

Smile without Limitations: Exploring the Benefits of Smileloc Abutment System over Traditional Whole Prosthesis in Dental Implant Restorations

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Abstract:

Prosthetics are attached to dental implants using cement- and screw-based retention mechanisms, although each technique has the potential to cause clinical issues including implantitis or crown fracture. In order to maintain the retrievability of screw-retained restorations while achieving the aesthetics and retention force of cement-based fixation, a unique abutment and prosthesis retention system has been developed.

It combines the benefits of screws (retrievability) and cement (occlusion, aesthetics), while removing the drawbacks of composite resins and residual cement. This novel solution comprises of an abutment that is precisely machined to fit into the majority of commercial dental implant fittings. The abutment is compatible with a shape memory sleeve.

Keywords: Abutment, shape-memory implant, screw-retained, cement-retained, nitinol.

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INTRODUCTION

Dental implants have successfully expanded the range of restorative treatments available for treating both completely and partially edentate individuals, restoring both their masticatory function and aesthetics. Over the course of around 50 years, restorative procedures and materials evolved alongside implant dentistry to meet the high demands of numerous difficult clinical situations¹.

There are currently more than 90 manufacturers of implants in the globe, and each one has a unique set of parts or variants that make it

special. This situation presents a challenge for the clinician in terms of choosing an adequate abutment to complete the case successfully, particularly if the implant placement was difficult or compromised.

This paper, thus, aims to aid the clinician in various types of implant abutment and clinical application of a shape memory implant abutment system.

DENTAL ABUTMENT

The link between the implant and the restoration is called an implant abutment, and the effectiveness of

implant prosthesis depends on the choice of this abutment. The market offers a wide variety of implant abutments. To pick the appropriate abutment, a clinician should be well-versed on both these abutments and the different variables that influence abutment selection. According to GPT 9 implant abutment is defined as, “the supplemental component of a dental implant that is used to support and/ or retain any fixed or removable dental prosthesis2.”

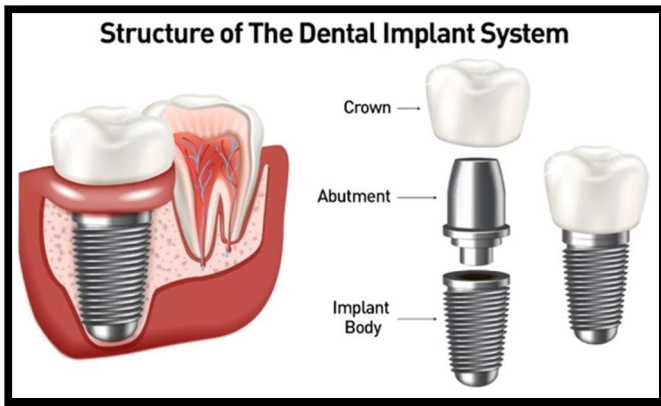


Fig. 1: Structure of the dental implant

Generally dental abutments are categorized into following types3:

Sr. No	Category	Options
1.	Method of connection to Restoration	One-piece screw-retained abutment-crown complex
		Two-piece design with screw-retained crown over the abutment
		Two-piece design with cemented crown over the abutment
2.	Material	Titanium
		Cast metal (noble, high noble, or base metal alloy)
		Cast metal with porcelain fused at the base Alumina
		Complete zirconia
		Zirconia with a titanium base (zirconia-titanium hybrid abutment)
3.	Method of fabrication	Prefabricated (unmodified or modified)
		Customized cast abutment
		Customized copy-milled abutment
		Customized CAD-CAM abutment
4.	Colour	Gold
		Silver (metallic finish)
		Pure white
		Customized white
		Customized pink/gingival shade at the cervical region

SCREW RETAINED VS. CEMENT RETAINED IMPLANT RESTORATION:

Dental prosthesis supported by implants is held in position using screw- and cement-based techniques. Both methods have benefits and drawbacks.

In principle, retrievability from screw-retained implant restorations allows for simple examination of underlying parts. Due to the time-consuming nature of screw removal, reinsertion, and occlusal hole restoration, screw retrieval is often only done to fix broken or damaged components4. When tightening screws on multiunit fixed prostheses, residual stress might be significantly increased if the framework and implants are not passively fitted. Additionally, the composite resin materials used to cover the screw access holes are brittle and do not provide durable occlusion control5.

The failure of the prosthetic materials, loosening of the prosthetic screw6, and fracture are drawbacks of screw-retained implants7.

In addition to enabling improved anterior aesthetics and allowing a restoration when implant angulation would position the access hole on the labial surface, cement also allows for better control over occlusion. Because cement fills up the misfit areas between the abutment and the restoration, a passive fit for multiunit prostheses is no longer as important8.

The two main drawbacks of cemented restorations are sub-gingival cement residue and irretrievability9. Due to the absence of irretrievability, it is impossible to repair high-temperature porcelain or tighten implant abutment screws without first drilling a hole through the restoration10. The crown may not fully seat during cementation due to hydrostatic pressure, which will cause hyperocclusion9.

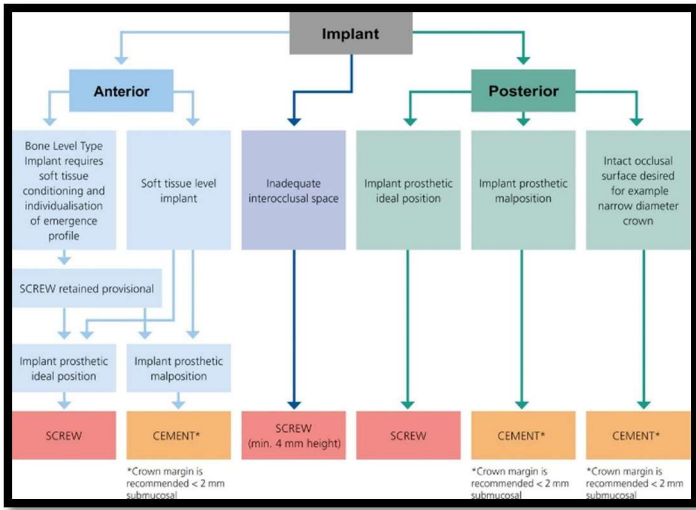


Fig.2. Decision tree illustrating the pathway of decisions in respect of the indication of screw vs. cementation in fixed prosthodontics supporting implants¹¹

SHAPE MEMORY ABUTMENT:

A new implant retention method has been developed to overcome these acknowledged difficulties. It combines the benefits of screws (retrievability) and cement (occlusion, aesthetics), while removing the drawbacks of composite resins and residual cement. This novel solution comprises of an abutment that is precisely machined to fit into the majority of commercial dental implant fittings. The abutment is compatible with a shape memory sleeve (Smileloc; Rodo Medical) that has two sets of adjustable flaps that can switch between locking and unlocking the restoration in the "engaged" and "disengaged" positions.

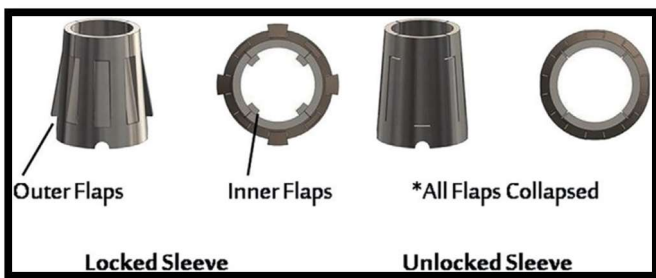


Fig.3 Occlusal and profile view of Smileloc Sleeve

The sleeve is made of nitinol, a nickel-titanium alloy with superelastic properties that is frequently used in interventional cardiology devices and has been shown to be human biocompatible. In dentistry, nitinol orthodontic arch wires and endodontic instruments make use of these superelastic properties¹². When used to secure a crown, nitinol is more powerful than attaching screws or cement in addition to being superplastic and capable of changing shape thanks to shape memory¹³. In the same way that a cemented method is operable, shape memory is also operative if abutment alignment and draw are present in the restoration¹⁴.

This abutment design makes use of the shape memory capabilities of nitinol, wherein the sleeve mechanically deforms to one shape at ambient temperature and then returns to its original, unreformed shape upon heating to a temperature above its transformation temperature¹².

Items	Advantages	Disadvantages
Cement	Ease of fabrication and clinical steps similar to other indirect restorations	Risk of peri-implantitis
	Control of occlusal contact	
	Restoration without an occlusal hole	
Screw	Retrievable	Occlusal contact interference with screw access channel
		Higher risk of porcelain chipping/fracture
Friction	Control of occlusal contact	Need to tap the restoration on and off
	Restoration without an occlusal hole	
Shape-memory sleeve	Retrievable	Need of an additional activator device to unlock the restoration ¹⁵
	Ease of fabrication and clinical steps similar to other indirect restorations	
	Control of occlusal contact	
	Restoration without an occlusal hole	

The ability to retrieve shapes from memory is one of its most important aspects. The Smileloc changes form and releases the crown for simple retrieval after 5 seconds of use of an electromagnetic wand. Once retrieved, a restoration may be fixed, cleaned, and a new Smileloc triggered to reconnect the crown in a matter of seconds¹⁴.

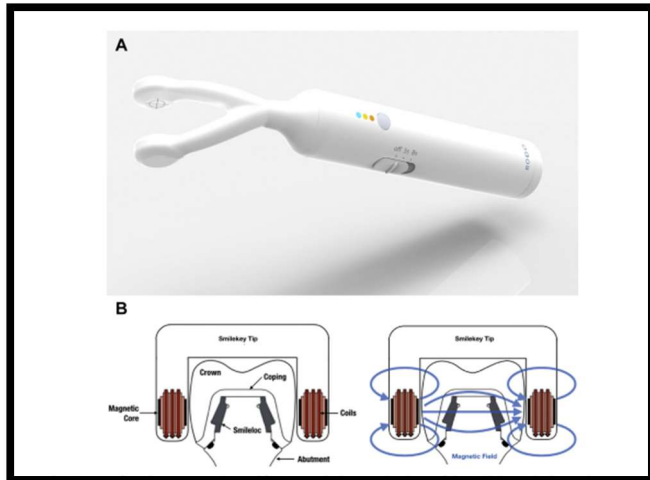


Fig. 4 Use of an electromagnetic wand for 5 seconds changes the shape of the Smileloc and releases the crown for easy retrievability as shown in (A, B).

SUMMARY

This revolutionary abutment technology combines cement-retained prostheses' aesthetics, convenience of use, occlusion control, and retrievability with screw-retained abutments' ability to be easily removed. Occlusal composite resins are not necessary and there is no chance of subgingival residual cement with the shape memory abutment. These definite benefits warrant further thorough research, a lengthier clinical assessment, and a more thorough examination of physical, electrochemical, and biological performance.

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