using the Dyna System are comparable with the Dyna Direct. They are however extended as there is literally no form limitation for casting the alloy.



DYNA EFM ALLOY (Pd/Pt/Co) (per gram)

2120





2.5 Dyna Medical Abutment.



Dyna medical abutments are specially designed abutments to be used with Dyna implants for making a magnetic attachment for overdentures. They are made of Dyna EFM alloy in a special form resembling flattened mushrooms. Variety of abutments is adjusted to different implant diameters and they have also different heights matching different mucosa thickness. This allows for optimal hygiene and optimal mechanical resistance.

Dyna medical abutments are screwed to the implants with Dyna hex screwdriver TW and the Torque Wrench (**30Ncm**). This prevents unscrewing during function.

DYNA ABUTMENTS FOR MAGNETIC OVERDENTURES (Dyna EFM Alloy)

Dyna Implant System

Ø 3 mm

DYNA MEDICAL abutment 3 mm	5443
DYNA MEDICAL abutment 4 mm	5444
DYNA MEDICAL abutment 5 mm	5445
DYNA MEDICAL abutment 6 mm	5446

Ø 3,6 mm

DYNA MEDICAL abutment 3 mm	5343
DYNA MEDICAL abutment 4 mm	5344
DYNA MEDICAL abutment 5 mm	5345
DYNA MEDICAL abutment 6 mm	5346

Ø 4 mm

DYNA MEDICAL abutment 3 mm	5543
DYNA MEDICAL abutment 4 mm	5544
DYNA MEDICAL abutment 5 mm	5545
DYNA MEDICAL abutment 6 mm	5546



Dyna Helix & Octalock Implant System

Applicable on all type Helix and Octalock implants

DYNA MAGNET abutment 3 mm	82MG3
DYNA MAGNET abutment 4 mm	82MG4
DYNA MAGNET abutment 5 mm	82MG5



Applicable on all extension level extension abutments **Octa**

DYNA EXTENSION level MAGNET Abutment octa L0	82EM0
---	--------------



Dyna Helix TM Implant System

DYNA MAGNET abutment TM octa L1	84MG1
--	--------------



One stage implants: ITI Straumann, 3/ and Compatible brands

MEDICAL abutment 1, 5 mm 6640



2.6 Dyna Magnet Bond

Dyna Magnet Bond is a special cold cure bonding agent to fix the magnets into the denture. Its properties allow for chemical connection between the metal and acrylic of the denture. The chemical connection provides reliable construction, no discolouration and even more seal to the magnet.

Applications:

- Fixation of magnets and other attachments in overdentures
- Establishing a very strong chemical bonding between the acrylic and metal frameworks of partial and full dentures thus preventing the notorious discolouration due to micro leakage between metal and acrylic.
- Refilling or adding in a simple and quick manner porcelain or acrylic teeth, also directly to metal partial dentures
- Relining of dentures with a metal framework
- Nearly all dentures repair.

Dyna Magnet Bond consist of a paint on primer containing a metal adhesive monomer (4-META – 4 methacryloxyethyl trimellitate anhydride) and a self curing resin specially formulated for maximum wetting and rapid polymerisation to the primed surface. Fast bonding liner should be applied to the pre-treated metal surface for better effect (air-abrasion, water rinsing and drying). The precious metal alloys should be further heat treated or tin-plated prior to liner application.

DYNA MAGNET BOND CASSETTE	21001
<i>Consisting of:</i>	
DYNA MAGNET BOND LINER 3,5 ml	21101
DYNA MAGNET BOND MONOMER 50 ml	21201
DYNA MAGNET BOND ACRYLIC 60 gr. Pink	21301



3.

Clinic



3.1 Indications

Dyna Magnet System can be used in following clinical situations:

- Retention of complete or partial overdentures in the maxilla or the mandible in combination with:
 - Natural elements
 - Implants

Dyna Magnet System is a multipurpose system for increasing retention and stabilisation of the overdentures. It is, however, important to remember that like every system it has limitations and specific indications. The indications of our system in relation to implant retained overdentures should be more specified as working with implants demands the best possible prosthetic solution. Therefore, the indications for using magnetically retained overdentures on implants may be formulated:

- Retention of complete overdentures in the maxilla or the mandible in patients with severely reduced alveolar bone
- Retention of complete overdentures in the maxilla or the mandible in patients with manual dexterity deficiency



3.2 General contra-indications

Dyna magnets are contraindicated in all those situations where clinical situation indicates that no proper load distribution can be achieved, except for the cases where magnets are treated as temporary measure in transition to e.g. edentulous status. Every case should be, however, considered individually. The operator should take into consideration the following:

- the Dyna magnets are to be placed on Dyna Medical abutments, Dyna alloy rootcaps or the Dyna Direct pre-fabricated keepers;
- bite relation, occlusion and articulation

- patients' habits
- type of prosthetic construction to be made.

Magnets are intended for improving the retention and stabilization of the dentures which means that any prosthetic construction that implies transferring the bite forces only to the magnet-abutment posts is contraindicated. Considering natural elements and implant situations one should notice already described differences in their mobility.

Choosing the right abutment is of primary importance to the full success. In some situations where the position of the tooth is not favourable, instead of Dyna Direct, the Dyna System should be used to produce individual keepers that could enhance the mechanical situation (see also Dyna Direct contraindications).

It is the dentist's responsibility to analyse every case with adequate care, and set proper indications in order to avoid overloading of the magnets.



3.3 Dyna Direct System



3.3.1 General considerations



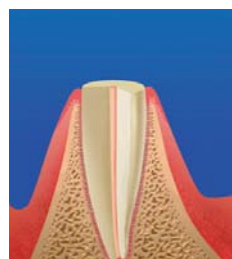
The Dyna Direct System is a chair-side magnetic attachment for both partial and full overdentures. This system consists of a prefabricated keeper made of a precious alloy susceptible to magnetism and Dyna magnets. Absolute corrosion-resistance and lack of any toxic or allergenic elements makes the use of keepers totally safe for the patient.

However, before proceeding with the system we recommend careful examination and evaluating of each clinical case.

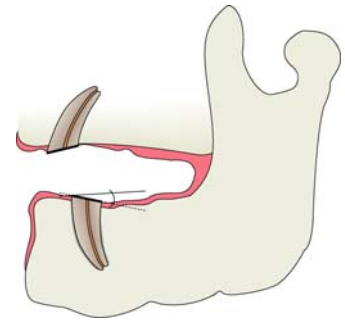


3.3.2 Clinical procedure

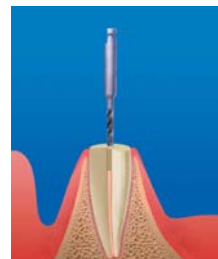
1. On chosen teeth perform an endodontic treatment in usual manner. Wait until you are sure that no further periodontal changes occur. When extracting the neighbouring teeth takes care that major resorption has slowed down enough to provide suitable stabilization of the future abutment root(s).



2. Decoronate the abutment tooth. Prepare the final surface more or less parallel to the alveolar crest but with a slight lingual or palatal inclination. Keep the preparation as low as possible. This prevents the problem of magnet fixing as well as leverage forces coming to the root. Enough tooth material should be removed in order to create sufficient space for the magnet which comes into the denture. On the other hand if sufficient inter-maxillary space is available and the periodontal conditions are good, one might choose to make a slightly higher preparation (2-3mm above the gingiva) in order to create more lateral stability for the overdenture.



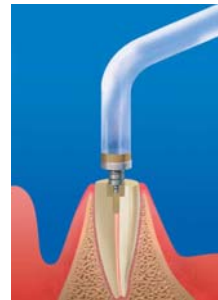
3. Drill a shaft in the root parallel to the prepared surface using the spiral drill. Beware that the future occlusal plane of the keeper is fully supported by the root.



4. Prepare the seat using the seat drill with the guiding pin assuring correct direction and depth.



5. Choose the standard (Ø 4,8mm) or small (Ø4mm) type Dyna Direct Keeper. Check the fitting and make the necessary adjustments.



6. Cement the keeper preferably with the combination of glasionomer and composite. You can use any bonding technique following the instructions of the manufacturer. Keep the transition (keeper-composite) as smooth as possible.



7. Finally polish carefully any rough surfaces or edges.

8. Make an full arch impression and realize the overdenture using the standard techniques. (see Dyna System chapter 3.4) Fixation of the magnets is described in chapter 3.7.



3.3.3 Advantages of the Dyna Direct System

- *simple chair-side procedure
- *easy to clean
- *direct use
- *no fragile parts
- *time saving
- *no spare parts
- *low costs
- *mainly axial loading
- *small size



3.3.4 Dyna Direct contraindications

- Angled roots enabling parallel positioning of the keeper (perforation). *
- Roots of which the cross-section shape (diameter) does not allow for complete support of the occlusal plane of the keeper. *
- Roots shorter than total height of the keeper plus the margin for the proper endodontic treatment. *
- Narrow roots where drilling could cause perforation. *
- Roots with a mobility $>2^\circ$
- Prosthetic appliances transferring all the occlusal loads only and directly to the magnet-keeper posts.

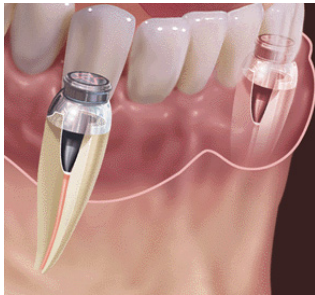
*** These contraindications can be solved by using the DYNA SYSTEM (castable Dyna alloy)**



3.4 Dyna System



3.4.1 General considerations



The Dyna System is a magnetic attachment system for different types of overdentures. It consists of Dyna magnets and a precious alloy susceptible to magnetism (EFM alloy) that can be poured out to desired form of the keeper. Likewise the Dyna Direct System it is indicated for improving the retention of overdentures on remaining dentition and it can be used almost in all those clinical situations where Dyna Direct is contraindicated.

Dyna system can be applied on remaining dentition, and in some situations even the mobile teeth with lengths beginning from 7mm up can be used to support the overdenture. For “extreme” situations, however, special care should be paid to all factors that may compromise functioning of the magnets.



3.4.2 Clinical procedure

DENTIST

1. On chosen teeth perform an endodontic treatment in usual manner. Wait until you are sure that no further periodontal changes occur. When extracting the neighbouring teeth takes care that major resorption has slowed down enough to provide suitable stabilization of the future abutment root(s).



2. Decoronate the abutment tooth. Prepare the final surface more or less parallel to the alveolar crest preferably with a slight lingual or palatal inclination. Keep the preparation as low as possible. This prevents the problem of magnet fixing as well as leverage forces coming to the root. Enough tooth material should be removed in order to create sufficient space for the magnet which comes into the denture. On the other hand if sufficient inter-maxillary space is available and the periodontal conditions are good, one might choose to make a slightly higher preparation (2-3mm above the gingiva) in order to create more lateral stability for the overdenture.

3. Prepare the internal part for the keeper. The outline of the preparation is indicated by means of bevel preparation, whereas, an intra-radicular part should have conical or step preparation and depth of approximately 5mm.

Such preparation has following advantages:

- Gradual transition between the post and rootcap (preventing fracture and porosity)
- Increase in volume of the casting, necessary for sufficient magnetic attraction.



There is no need to use the full length of the root as there are no leverage forces that might interfere with rootcap fixation.

4. Take a full arch impression with any material suitable for root posts impression. Make sure that the outline of the preparation is clearly visible.



5. Close the preparation with temporary cement.



3.4.3 Laboratory procedure

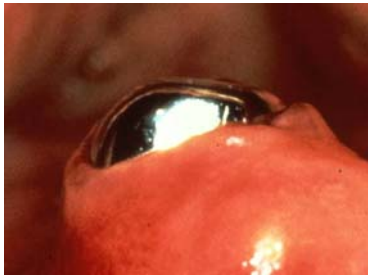
LABORATORY



6. Pour out the plaster model.



7. Wax the rootcaps.



8. The shape of the rootcaps

The height of the rootcaps should be 1.5-2mm above the gingiva. The shape from the outline up to the mucosa must be reversed conical to prevent overgrowth of the mucosa.

The contour of the rootcap should be smooth and rounded. No sharp edges are allowed.

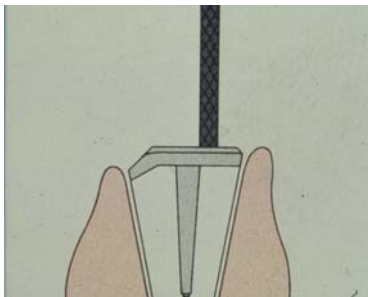
The rootcap should be provided with an occlusal plane of diameter minimum 3mm, parallel to the vertical height with slight inclination to lingual/palatinal. Very steep inclination should be avoided to prevent orthodontic displacement.

Because Dyna alloy has a relatively high (1.9%) thermal expansion and consequently contraction, the intraradicular post section may break from the rootcap after casting if:

- The post section was shaped too thin and/or too long
- The shape of post section causes irregular cooling
- The transition between the post and rootcap is sharp and thin
- The alloy is overheated
- No wax wire vents used

9. Sprues

Use sprues with a diameter larger than the thickest part of the pattern (min 3 mm) (sprues that are too thin cause porosity of the casting or fracture of the sprue).

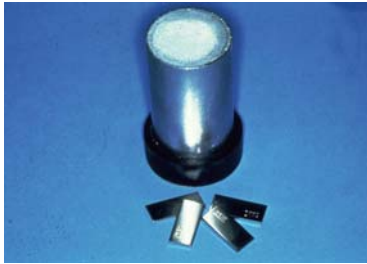


When using thinner sprues with an expansion reservoir the volume of the reservoir should always be more than the pattern (in this case the rootcap). The reservoir should be approx. 3.0 to 4.0 mm away from the pattern and must be located in the thermal centre of the cylinder.



Always use wax wire vents (\varnothing 0,8mm) positioned on the top of the posts to prevent porosity at the transition between post and rootcap.

When using a centrifugal casting machine, the casting direction is indicated on the cone former by means of a small drop of wax. This allows positioning of the muffle in the casting machine in such a way that the casting distance for the molten alloy is kept as short as possible.



10. Investment

Use phosphate bonded, graphite free investment (graphite may react with palladium and cause brittleness of the cast alloy) with a distilled water/liquid ratio corresponding to an expansion of 1.9% (follow instructions of investment manufacturer).

Roughen the upper side of the muffle to allow easy escape of gases.

11. Preheating

Burning out;

First step: 0 to 300° C (550° F) Leave the cylinder for 30 minutes on 300° C (550° F)

Second step: 300° C to 600° C Leave the cylinder for 30 minutes on 600°C

Third step: 600°C to 850°C Leave the cylinder for 60 minutes on the end temperature.

In most furnaces you can program these settings.



12. Casting

The casting temperature is 1350 °C (2460°F). Do not use graphite or carbon crucibles because they may cause brittleness of all high content palladium alloys. In order to extend the working life of ceramic crucibles they may be glazed by heating the crucible to 900 °C and coat the inside with casting flux.

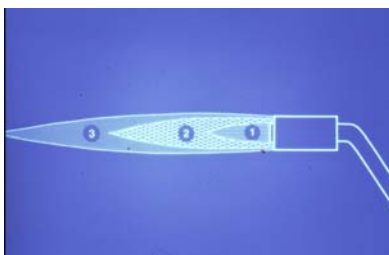
When applying centrifugal methods the casting cylinder is positioned in such a way in the casting machine that the casting distance of the alloy is kept as short as possible. This is of great importance because the Dyna alloy has only a melting interval of 15°C. (solid - liquid: 1195°-1210°).

The alloy must be cast directly after the total quantity of alloy has reached its liquid temperature. The oxide layer should not break open. This means that the alloy will cool down rapidly below casting temperature so the positioning of the casting cylinder is extremely important to avoid miscasting.

Propane - Oxygen

Preheat the crucible (if a new crucible is used glaze it with a little flux) together with the muffle, in the preheating furnace.

Never melt with the inner cone (1) of the flame. This consists of oxygen and unburned gas. The flame is relatively cold there and promotes oxidation. The hottest point of the flame is in front of the inner cone (2). Here combustion takes place and all oxygen is extracted from the environment, so the flame has a reducing effect with respect to oxidation.



Follow instructions of torch manufacturer!

- A. Take the crucible from the oven,
- B. Place the alloy into the crucible and add some flux,
- C. Melt the alloy. Do not rotate the flame,
- C. When the alloy is almost melted place the muffle in the correct casting direction (centrifugal force) in the casting machine,
- E. cast as soon as the alloy is melted and moves under the pressure of the flame!

OXIDE layer remains visible!!

If the alloy shines in the molten condition it is overheated.

Always avoid overheating.

Solid 1195°C (2180°F) - Liquid 1210°C (2210°F).

Electrical (vacuum) casting apparatus

Preheat the ceramic crucible to the highest temperature and then turn back the oven to the specified casting temperature (1350°C (2460°F) or 1400°C (2550°F) for older casting machines.

Glaze the new crucible with some flux. Place the alloy into the glazed crucible and add some more flux. When the alloy is molten (melting interval is only 15 degrees!) take the muffle from the oven, place it in the casting apparatus. Heat the alloy until it can move inside the crucible, then cast.

Oxide layer remains visible!!

Now cast the alloy immediately.

If the alloy shines in the molten condition it is overheated.

Therefore do not melt for too long. Always avoid overheating.

Solid 1195°C (2180°F) - Liquid 1210°C (2210°F)

High frequency apparatus

Glaze the crucible with a little flux. Preheat the crucible (if possible 850°C (1560°F)). Place the alloy into the crucible. Add sufficient flux. Handle as quickly as possible.

Melt with intervals in order to avoid local overheating. When the alloy is at approx. 1,000°C (1830°F) stop melting and place the muffle into the casting machine.

Add some more flux. Now continue melting and cast immediately after the alloy is completely molten.

Watch out for overheating.

Melt a minimum of 10 grams of alloy. This is necessary, as because of the low gravity of the alloy, the narrow melting interval of 15°C and because the upper part of the crucible is not heated, the alloy will cool down rapidly which might cause some material to remain behind after casting in the upper part of the crucible.

Recasting

Dyna E.F.M. alloy can be re-casted several times if oxide layer of the cone is removed. However, it is a must that 30% of the new alloy is added after each new casting.

13. Soldering

Use a solder of 1060°C which is suitable for palladium alloys.

If an attachment is soldered onto the Dyna rootcap, first pre-solder with 1060C and then use the solder recommended by the manufacturer of the attachment.

General:

- space between the two objects 0,1 to 0,2 mm
- use a flux which covers all soldering temperatures
- use solder of good quality
- keep the investment model as small as possible

Use casting wax and then for more strength a plaster or acrylic

13.1 Soldering the Dyna EFM alloy with Pre-solder.

- Roughen the surface to be soldered (take away a minimum of 0,1 mm so the oxide layer will be completely removed) with ceramic bonded stones (pink or brown stones or blue aluminium oxide stones)
- You can also roughen the surface to be soldered by sandblasting (aluminium oxide 110 µ (microns))
- Place the object to be soldered in the investment
- Remove the wax or the acrylic or the plaster
- Attach the flux and pre-heat the investment and the object up to approx. 1100°C (2012°F) with a soldering torch.(Warning: the Dyna EFM alloy has a solid/liquid temp of 1195/1210°C !)
- Attach a thin layer of 1060°C solder. Than finish the surface.

13.2 Soldering of the Dyna EFM alloy with low fusing solder in the furnace.

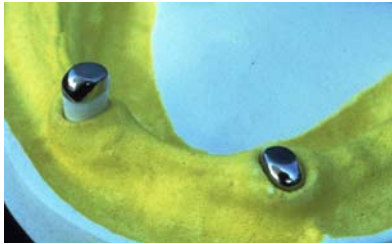
Always first pre-solder with a high fusing solder!

- Roughen the pre-soldered surface to be soldered. (e.g. aluminium oxide 110 µ (microns))
- Place the object to be soldered in the investment.
- Remove the wax or the acrylic.
- Attach the flux and the solder.
- Place the object in the furnace and complete the soldering program.

Recommended cycles in the furnace:

- * starting temperature : 600°C (1112°F)
- * rising 55°C (131°F)
- * to end temperature of the solder + 50°C (122°F)
- * keep end temperature for 1 minute.

After soldering process remove the object immediately out of the furnace



14. Check the fit and polish the castings.

DENTIST

15. Remove temporary material, clean the root and check the fit of ready rootcaps.

16. If rootcaps meet all the criteria cement them with e.g. glass ionomer cement.

17. Remove the excess of the cement and make necessary adjustments.

18. Make first impressions and sent them to the laboratory.



Samples of Dyna System overdentures



Daniel den Hoed Cancer Hospital Rotterdam NL





3.5 Impression & Model realisation

Impression taking in cases of overdentures is almost the same as for full dentures. The dentist should follow generally accepted way of taking the impression for full dentures, meaning two impressions, anatomical and functional.

It is, however, important to choose the impression material properly in relation to the required technique.

DENTIST

1. Make the first anatomical impressions and send them to the laboratory.



LABORATORY

2. Pour out the impressions in plaster and make the individual impression trays and send them to the dentist.



DENTIST

3. Make the individual impressions and send them to the laboratory.



LABORATORY



4. Cast the final impression in a hard stone. On this plaster cast the rootcap contours must and should be clearly visible.

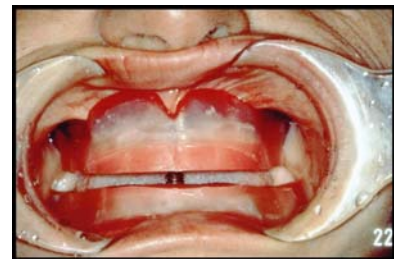
Note: During casting you can apply a ferromagnetic nail in the plaster at the site of the rootcaps. These nails will keep the magnets in place during set up of the teeth (see 7).



5. Make the bite registration plates and sent them to the dentist.

DENTIST

6. Establish proper registration of the bite with one of the commonly used techniques. Sent it to the laboratory.



LABORATORY



7. After bite registration the casts are mounted in the articulator. To prevent undue pressure of the denture on the tissues around magnet keeper during the "wearing-in" period, attach a small piece of tin foil (with a thickness of ± 0.3 mm) onto the cast, covering the rootcap and approximately 1.5 mm. of the surrounding plaster with a cyano acrylate.



8. The magnets can now be temporarily placed on the cast. If wax is used take care **not** to heat the magnet above 120°C! After waxing up the denture they are removed.



9. When waxing up the denture takes care there is enough space for the magnets.
Sent the denture in wax to the dentist.

DENTIST

10. Verify the try-in denture in wax intra-orally.



LABORATORY



11. After embedding, the wax is removed from the muffle. Now we can choose if we want to use the indirect (3.6.1) or direct (3.6.2) method for magnet fixation.



3.6 Magnet fixation

Before seating the magnets a wear-in period is recommended. This period is the time to eliminate all possible problems with the denture like ulcerations, occlusion problems etc. It is also the time to allow for an “initial” resorption and allow the patient to become accustomed with the new denture.

The Dyna magnets can be seated into the overdenture either by the dental technician or by the dentist chair-side.

- 1 at the dental laboratory:
A with Dyna Magnet Bond¹
- 2 chair-side:
A using the Dyna magnet bond¹

¹ see the Dyna magnet bond manual.

Note:
When fixing the magnets extra precautions must be undertaken not to damage, at no condition, the magnet capsule.



3.6.1 Laboratory indirect method (recommended)

LABORATORY

1. After embedding press, cast or inject the denture acrylic and polymerise. The tin foil is removed with a probe and any sharp acrylic edges are finished. Sent the denture to the dentist.



DENTIST

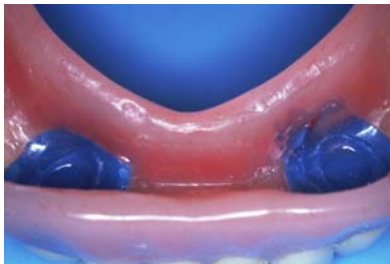
2. Insert the denture intra-orally, and verify for correct fit, occlusion and articulation.
Sent the patient home to let the denture wear-in for approximately 2 weeks.



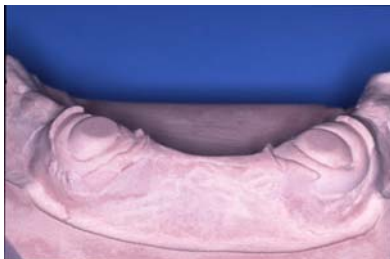
3. After the wear-in period, a local impression is made.
First attach an adhesive in the denture only at the rootcap area!
Only make an impression locally inside the denture at the site of the rootcaps with a light body impression material. The denture is sent to the laboratory.



LABORATORY



4. Equalize the undercuts in the denture.



5. Cast the denture in putty or plaster.



6. Create some free space around the rootcap allowing lateral movement of the denture and giving relief to the surrounding gingiva.



7. The Dyna magnets are placed on the cast, exactly on top of the flat surface of the rootcap.
The Dyna logo has to be visible at the upper side of the magnet.
By applying a little cyano acrylate to the side of the magnets, they are glued on the cast (do not use magnetic instruments).



8. Use **Dyna Magnet Bond** to obtain a strong chemical bonding between magnet and denture acrylic, thus preventing fracture of the denture and discoloration around the magnet. Dyna Magnet Bond consists of a liner and a special resin. These materials have to be applied to the magnet in a thin layer before pressing the denture. (Read Manual before use!)



9. Separate the denture base with Vaseline to prevent attachment of acrylic at unwanted areas. Place the denture on the cast, while checking if the space for the magnets sufficient. Apply a fluid mix of cold-curing resin in the cavities with a plastic spatula.



10. After curing the acrylic, the denture is removed from the cast.
Sharp angles should be finished.



11. Finish and polish the denture.

Note:

Take care not to damage the magnet! Most steel drills are attracted by magnets. Use only drills that are not susceptible to magnetism.

DENTIST

12. Insert the overdenture and verify the adaptation of the magnets to the rootcaps with a fit-checker material. If the fit-checker indicates excessive pressure between the rootcap and the magnet(s), the magnet(s) **must be reinserted**. If there is no visible sign of contact between rootcap(s) and magnet(s), this will usually not cause any problems. Within a few days after insertion the magnets will be in contact with the rootcaps and reach maximum retention.



3.6.2 Laboratory direct method

LABORATORY



1. Before pressing, casting or injecting the denture acrylic the magnets are fixed on top of the rootcap by means of a little drop of glue (e.g. cyano acrylate). Use **Dyna Magnet Bond** to obtain a strong chemical bonding between magnet and denture acrylic, thus preventing fracture of the denture and discoloration around the magnet. Dyna Magnet Bond consists of a liner and a special resin. These materials have to be applied to the magnet in a thin layer before pressing the denture. (Read Manual before use!).



2. Polymerise the denture. The tin foil is removed with a probe and any sharp acrylic edges are finished.



3. Sent the denture to the dentist

4. Insert the overdenture and verify the adaptation of the magnets to the rootcaps with afit-checker material. If the fit-checker indicates excessive pressure between the rootcap and the magnet(s), the magnet(s) **must be reinserted**. If there is no visible sign of contact between rootcap(s) and magnet(s), this will usually not cause any problems. Within a few days after insertion the magnets will be in contact with the rootcaps and reach maximum retention.



3.6.3 Chair-side method

DENTIST

1. After a "wear in" period of the new overdenture the magnets can be seated into the overdenture intra-orally. At the sites corresponding to the flat surfaces of the rootcaps, cavities are drilled into the denture base, with a size slightly larger than the magnets (unless provided earlier by the lab).
2. From the inside of these cavities small channels are drilled through the denture to lingual/palatinal.
3. Block out possible undercuts with wax or any other suitable material.



The magnets are placed onto the rootcaps, Direct Keeper or as in this case on the magnetic abutments inside the mouth.

The Dyna logo should now be visible at the upper side of the magnet!



4. Insert the denture over the magnets while checking if the cavities are sufficiently wide and the magnets are not displaced.



5. Separate the denture base with Vaseline, except for the cavities (when Dyna Magnet Bond is used, the rootcaps should also be separated).



6. Apply a fluid mix of cold-curing resin in the cavities with a plastic spatula.



7. The Dyna magnetic overdenture is now ready for insertion. Check occlusion and articulation and verify if the magnets are properly in contact with the rootcaps by means of a fit checker material. If the fit checker indicates excessive pressure between the rootcap and the magnet(s), the magnet(s) must be reinserted. If there is no visible sign of contact between rootcap(s) and magnets(s) this will usually not cause any problems, as the denture will "wear in" and within a few days after insertion the magnets will be in contact with the rootcaps and reach maximum retention.



Note:
Do not damage the magnet coating! Most steel drills and fraises are attracted by magnets. Use only drills that are not susceptible to magnetism.



3.7 Rebase

A magnetic overdenture (like any overdenture with attachments) should be rebased regularly. The procedure is equal to the procedure of a conventional denture. This means that the magnets do not need to be removed before making the impression (if necessary they will be removed in the laboratory). However an increasing of the height of the bite has to be prevented. In that case the magnets have to be removed before the impression is taken.

In some cases (very strong resorption of the alveolar bone) one might decide to remove the magnets before rebasing. The magnets can be removed by carefully removing as much acrylic as possible around the magnet with a small fraise, **without damaging the magnet!** If the magnet capsule is damaged, it can not be used anymore. Remaining acrylic around the magnet can be removed with a hot instrument; however do not overheat the magnet itself as overheating will destroy the magnetism (above 120°C).

If Dyna Magnet Bond has been used previously to insert the magnets, the acrylic around the magnets has to be removed very carefully, leaving a thin layer of acrylic on the magnet. The magnet with the remaining acrylic can be reinserted during the rebase procedure.

Then the impression is made and the magnets can be reinserted by one of the aforementioned techniques.



3.8 Warnings and remarks

1. The Dyna magnetic attachment is an easy to use system. However we advise you to attend one of the Dyna courses or seminars before using the system in order to prevent failures and disappointments.
2. The use of the Dyna System is limited to qualified dentists and dental technicians and has to be performed according to the procedures described in this manual.
3. In case of doubt and or questions in relation to the procedures to be followed, we urgently advise you to contact Dyna Dental Engineering BV or the appointed Dyna dealer in your country.
4. Extensive clinical and animal research has shown that a magnetic field as generated by the Dyna magnets has no harmful affects on the human body.
5. Dyna Dental Engineering BV cannot be held responsible for any damage to the human body caused by misuse of the Dyna System.
6. The use of Dyna alloy or Dyna magnets in combination with similar products of other manufacturers may lead to corrosion or loss of magnetic properties. Dyna Dental Engineering BV cannot be held responsible (product liability) for any damage caused by such use. Moreover, damage caused by such use is not covered by the Dyna product guarantee. In case of doubt concerning unknown magnets or alloys please contact Dyna Dental Engineering or the appointed Dyna dealer in your country.
7. Magnetic materials used in dentistry are not corrosion resistant. For this reason all Dyna magnets are provided with a very thin corrosion resistant capsule. Whenever this capsule is damaged with a drill or fraise or by wrong installation or overpressure, corrosion of the magnet and subsequently loss of magnetic retention will occur.
8. A magnet of which the coating or the casing has been damaged may not be used for clinical applications anymore.
9. Dyna magnets may not be heated over **120°C**, because overheating will destroy the magnetic field. (Hot cure procedures cause no problem for the magnets)

4.

General Information



4.1 Dyna Dental Engineering BV

Dyna Dental Engineering BV, located in Bergen op Zoom, The Netherlands is a company active in the field of dental implants and magnetic attachments. It is established in 1984 and started with production of dental mini-magnets for improving denture retention and stabilisation. The idea of using permanent rare-earth mini-magnets in dentistry led to development of Dyna System and Dyna Direct System – two approaches of using remaining dentition and Dyna magnets to produce an overdenture. The first was based on producing casted root cores whereas the other adopted pre-fabricated keepers to be matched with magnets.

The success of this solution and experiences gained during several years of market presence gave us confidence and guided through development of the implant system that would be suitable for employing idea of magnet retained overdentures in atrophic jaws.

Introducing the new implant in 1986 was a major step forward. Initially available only in diameter 3mm (8mm, 10mm length) and only for magnetic attachment Dyna has soon increased its product array by placing on the market in 1991 the revolutionary memory abutment - an adjustable abutment for those situations where implants could not be placed parallel. The unique characteristics of the memory abutment have been made available to all the implantologists by designing various abutments for other implant systems. Also at that time, the implant line gained several diameters en lengths. Easy implantation technique in combination with pioneer prosthetic works made us successful and pushed to development of new products.

By market surveillance and experience of our customers our research and development division continuously improves and extends the existing product line. Also regularly new products are introduced like the new Dyna WR (wear resistant) magnets and the Instant Adjusting Bar system. All unique products stand for simplicity with a high quality to serve your patients. Dyna Dental Engineering unceasingly strives to be at the spearhead of new developments and techniques in dentistry.

The company policy is to supply products that are easy to use on the one hand and have variety of applications on the other.



4.2 Materials

Dyna system – product material information

Name	Elements	Composition	Intended use
Dyna Magnets All Dyna Magnets are encapsulated in surgical steel 316 L	300 gr. 1.5mm	Ne/Bo/Fe	Rootcaps
	500 gr. 2.5mm	Ne/Bo/Fe	Implant borne prostheses
	WR S3 300g 1,8mm	Ne/Bo/Fe	Epitheses
	WR S5 500g 2,8mm	Ne/Bo/Fe	
Dyna System	EFM alloy	Pd60%, Co38%, Ga1.2%, Pt1%	Rootcaps
	Dyna Magnets		<i>see magnets</i>
Dyna Direct System	Dyna pre-fabricated keepers	EFM alloy	Rootcaps
	Dyna Magnets		<i>see magnets</i>
	Root preparation drills	Stainless steel	
Dyna Medical Abutments	Ø3.0mm height 3,4,5,6mm	EFM alloy	Implant prostheses
	Ø3.6mm height 3,4,5,6mm	EFM alloy	Implant prostheses
	Ø4.0mm height 3,4,5,6mm	EFM alloy	Implant prostheses
	Octa height 3,4,5mm	EFM alloy	Implant prostheses
	Extension level octa height 0mm	EFM alloy	Implant prostheses
	TM height 1mm	EFM alloy	Implant prostheses
	Dyna hex screwdriver TW	Stainless steel	Screwing abutments
Dyna Magnet Bond		4-META/ PMMA	Fixing magnets

Dyna Medical Abutments for other implant marks

Compatible mark	Medical abutment* (EFM alloy)
ITI Straumann ²	Medical ITI Straumann

*abutments for other brands are available only after previous consultation with Dyna Dental Engineering.

² ITI Straumann is a registered trade name of the company Straumann AG Switzerland.

The magnetic power of the magnets is nowadays high enough to retain overdentures of a different kind. Magnets themselves extend attractive alternative to conventional retention units for prostheses especially in geriatric dentistry. Other walks of dentistry like implantology and maxillofacial prosthetics make extensive use of them either. The use of magnets is not, however, restricted only to dentistry. The major use of magnets in medicine today is as instrument and needle holders in surgery but other applications are equally interesting. Magnets have been used for years to change the pulsing characteristics of implanted heart pacemakers. Metallic foreign bodies are removed from tracheo-bronchial tree with help of special magnets and the list of magnet applications in specialized use is quite impressive. Only some physicians who stand at the spearhead of new treatment methods perform these applications. Some of those applications are eyelid magnets, colostomy closure device and hearing prostheses.



4.3 Overdentures

An overdenture may be defined as a removable prosthodontic appliance, either complete or partial, that restores missing dentition and is fabricated to fit over retained teeth and/or roots that are properly prepared. (Magnetically retained overlay dentures NJ Gendusa Quintessence Int. Vol. 19 nov.4/1988) this definition can be modified to fit within the framework of dental implants. So the overdenture is also a special denture that fits over dental Osseo integrated fixtures.

Till 60' the use of overdentures was not popular as some problems like caries or periodontitis around the supporting elements were associated with this type of dentures. Further researches proved that the bone resorption may be markedly slowed down when using overdentures and it happens not only around preserved elements but in edentulous parts of the ridge as well. (Plooy) Additionally patients' proprioception with overdentures is much better and they get used to them much faster. For patients with severely reduced, or hopeless dentition planned for total extraction overdentures may serve as an temporary measure that lets the patients accustom to the new situation being edentulous. The advantages of such treatment are especially seen with patients who have never before worn a removable denture.

In cases where natural elements have a poor prognosis to be restored by conventional fixed or removable partial dentures, overdentures treatment should be considered.

Overdentures may be divided into several groups depending on connecting structure between the supporting element and the denture itself. Implant-retained overdentures are a special type of prostheses that has grown in popularity over the last years. This therapy is preferred for completely edentulous patients because of comfort and functional capacity. Implant-retained overdenture implies using osseo-integrated implant, overdenture and attachment system between those two.

Three most popular are:

- Ball retained overdenture
- Bar retained overdenture
- Magnet retained overdenture



Overdentures retained on natural elements are nowadays also very popular. Different types of those prostheses are used with success in every-day practice. We refer to specialist literature for more details concerning teeth-retained overdentures.

Although it is said that the oral hygiene procedures are simplified for overdentures, different types of attachments may be found unsuitable for some patients. Load transfer to supporting tissues is also an important issue for successful implant therapy and therefore careful patient examination before any treatment is a must.

Selection of connecting structures between the natural teeth and a denture is dependant on the displacement of the soft tissue of the edentulous area and natural tooth under loading (Tylor H Caputo AA Effects of overdentures upon remaining oral structures. J Prosth. Dent. 1977; 27; 374-381.) The maximum displacement of a natural tooth under loading is about 100um and that of soft tissue 500um whereas that of the implant 20 – 30 um. (In vitro study of mandibular implant retained overdentures: the influence of stud attachments on load transfer to the Implant and soft tissue. T Ichikawa et al The Int J Prosth Vol 9 no4, 1996). Therefore it is clear why implant overdentures cannot be evaluated and designed according to concepts of overdenture on natural teeth. In general overdentures with implants are not implant supported but implant retained. Patients who experience problem with denture instability will benefit significantly from any increase in retention. It seems that 2 to 4 implants in the mandible are enough for improving retention and stability of the denture. (De Boer J. Edentulous implants: Overdenture versus fixed. J Prosth Dent. 1993; 69; 386-390).

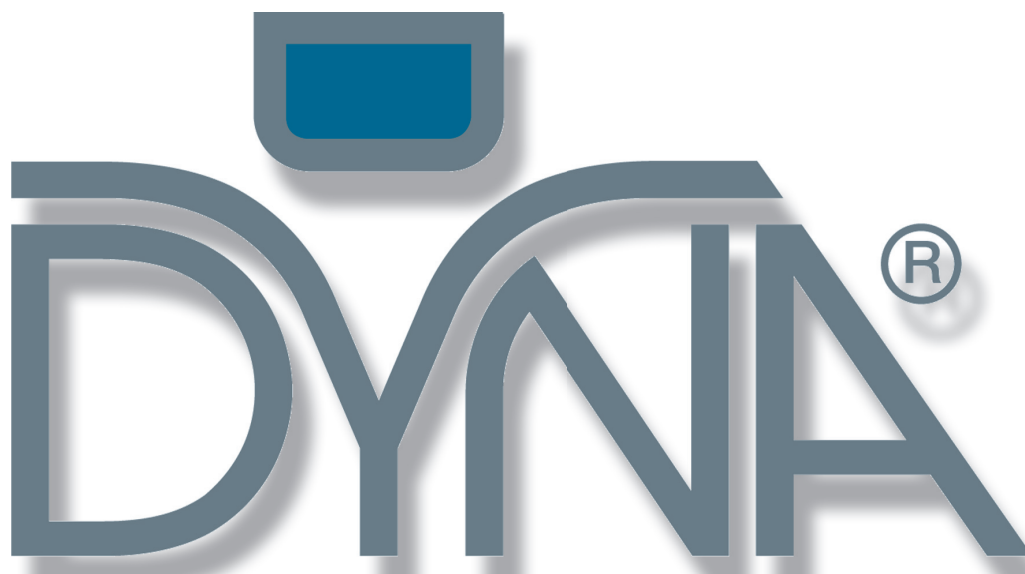
Choosing particular type of overdenture depends not only on the above-mentioned considerations, but on the clinical situation as well. Prosthetic aspects should always be considered before the surgery. Nobody plans to fail, but many fail to plan!

Magnetically retained overdentures are virtually maintenance-free and inexpensive to fabricate, and the technique lies within the scope of every dentist. They have numerous advantages and little or no disadvantages. The book of Brewer and Morrow (1976) describes that overdentures have been used since 1847. In the same book the basics are described for indicating an overdenture.

The major purpose of an overdenture is preservation the alveolar bone by retaining teeth or/and roots underneath. Studies have shown that the load distribution plays here an important role. Magnetically retained overdentures transfer no detrimental lateral forces to those supporting element helping in maintaining favourable clinical situation.

The use of magnetic materials as an aid to denture retention is not new. The use of magnets to provide retention by direct attraction followed, with the placement of a magnet beneath the mucosa, embedded in the bone, and the opposite pole magnet in the fitting surface of the denture base (Behrman 1960). This procedure failed as the embedded magnets came to surface contact through the mucosa (Toto, 1962). The surgical procedure was also not easy.

Generally several attempts were made to apply magnetic force to help making prosthesis, but only when the rare earth cobalt-samarium magnets were developed has they received adequate attention. Small size in connection with comparatively strong force made this idea very attractive and useful in prosthetics.



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