Prosthodontics at a Glance

Irfan Ahmad

WILEY-BLACKWELL
Titles in the dentistry *At a Glance* series

**Orthodontics at a Glance**  
Daljit S. Gill  
978-1-4051-2788-2

**Periodontology at a Glance**  
Valerie Clercough, Aradhna Tugnait, Robert J. Genco  
978-1-4051-2383-9

**Dental Materials at a Glance**  
J. A. von Fraunhofer  
978-0-8138-1614-2

**Oral Microbiology at a Glance**  
Richard J. Lamont, Howard F. Jenkinson  
978-0-8138-2892-3

**Implant Dentistry at a Glance**  
Jacques Malet, Francis Mora, Philippe Bouchard  
978-1-4443-3744-0

**Prosthodontics at a Glance**  
Irfan Ahmad  
978-1-4051-7691-0

**Paediatric Dentistry at a Glance**  
Monty Duggal, Angus Cameron, Jack Toumba  
978-1-4443-3676-4
Prosthodontics at a Glance

Irfan Ahmad
BDS
The Ridgeway Dental Surgery
Middlesex
UK
For my caring wife, Samar, my shining children Zayan and Zaina, and my loving father Mansur Ahmad
What good’s a disease that won’t hurt you?

Lou Reed
Contents

Preface 8
Acknowledgements 9

Section 1: Overview of prosthodontics
1. Overview: rehabilitation of natural teeth 10
2. Overview: rehabilitation by artificial teeth 12

Section 2: Diagnostics
3. Diagnostics: history taking 14
4. Diagnostics: initial consultation 16
5. Diagnostic adjuncts 1 18
6. Diagnostic adjuncts 2 20
7. Radiography 22
8. Computed tomography 24
9. Dental photography 26
10. Occlusal analysis 28
11. Plaster casts and additive diagnostics 30

Section 3: Treatment planning
12. Treatment planning: evidence-based treatment 32
13. Treatment planning: decision-making 34

Section 4: Occlusion
14. Occlusion: terminology and definitions 36
15. Occlusion: clinical procedures 38
16. Occlusion: laboratory procedures 40
17. Occlusion: adjustment and splints 42

Section 5: Periodontal aspects
18. The dentogingival apparatus 44
19. Prosthodontic considerations 46

Section 6: Endodontic aspects
20. The dental pulp 48
21. Intraradicular support 50
22. Coronal support: core build-up 52

Section 7: Anterior dental aesthetics
23. Anterior dental aesthetics: basic principles 54
25. Anterior dental aesthetics: guidelines 58
26. Anterior dental aesthetics: bleaching 60

Section 8: Intracoronal restorations
27. Choice of intracoronal restorations 62
28. Choice of materials for direct restorations 64

Section 9: Extracoronal restorations
29. Choice of extracoronal restorations 66

Section 10: Materials for indirect restorations
30. Cast metal alloys, titanium and resin-based composites 68
31. Ceramic materials 70

Section 11: Tooth preparation
32. Micro-invasive and minimally invasive techniques 72
33. General guidelines for rotary tooth preparation 74
34. Preparation for resin-bonded fixed partial dentures 76
35. Preparation for inlays and onlays 78
36. Preparation for porcelain laminate veneers 80
37. Preparation for full coverage crowns and fixed partial dentures 82

Section 12: Temporary restorations
38. Provisionals 84

Section 13: Impressions
39. Impression materials 86
40. Impression techniques and armamentarium 88
41. Impressions: soft tissue management 90

Section 14: Dental laboratory
42. Computer-aided design and manufacture technology 92

Section 15: Cementation
43. Luting agents 94
44. Luting agents for definitive restorations 96
45. Dentine bonding agents 98
46. Luting techniques 100

Section 16: Removable prostheses
47. Removable prostheses 102

Section 17: Dental implants
48. Osseointegration 104
49. Implants: general considerations 106
50. Implants: treatment planning 108
51. Augmentation and site preparation 110
52. Implants: surgical techniques 112
53. Types and configuration of implants 114
54. Implant abutments 116
55. Restorative options 118

Index 121
Preface

In a Utopian context, a tooth should survive throughout life, unscathed by disease or trauma. However, in the real world, a tooth endures vicissitudes, often necessitating clinical intervention for ensuring its viability. Assuming a pessimistic stance, from nascence to its final demise, a tooth may undergo the following pathological sequelae: incipient fissure or proximal caries, intracoronal decay, pronounced multi-surface caries, endodontic involvement, extracoronal restoration, intra- and periradicular compromises with or without periodontal involvement leading to extraction, and eventual replacement by either a denture (removable or fixed) or dental implants. On an optimistic note, it is not a fait accompli that these events are inevitable; clinical intervention at any stage can prevent progression to the next, more destructive, eventuality. All these aforementioned stages require some form of clinical intervention for salvaging or replacing lost teeth. This is the basic premise of prosthodontics.

Prosthodontics is defined as restoring and/or replacing missing teeth. At times, the line dividing restorative dentistry and prosthodontics can be vague. As a generality, restorative dentistry is concerned with restoring teeth directly, involving a single visit, while prosthodontics is restoring or replacing teeth indirectly, invariably involving multiple visits, usually with impression and employing a dental laboratory. Furthermore, prosthodontics is a multidisciplinary subject, involving specialties such as periodontics, endodontics, orthodontics, implantology and oral surgery.

Besides resolving pathology, another factor requiring consideration is vanity. In an ever-increasing appearance-conscious society, elective cosmetic dental treatment is burgeoning. Although, at times, this type of treatment may be questionable, the communication revolution has created immense patient awareness leading to an escalating demand for patient-driven treatment planning. Hence, cosmetic or aesthetic treatment is now a major part of prosthodontics.

The purpose of this book is to describe the main concepts of prosthodontics. Its aim is to act as a platform for further reading on a chosen aspect of prosthodontics. The ordered format of the ‘At a Glance’ series accelerates learning, ensures relevance to daily clinical practice, and avoids the tedium and frustration of a verbose text.

Irfan Ahmad
There are innumerable friends and colleagues who have, directly or indirectly, helped with the fruition of this project, and at the outset my apologies if I do not mention each person by name. Instead, I offer ‘a big thank you’ to all those who have supported and inspired me during the four years it has taken to write this book.

However, the protagonists that come to mind are my family, relatives and close friends; Karl-Wilhelm Theis for his rock-solid unflagging moral support, Horst-Wolfgang and Christian Haase for creating an aura for global belonging, aesthetic dentistry icon Claude Rufenacht et Madame for showing me a world of art that I never knew existed, Nairn Wilson for pointing me in the right direction regarding topics in this book, Stephen Hancocks for his charismatic persona, Alan Sidi for his continuing help, Federico Ferraris, Angelo Putignano, Francesco Mangani, Antonio Cerutti, Carlo Zappala, Lauro Dusetti, Dinos and Mary Kontouras, Dimitrios Kapagiommidis and Alex Grous for being wonderful company at conferences where we have lectured, Mauro Fradeani for his comprehensive teaching methods, direct composite artists Didier Dietschi, Roberto Spreafico and Newton Fahl, Serhiy and Vera Radlinsky for their entrepreneurial skills, Meshari Al-Otaibi for organising exceptional dental symposia, Petar Duchev, Yaroslav Zablotsky and Joso Skara for creating unique teaching environments for their fellow dental colleagues, Nitzan Bichacho and Bernard Toutai for their everlasting guidance, my friends at the European Academy of Esthetic Dentistry, Ireneusz Czyzewski, Ivona and Wydawnictwo for their compassion, Harald Kubiak-Essmann and his team for supplying images of the latest advances in CAD/CAM technology, Ilan Gilboa, Ami Smidt, Yuval Eilat, Rafi Romano, Nitzan Fuhrer and Avishai Sadan for their continuing encouragement, Giulio Rasperini for his vivacious gregariousness, Ann-Louise Holding for her warm friendship, forward-looking clinician Egle Kunciuviene, Douglas Terry for his unrivalled enthusiasm, Rich Groves for his comradeship, critical thinking Graeme Beresford, Stephen Chu for his ongoing advancements in cutting-edge clinical research, living dental legend Denis Tarnow for being an exceptional role model, and Hina Robinson for ‘being there’.

Image acknowledgements:

- Ami Smidt (Figs. 11.6, 32.7–32.9, 39.18, 39.20 and 39.21)
- Ilan Gilboa (Figs. 26.4 to 26.6)
- Giulio Rasperini (Figs. 52.10 to 52.12)
- Alan Sidi (Figs. 19.3, 19.4, 19.11, 19.12, and 51.11)
- Patrick Holmes (Figs. 19.9a to 19.10, 52.1 to 52.6, 55.11 to 55.13, 55.18 to 55.20 and 55.22)
- Dorina van der Merwe (Figs. 10.2, 10.3, 39.1 to 39.3, 47.3 and 47.4)

I would like to extend a special and warm thanks to Manuela Brusoni for her friendship, kindness, and belief in my work. Ciao Manuela!

Finally, my gratitude goes to Sophia Joyce and her team at Wiley-Blackwell for their patience in enduring the lapsed deadlines for this book. Thanks for waiting!

Irfan Ahmad
Overview: rehabilitation of natural teeth

Black’s cavity classification

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class II</th>
<th>Class III</th>
<th>Class IV</th>
<th>Class V</th>
<th>Class VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>B/L</td>
<td>F</td>
<td>F</td>
<td>F/L</td>
<td>B/L</td>
</tr>
</tbody>
</table>

Key: B (buccal), L (lingual), F (facial)

Inlay
Preoperative
Preparation
Impression
Fabrication
Postoperative

PLV
Preoperative
Wax-up
Preparation
Impression
Fabrication
Postoperative

Crowns
Preoperative
Preparation
Temporary
Fabrication
Postoperative

Post-crown
Preoperative
Preparation
Impression
Fabrication
Postoperative

An indirect restoration requires taking an impression and employing a dental laboratory to fabricate the prosthesis. Conversely, a direct restoration is carried out chair-side, usually in a single visit, without using a dental laboratory. Dental prostheses can either be intra- or extracoronal.

### Indirect intracoronal prostheses

Intracoronal prostheses are defined as those surrounded by one or more natural tooth surface(s). This categorisation is broadly based on Black’s cavity classification:

- **Class I**: lesions of pits and fissures of all teeth, predominantly in premolars and molars;
- **Class II**: lesions on the proximal surfaces of posterior teeth, referred to as MO (mesial-occlusal), DO (disto-occlusal), and MOD (mesial-occlusal-distal);
- **Class III**: lesion in the anterior teeth, similar to a class II lesion, the class III lesion typically appears at the contact point;
- **Class IV**: the class IV lesion is a class III lesion including the incisal corner of an anterior tooth;
- **Class V**: typically occurs at the cervical margins on the buccal, rather than the lingual, aspect of any tooth;
- **Class VI**: not originally in Black’s classification, but has become accepted as an additional lesion that occurs on the tips and cusps of posterior teeth, or along the biting surfaces of the incisors.

Three developments have made Black’s cavity classification redundant. First, research has elucidated biological mechanisms such as deminerisation/remineralisation and the role of fluoride ion, and removal of infected and affected dentine is no longer a prerequisite. Second, new restorative materials such as resin (plastic)-based adhesives and filling materials, and therapeutic filling materials, which are both bacteriostatic and bactericidal, avoid removing vast amounts of tooth. Third, improved and sophisticated techniques such as adhesive protocols allow restorations of small lesions, preventing progression to larger cavities. All these advances preserve more of the natural tooth, and Black’s classification is therefore used today as a notation, rather than as a basis for restoring decay. Whereas, in the past, cavity design was geometric (dictated by the restorative material), it is now amorphous (dictated by the extent of disease).

Smaller lesions are restored by a direct approach, while larger Class II or Class IV are restored indirectly with inlays or onlays (extracoronal), when a direct approach is mechanically or aesthetically inferior. Inlays and onlays are fabricated in a dental laboratory using a variety of materials including composite resins, ceramics and cast gold alloys.

### Indirect extracoronal prostheses

Extracoronal prostheses are defined as those surrounding one or more natural tooth surface(s). The indications for extracoronal restorations are:

- Restoring structurally compromised teeth;
- Improving function (e.g. altering occlusal vertical dimension – OVD);
- Improving aesthetics (e.g. anterior maxillary and mandibular sextant);
- Abutments for a fixed partial denture (FPD).

Extracoronal prostheses are categorised as:

- **Inlays and onlays** – the difference between an inlay and an onlay is the extent of tooth loss requiring replacement. Broadly speaking, an inlay ‘fits into’, while an onlay incorporates cuspal coverage and ‘fits onto’ the tooth;
- **Porcelain laminate veneers (PLV)** – the principal use of PLVs is improving anterior aesthetics by altering tooth morphology and colour. PLVs are the least invasive of extracoronal restorations, usually involving the buccal surfaces of anterior teeth. If the underlying tooth colour is acceptable, only minimal tooth reduction is necessary (0.3–0.8 mm) for improving shape and colour with a thin porcelain laminate fabricated in a dental laboratory. PLVs are the most prescribed type of restoration for purely cosmetic reasons. However, it should be remembered that preparing vital healthy teeth for PLVs with little aesthetic improvement is contentious, especially if similar results are achievable with less invasive protocols such as bleaching or composite resin fillings;
- **Partial coverage crowns** – partial coverage crowns are an extension of PLVs. They occupy a midpoint between full coverage and the minimally invasive PLV. Many configurations are possible, e.g. ¼, ⅜, ⅝, etc. The rationale for partial coverage is retaining as much natural tooth substrate as possible, and hence preserving pulpal and structural integrity;
- **Full coverage crowns and fixed partial dentures (FPD) or bridges** – a full coverage, 360° crown is indicated for severely broken-down teeth, abutments for FPDs, or rarely for elective aesthetic treatment. Various materials are used for fabricating crowns depending on the clinical scenario, e.g. cast metal, metal-ceramic, all-ceramic, composite and acrylic. For vital teeth, a crown can be supported either by coronal dentine or a core build-up. For endodontically treated teeth a post-and-core complex may be necessary. Intraradicular posts are available in many materials, designs, configurations and sizes. A core can be fabricated directly in the mouth using amalgam or composite, or indirectly in a dental laboratory using cast metals or ceramics. The sole purpose of a post-and-core complex is supporting the eventual extracoronal crown. Posts and cores do not reinforce or strengthen teeth, but weaken an already compromised root and the remaining coronal dentine. A ferrule effect is highly desirable for cores (with or without posts);
- **Combination prostheses** – depending on the extent of the clinical requirements, any intra- and extracoronal restoration can be combined into a single entity, e.g. inlay + onlay or PLV + inlay (veneerlay).

### Key points

- A direct restoration is carried out chair-side, while an indirect restoration requires using a dental laboratory.
- Black’s classification, although redundant, is useful for describing the site of a lesion.
- Intracoronal restorations are surrounded by tooth surface(s).
- Extracoronal restorations surround tooth surface(s).
- Inlays are examples of intracoronal prostheses.
- Onlays, PLVs and crowns are examples of extracoronal prostheses.