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# Implant-supported prosthesis

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## Implant-supported prosthesis and its retention

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Copyright:

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the copyright holder of this book. **Preface** 

The progression of dental implant treatment over the past 50 years is overwhelming.

Furthermore, retention of implant-supported prosthesis plays a major role in the success of the

treatment. Therefore, this book draws upon a spectrum of knowledge ranging from fundamental

principles to cutting-edge advancements in basic science and clinical treatment within the field of

retention for implant-supported prosthesis. It synthesizes insights gleaned from my tenure at the

Dental Implant Center and Prosthodontics Department at Tuebingen University, Germany, as well

as my extensive experience in clinical dental implant treatments across various prosthetic

modalities in esteemed clinics and hospitals in Thailand.

This book aims to delve into retention aspects of implant-supported prosthesis. Therefore,

this book is comprised of overview of implant-supported prosthesis, implant-supported fixed

prosthesis and its retention, and implant-supported removable prosthesis and its retention, which

allow the prosthodontist and implantologist to have a thorough understanding of retention for

prosthodontic treatment and research. Additionally, the readers will build a strong foundation of

knowledge in retention of implant-supported prosthesis, so they lead to better overall treatment

outcomes for patients.

My hope is that this book is an up-to-date device for researchers and encourages clinicians

to properly select and use implant-supported prostheses for patients.

Mali Palanuwech

March 18, 2024

(ii)

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Without knowledge during my study in Germany, I cannot delve into retention aspects of

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I would like to express my sincere gratitude to my families in Thailand and in Germany

that have moral supported me in the writing of this book.

Mali Palanuwech

(Born in Munic, Germany/Live in Bangkok, Thailand)

(iii)

### **Table of contents**

Copyright	( <b>i</b> )
Preface	(ii)
Acknowledgments	
List of tables	
List of figures	(Viii)
Chapter 1 Implant-supported prosthesis	1
1.1 Introduction	1
1.2 History of dental implants	1
1.3 Fundamentals of implant-supported prosthesis	4
1.4 Classification of implant-supported prosthesis	6
1.5 Conclusion	10
1.6 Questions	11
1.7 References	12
Chapter 2 Implant-supported fixed prosthesis	15
2.1 Introduction	15
2.2 Classification of implant-supported fixed prosthesis	16
2.3 Implant-supported fixed prosthesis in partially and completely	
edentulous arch	16

	2.4 The decision making between cement-retained or screw-retained	
	fixed prostheses	19
	2.5 Conclusion	35
	2.6 Questions	37
	2.7 References	38
Chapter 3	Retention of implant-supported fixed prosthesis	49
	3.1 Introduction	49
	3.2 Retention of implant-supported fixed prosthesis in partially and	
	completely edentulous arch	51
	3.2.1 Implant-supported fixed prosthesis: cement-retained fixed prosthesis	51
	<ul> <li>Surface</li> </ul>	52
	<ul> <li>Dimension of the implant abutment</li> </ul>	59
	<ul> <li>Cement</li> </ul>	62
	3.2.2 Implant-supported fixed prosthesis: screw-retained fixed prosthesis	67
	3.3 Conclusion	70
	3.4 Questions	72
	3.5 References	73
Chapter 4	Implant-supported removable prosthesis	81
	4.1 Introduction	81
	4.2 Development of implant-supported removable prosthesis	81
	4.3 Classification of implant-supported removable prosthesis	83

	4.4 Implant-supported removable prosthesis in partially and completely			
	edentulous arch	83		
	4.5 Conclusion	88		
	4.6 Questions	88		
	4.7 References	89		
Chapter 5	Retention of implant-supported removable prosthesis	93		
	5.1 Introduction	93		
	5.2 Attachments of implant-supported removable prosthesis	94		
	5.3 Retention of implant-supported removable prosthesis in partially and			
	completely edentulous arch	97		
	5.4 Recommendation for implant-supported removable prosthesis in			
	completely edentulous arch	106		
	5.5 Conclusion	114		
	5.6 Questions	117		
	5.7 References	118		
Index		123		

#### **Chapter 1 Implant-supported prosthesis**

#### 1.1 Introduction

Although conventional denture has been used worldwide more than a century, the progression of dental implant treatment over the past 50 years is overwhelming. Therefore, it is undeniable to understand implant-supported prosthesis.

To understand the retention in implant-supported prosthesis, the history and foundation of implant-supported prosthesis as well as its classification needs to be understood first.

History of dental implants can be divided into two phases, before and after the osseointegration concept. Professor Per-Ingvar Brånemark, a Swedish orthopedic surgeon, studied blood flow in rabbit bone by using titanium in the 1950s. During his study, he found that the titanium could be embedded in the bone and was hard to remove. Subsequently, he named this phenomenon as "osseointegration" in 1969. Additionally, it is well documented that the surgical approach needed to achieve osseointegration.

#### 1.2 History of dental implants

#### 1.2.1 The phase before the osseointegration concept.

In 1943, implant-supported prostheses were first introduced, but with a poor reputation because of questionable clinical outcomes and the absence of scientific documentation. The prosthesis involved the use of subperiosteal implants (blade implant-supported fixed prostheses). However, after the publication by Goldberg NI and Gershkoff A (1949), worldwide use of subperiosteal implants began. (1,2)

Significant scientific developments and the early development of modern dental implant research that supported the development of osseointegrated implants occurred in several locations across Europe. The three most important European centers of the early development of modern implant dentistry were in Gothenburg, Bern, and Tuebingen. (3,4)

However, the change to the successful treatments with well-documented scientific support was initiated by the three scientific pioneers of modern implant dentistry, Professor P. I. Brånemark, University of Gothenburg, Sweden; Professor André Schroeder, University of Bern, Switzerland; and Professor Willy Schulte, University of Tuebingen, Germany. Professor P. I. Brånemark made the initial publication in his finding, and the other two centers conducted their own research into different aspects of this field. (3,4)

In 1952, the concept of tissue-integrated prostheses was investigated at the University of Lund, followed by the laboratory of experimental biology at the University of Goteberg. (5)

In 1965, tissue-integrated prosthesis was evaluated for bone anchorage in the first edentulous human based on the principle of osseointegration.<sup>(5)</sup>

#### 1.2.2 The phase after the osseointegration concept.

In 1969, the concept of osseointegration was introduced by professor Per-Ingvar Brånemark from the Institute of Applied Biotechnology, University of Goteborg in Sweden, which proved the long-term success of titanium implants. Osseointegration was defined as a structural and functional attachment between the surface of the implant and the surrounding living bone.<sup>(5)</sup>

In 1975, the Frialit I immediate implant also known as Tuebingen implant was developed by Professor Willy Schulte at the Department of Prosthodontics, University of Tuebingen in Germany. The Willy Schulte concept is the first immediate implants concept and is based on the concept of filling the alveolar socket at the same time as tooth extraction as a flapless implant insertion. To immediately fill the post-extraction alveolar socket, a form of stepped-cylinder design

#### Chapter 2 Implant-supported fixed prosthesis

#### 2.1 Introduction

To restore esthetics, mastication, speech, and satisfaction of the patients, oral rehabilitation of the missing teeth requires conventional complete denture, conventional RPD, conventional fixed prosthesis, or contemporary implant-supported prosthesis. Although, the connection between the expectation and satisfaction of the patients are not well understood, patient satisfaction plays an important role in evaluating the quality and effectiveness of the patients health care. (1,2)

Titanium dental implants have been developed and are widely used to replace missing teeth for over the past 50 years with high success in terms of esthetic outcomes as well as long-term treatment option. Long-term survival rates (not less than 10 years) of not less than 90% have been reported in prospective studies and meta-analyses. Patient satisfaction was observed in approximately 90% of the patients with the treatment outcome 6–16 years after implant-supported prosthesis. Approximately 15 million dental implants per year have been recently performed worldwide.

From the introduction of dental implant technology, contemporary implant-supported prosthesis have been further developed and the use has been spread worldwide. Oral rehabilitation of missing teeth using dental implants has become a well-established approach and has gained acceptance among people worldwide. Furthermore, implant-supported fixed prostheses provide widely accepted and predictable treatment method and have currently become one of the most common forms of oral rehabilitation. (11-13)

Implant-supported fixed prostheses can be screw-or cement retained. Therefore, a retentive system should be selected that best suits the patient's satisfaction as well as promotes comfort, restores function and esthetics of the patient, and gain durability in the results along with the achievement of successful clinical and radiographic outcomes. Furthermore, screw-retained fixed

retention, risk of peri-implant tissue damage, retrievability, and esthetics (Figure 2-1). The advantages and disadvantages of each type (cement-retained or screw-retained fixed prostheses) has been well documented, with neither method shown to be superior than the other. However, the decision making regarding the type of prosthesis retention for implant-supported fixed prosthesis is still important and can result in biological and/or technical complications in both short and long term. <sup>28,39</sup> In addition, the important topics of implant-supported fixed prosthesis, which are compared between cement-retained or screw-retained fixed prostheses in this chapter, are as follows (Figure 2-2):

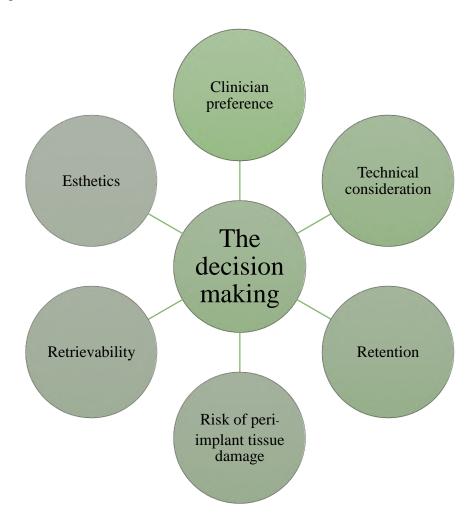


Figure 2-1 Diagram of the decision making between cement-retained or screw-retained fixed prostheses for dental implant

load distribution during mastication compared with screw-retained prosthesis. (15,71,73-76)

Furthermore, retrievable-screw type, cement-retained fixed prosthesis demonstrated relatively similar esthetics as that of cement-retained implant-supported fixed prosthesis. (75)

Because of recent developments, the screw-access hole for the retrievable-screw type, cement-retained, all-ceramic, implant-supported fixed prosthesis, can be fabricated in ceramic, especially zirconia. Therefore, white esthetic outcome of this new type of prosthesis may be comparable to that of cement-retained implant-supported fixed prosthesis. <sup>(77)</sup> In addition, the screw-access hole does not negatively affect the fracture load of monolithic zirconia, monolithic lithium disilicate, or veneered zirconia ceramic implant crowns. <sup>(78)</sup> Therefore, this method is recommended.

#### 2.5 Conclusion

The selection between screw- or cement-retained implant-supported fixed prosthesis should be based on the following factors mentioned in table 2-4. However, neither alternative is clearly better than the other for all clinical situations.

Table 2-4 Factors influencing the selection of screw- or cement-retained implant-supported fixed prosthesis and their properties

E4-	Screw-retained implant-	Cement-retained implant-
Factor	supported fixed prosthesis	supported fixed prosthesis
Retention value	Predictable	Wide range
Loss of retention	Screw loosening or fracture	Debonding of the luting agent
Risk of peri-implant	Yes	Yes
tissue damage	1 68	Tes

#### Chapter 3 Retention of implant-supported fixed prosthesis

#### 3.1 Introduction

The method of connecting implant-supported fixed prosthesis to the implant abutment plays a major role in its success. Implant-supported fixed prosthesis and implant abutment may be connected through one of the following two techniques:

- (a) Screw-retained fixed prosthesis: the prosthesis is secured to the implant abutment with screws and the implant abutment is attached to the endosseous implant with another screw. In addition, the prosthesis can also be secured to the endosseous implant with a screw and the implant abutment and prosthesis may be combined into one piece. Furthermore, to improve the retention of screw-retained fixed prosthesis is achievable by mechanical method.
- (b) Cement-retained fixed prosthesis fixed prosthesis, the prosthesis is secured to the implant abutment using a luting cement, whereas the implant abutment is attached to the endosseous implant with another screw. However, to improve the retention of cement-retained fixed prosthesis is achievable by mechanical, mechanical and chemical, or chemical methods (Figure 3-1).

The choice of using screw-retained or cement-retained fixed prosthesis is still controversial, however, preferring one method of retention rather than the other was found in certain clinical situations.<sup>(1-7)</sup>

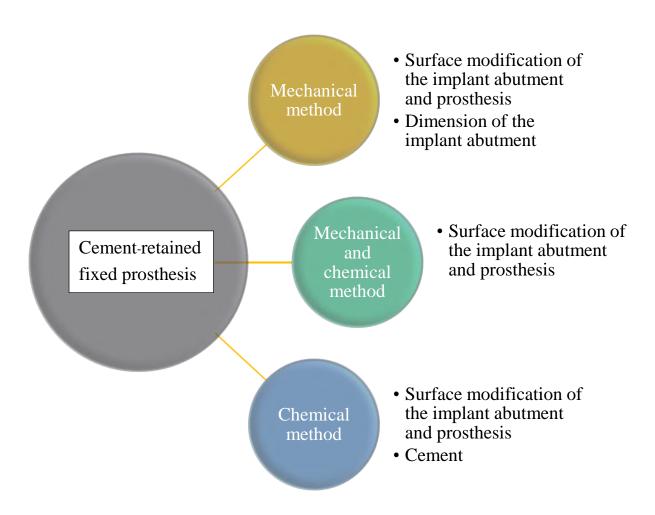


Figure 3-1 Diagram of methods to improve the retention of cement-retained fixed prosthesis