1 Treatment planning – assessment, planning and treatment

Treatment planning involves applying learned didactic scientific knowledge to clinical realities. To achieve this goal, a systematic approach is necessary, using the acronym APT (assessment, planning and treatment) (Fig. 1.1). Aesthetic treatment, unlike other forms of dental care, requires a radically different approach. For example, the protocol for endodontic treatment is infection removal and subsequent sealing of the canal(s), requiring little or no input from the patient. In fact, the patient is usually oblivious to the treatment modality, and is only aware of resolution of symptoms. Aesthetic treatment on the other hand, is highly subjective, with active patient participation. The colour, form and characterisation of anterior aesthetic restorations are open to scrutiny by the patient, family and friends. The clinician therefore has to adopt a different protocol to meet these challenges for avoiding disagreements and unsatisfactory outcomes.

In order to execute aesthetic treatment successfully, the following items are prerequisite:

- Time
- Aptitude
- Knowledge
- Skills
- Experience
- Patience

Without these qualities, aesthetic treatment is neither possible nor successful. To achieve these objectives, use of a systematic approach, such as APT, maximises success and minimises failures.

Assessment

Assessment begins with an initial consultation, which is a mutual evaluation between the patient and clinician. This appointment generates revenues below the clinician's usual hourly rate, but is worthwhile in the long run. The initial encounter is predominantly psychological, the clinician determining the patient's persona, emotional make-up and needs, and the patient assessing his/her confidence of the dental team, as well as the ambience of the dental practice. The clinician's approach should be empathetic and sincere, rather than dismissive and authoritarian, since this meeting will determine whether a satisfying dentist–patient relationship is possible.[1] Because aesthetic treatment is protracted, often

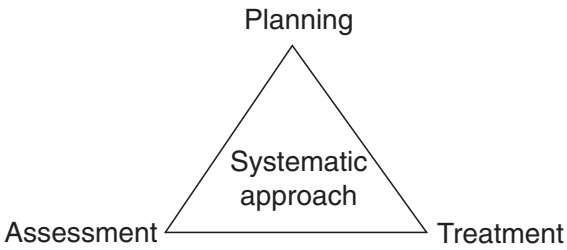

Figure 1.1 The APT (assessment, planning, treatment) model for a systematic approach to treatment planning.

involving a multiphase treatment plan, mutual respect should be established and maintained throughout the entire period. If mutual respect and rapport are not forthcoming, therapy is destined to failure, irrespective of clinical skill and support of the dental team.

The subsequent appointment is much longer, involving information gathering using a variety of examinations. More than one appointment may be necessary to gather information, requiring referral to a hospital or specialist clinics for specific diagnostic tests. The information-gathering process is divided into histories, examination and technological tests. Of course, not every item is necessary for every patient, depending on prevailing symptoms. Below is a proposed list, together with salient points for each item.

(1) Histories:
- Medical history – diabetes, immune response compromises, medication
- Risk history – medical (xerostomia, diabetes, immunosuppression), genetic (periodontal disease and caries), community (cultural, lifestyle priorities), fluoride (demographic), status (socio-economic, education), environmental (occupational hazards), disabilities (Down's syndrome, epilepsy), habits (smoking, betel nut chewing, poor plaque control)
- Nutritional history – diet, gastric regurgitation, bulimia
- Dental history – attendance, previous treatment, records from former or referring dentist, phobias, dental priorities, oral hygiene

(2) Examination:
- Verbal – initial consultation (listening and evaluation to determine patient's chief complaint as well as gauging persona, expectations and wishes)
- Visual:
  - Extra-oral: facial symmetry, facial contours, labial grooves and fissures, skeletal profile, muscular spasms, lymph nodes, speech
  - Aesthetic: smile line, degree of gingival exposure during a smile, degree of tooth exposure at rest and during a smile, tooth form, colour and texture
  - Intra-oral: soft tissue lesions. Tongue size and breathing pattern due to enlarged tonsils causing pharyngeal airway obstruction and tongue thrust may compromise anterior restorations. Caries, periodontal biotypes and bioforms, width of attached gingiva, edentulous ridge configuration according to the Misch classification[2], dental arch shape (anterior–posterior and lateral), imbrications and spacing, interocclusal clearance (checking for over-eruption, displacement of condyles, alveolar bone loss due to previous extractions, tooth wear (erosion, attrition, abrasion, abfraction), fractured teeth using transillumination
  - Occlusal assessment: centric occlusion (CO), centric relation (CR), lateral guidance, anterior guidance, horizontal and vertical overbite, Curve of Spee and Wilson, eccentric contacts, bruxism, failed restorations
- Tactile – muscle palpation, temporomandibular joint (TMJ), fremitus, tooth percussion (endodontic evaluation)
- Written – document verbal and visual finding. Use questionnaire(s) for ascertaining patient's aesthetic expectations. These forms should enquire about which aspect of aesthetic treatment is important to the patient, e.g. colour, shape, alignment of the teeth, etc.

(3) Technological tests:
- Articulated study models with jaw relation records
- Articulators and jaw movement/registration analysers
- Diagnostic wax-ups (Figs. 1.2 & 1.3)
- Radiographs (current and from previous or referring dentist)
- Photographic documentation (intra-oral and 35 mm cameras)
- Scans: computerised tomography (CT) scan, linear tomography, or interactive CT for assessing adequate bucco-lingual width and length of alveolar ridge for implant placement (Figs. 1.4 & 1.5); and magnetic resonance image (MRI) for suspected TMJ arthropathy
- Shade analysis: visual, digital, visit to ceramist (see Chapter 4)
- Instrumental/chemical caries and periodontal detection
- Pulp vitality tests (thermal and electrical)
- Bacterial and biopsy tests

Planning

Having completed the initial consultation, necessary histories, examinations and tests, the next stage is planning. The planning phase involves diagnosis, risk assessment, evidence-based decision making and presenting treatment proposals to the patient.

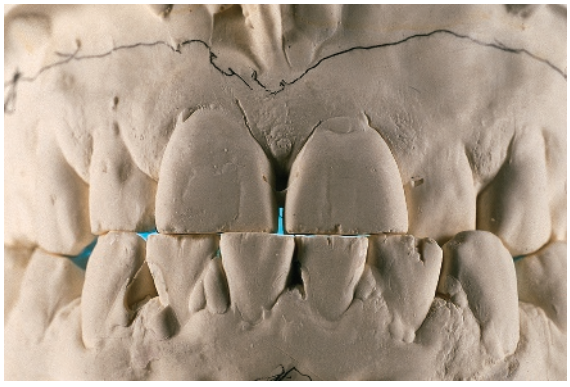

Figure 1.2 Pre-operative study casts showing reduced vertical dimension.

Figure 1.3 Diagnostic wax-up for proposed increase in occlusal vertical dimension for patient in Figure 1.2 (laboratory work by Gerald Ubassy, France).

Diagnosis

Before a diagnosis can be established, the clinician has to integrate all the pieces of information in a coherent and logical manner, not unlike a jigsaw puzzle, creating a picture of the patient's medical and dental status. Depending on the clinician's experience, relevant data is highlighted, while less important information is relegated, allowing commencement of the diagnostic process.

Diagnosis is the premise of planning, preceding any prescribed treatment. It is not limited merely to current symptomatic signs, but incorporates aetiology of the prevailing pathology.

A definitive diagnosis is essential before commencing therapy. For example, repairing a fractured tooth or crown with a replacement restoration is insufficient. The underlying cause of why the tooth or crown fractured is essential if the repair is to be successful (Fig. 1.6). Factors such as occlusal abnormalities, periodontal disease, endodontic status, etc. require investigation so that aetiology is defined and treated, before repair is instigated.[3]

Risk assessment

Currently, most risk assessment by clinicians is highly subjective, leading to inconsistencies and

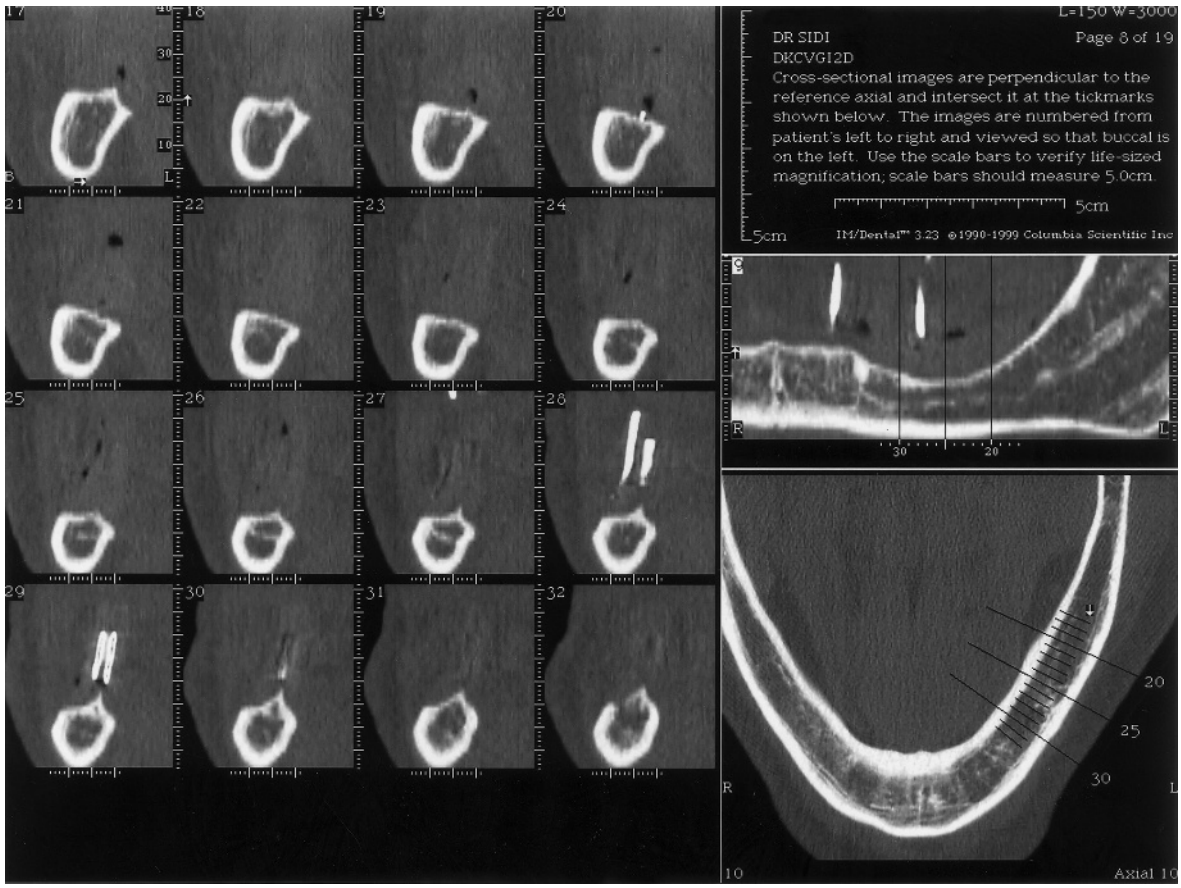

Figure 1.4 CT scan showing insufficient bone for endosseous implant placement (image courtesy of Dr Alan Sidi, UK).

inaccuracies. This usually results in underestimating disease severity, and necessitates more complex and costly treatment later. The aim of risk assessment is to tailor treatment plans individually according to a patient's dental profile, thereby moving away from a 'repair model' to a 'wellness model'. This will discourage disease recurrence and encourage long-term oral health.

Many studies have cited that the two major dental diseases, caries and periodontal disease, are preventable. This assertion is based on identifying and reducing risk, and implementing appropriate preventive measures.[4] For example, the diagnosis of severe periodontal disease does not imply a high risk of periodontal disease. Diagnosis assesses current clinical findings, while risk assesses or predicts future disease patterns. This is because traditional diagnosis is two-dimensional (2D) (clinical examination and radiographs), which indicate disease severity. The third dimension, risk assessment, is omitted. A three-dimensional (3D) diagnosis for periodontal disease incorporates the following (Fig. 1.7):

- Clinical examination and findings
- Radiographic assessment
- Risk prediction

Using a 2D diagnosis, all patients will be prescribed the same treatment, irrespective of risk. However, when individual patient risks are incorporated in a 3D diagnosis, the treatment plan differs for each patient, even though the 2D diagnosis is identical. Periodontal risk factors are crucial when considering implants or aesthetic prostheses. For low-risk patients, simple

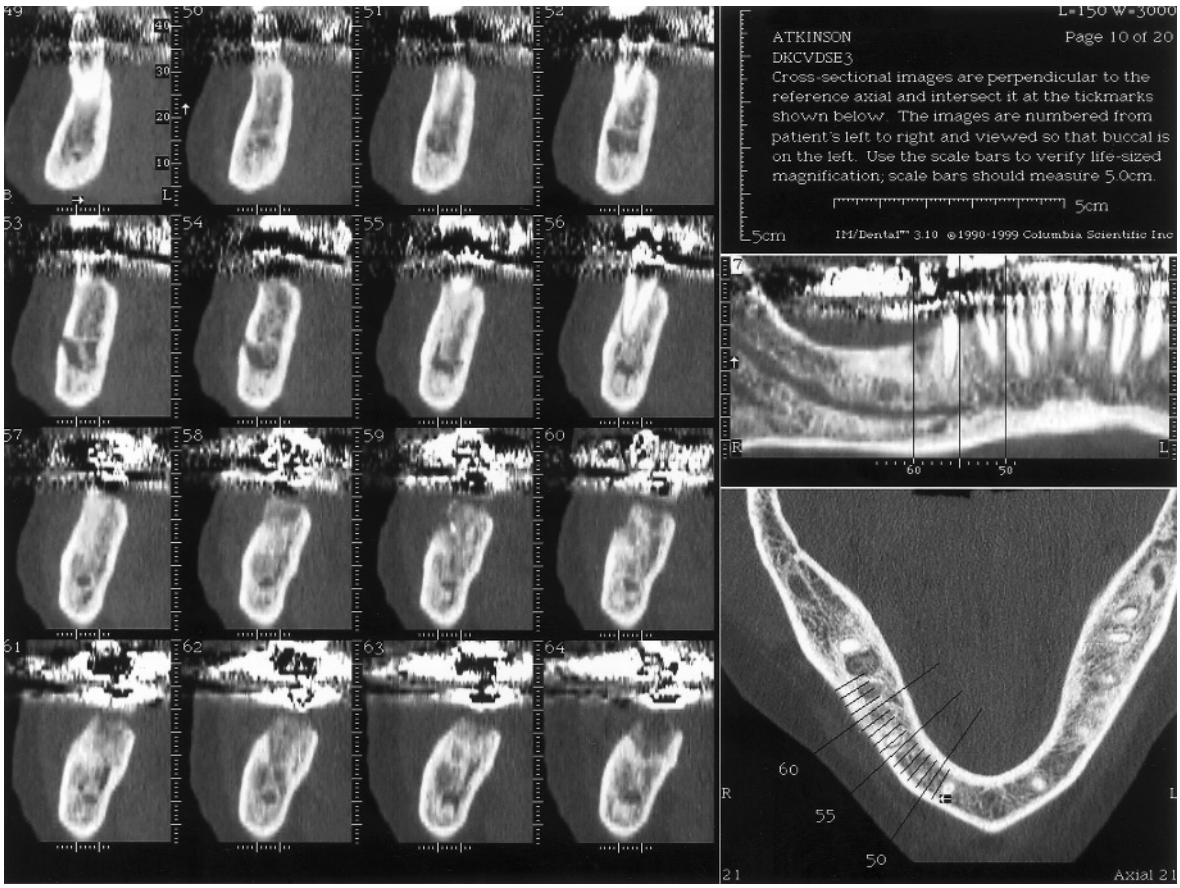

Figure 1.5 CT scan showing adequate bone for endosseous implant placement (image courtesy of Dr Alan Sidi, UK).

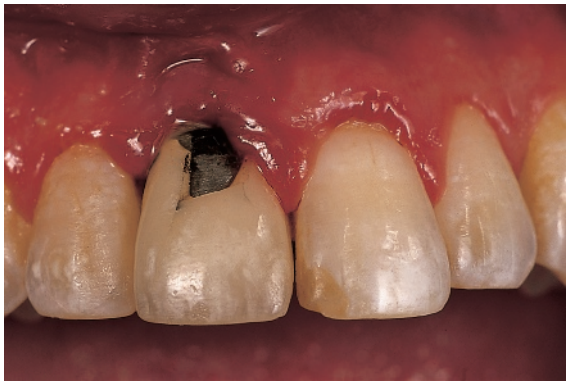

Figure 1.6 De-lamination of veneering porcelain on a metal–ceramic crown.

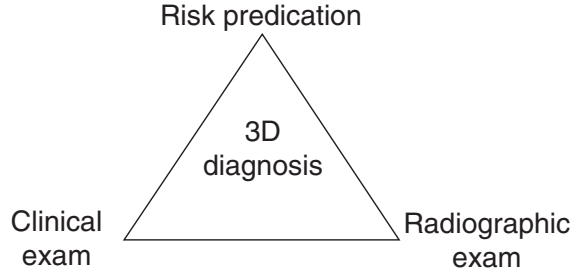

Figure 1.7 The three-dimensional diagnosis model.

prophylactic procedures are sufficient, and the probability of success of aesthetic restorations or implants is high. This is not the case with moderate- to high-risk periodontal patients, who require extensive periodontal therapy and more frequent recalls ensuring that periodontal health is established and maintained. In the latter, patients should be informed that unless their periodontal status is maintained, aesthetic restorations or implant longevity may be severely compromised.

The next question is how predictably and accurately to assess risk. A recent study shows that only 20% agreement was evident among expert clinicians, indicating that inter-evaluator assessment is unreliable. The clinical significance is that either over or under-treatment is prescribed depending on the opinion of the examiner.[5] A quantitative analysis using the Previser Risk Calculator has been proposed, which accurately predicts risk of periodontal disease, from a scale of 1 (low risk) to 5 (high risk). This test uses the latest computer technology and has been clinically evaluated over a 15-year period. As well as assessing risk, the test also provides a rating for current disease status from 1 (periodontal health) to 100 (severe generalised periodontitis). [6] This objective evaluation is a step towards the clinician being able to modify treatment according to risk, achieve and maintain periodontal health, and prevent future complex and costly therapies. This quantitative analysis is a paradigm shift from a repair to a wellness model.

Evidence-based decision making and treatment

Historically, dentistry was far ahead of medicine with regard to implementing preventive measures for caries and periodontal disease. These prophylactic interventions were underpinned by nearly four decades of scientific research and clinical trials. However, today the profession is so enamoured with technology that it has shed the solid scientific platform in favour of spurious marketing claims. Inventive materials and devices are readily embraced, endorsed by charismatic lecturers, and used on patients without evidence of long-term clinical success. Many 'opinion leaders' that lecture frequently at dental symposia reiterate a particular point of view, which may or may not be evidence-based. An opinion that is repeated perpetually eventually becomes the truth, irrespective of its validity.

There is nothing wrong with this approach as long as delegates are informed beforehand that the speakers are expressing their empirical experience, not scientifically proven rules and guidelines. As stated below, clinical experience forms a part of an evidence-based approach. Added to this are peer and media pressure, castigating those who prefer the traditional scientific approach as archaic or old-fashioned. However, sometimes faith is not enough, and seeing or reading anecdotal case studies are insufficient for sound clinical decision making.[7]

Viewed from a manufacturer's perspective, dental companies are keen to introduce novel products and make profits, which indirectly filter back to the profession in sponsorship for educational symposia. Furthermore, research is onerous, expensive and protracted, and by the time the results are published, the product may be obsolete, often replaced by a newer version. This vicious cycle is then repeated and perpetuated.

The scientific approach, although utopian, hampers innovation and technological advancement. Many new technologies have faced problems before a reliable product eventually emerges. Ultimately, it is the dentist, not the manufacturer, who is responsible for clinical decision making that impacts on patients' treatment. If things go wrong, the patient is unlikely to blame the manufacturer for the failure. Therefore, the onus is on the dentist to choose appropriate materials, backed by evidence-based research, to avoid rebuke or professional negligence litigation in the event of failure. Evidence-based treatment[8] is succinctly summarised as a combination of (Fig. 1.8):

- Clinical erudition
- Sound scientific research
- Patients' needs and wants

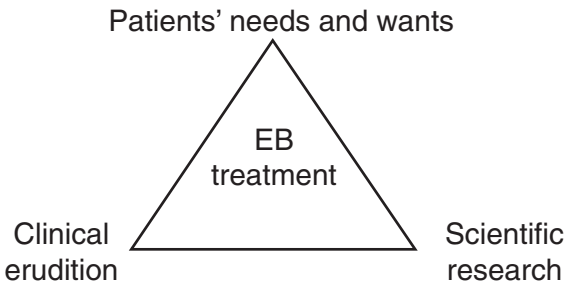

Figure 1.8 Components of evidence-based (EB) treatment.

Figure 1.9 External trauma resulting in a fractured right maxillary lateral incisor.

Performing successful treatment is a combination of evidence-based information, clinical judgement and personal experience. It is this combination, rather than just one factor, which ensures validity and successful outcomes. Each factor requires scrutiny. Evidence-based information relies on randomised clinical trials as the gold standard, not merely a single anecdotal case study relying on chance events. Clinical judgement relies on reading appropriate literature and attending reputable symposia. Finally, personal experience, although invaluable, should not shroud or bias decision making. What works for one patient, is not a universal therapy for every patient.

Choosing the most appropriate treatment for a given clinical finding is influenced by the three components of evidence-based therapy: clinical erudition, sound scientific research and patients' needs and wants. For any given predicament, there are many solutions that yield the desired result. However, each modality should be assessed according to risks and, eventually, benefits.[9] For example, an accidental fracture of the maxillary incisor has the following treatment options (Fig. 1.9):

(1) Restore with a direct composite filling:
   - Benefits – minimally invasive, immediate, economical
   - Risks – technique-sensitive bonding procedures, future staining of composite, microleakage leading to endodontic involvement and compromised aesthetics, requiring replacement fillings and possible root canal therapy (RCT)

(2) Restore with indirect ceramic prosthesis (veneer or full coverage crown):
   - Benefits – excellent aesthetics using an all-ceramic restoration
   - Risks – highly destructive, technique-sensitive procedures, possible endodontic involvement due to tooth preparation trauma, use of a skilled (and therefore costly) ceramist to match a single crown with adjacent teeth, protracted, expensive, porcelain fracture due to improper clinical or laboratory protocols

(3) Extraction and immediate replacement with endosseous implant and implant supported crown:
   - Benefits – immediate, avoids future endodontic complications
   - Risks – surgical involvement, possible unpredictable soft and hard tissue healing with compromised aesthetics, use of a skilled (and therefore costly) ceramist to match a single crown with adjacent teeth, protracted, expensive

Figure 1.10 Fractured crown on root-filled second premolar.

Figure 1.11 Radiograph of tooth in Figure 1.10 showing a thin root cross section and periapical radiolucency.

Another example is a fractured crown at the cervical margin, on a root-filled premolar with periapical radiolucency but no active suppuration (Figs. 1.10 & 1.11). The treatment options are:

(1) Re-RCT with intra-radicular support and replacement crown:
   - Benefits – established clinical protocols for treatment modalities
   - Risks – further trauma from re-RCT and post placement to an already weakening, delicate root, relapse of re-RCT, compromised retention for definitive crown and protracted treatment plan

(2) Apicectomy with intra-radicular support and replacement crown:
   - Benefits – retrograde filling without inflicting trauma to delicate root from re-RCT
   - Risks – shortening of root, resulting in poor root-to-crown ratio, compromised retention for definitive crown and protracted treatment plan

(3) Crown lengthening or orthodontic extrusion to increase retention and resistance form for definitive crown in conjunction with options (1) or (2):
   - Benefits – exposure of root surface for definitive crown margin placement
   - Risks – shortening of root, resulting in poor root-to-crown ratio and protracted treatment plan

(4) Extraction and immediate replacement with endosseous implant and implant supported crown:
   - Benefits – expedient, predictable, but requires surgical experience and expertise
   - Risks – surgical involvement. Local anatomy must be suitable with sufficient quality and quantity of soft and hard tissue volume for success

The patient opted for the last proposal. Firstly, the costs of all the options were similar. Secondly, the bone and soft tissue anatomy were conducive for successful immediate implant placement with immediate temporarisation, including sufficient bone apical to root apex primarily for stability, adequate mesial-distal implant-to-tooth distance of 1.5 mm and occlusal clearance (Figs. 1.12–1.16).

Arriving at the most appropriate treatment plan involves clinical findings and a definitive diagnosis, risk assessment, followed by an evidence-based approach (clinical erudition, sound scientific research and patients' needs and wants). Using evidence-based decision making and treatment planning maintains professional competence and competitiveness for delivering high quality, predictable treatment. When using an evidence-based approach, it is important to appreciate that this principle is not dogmatic but

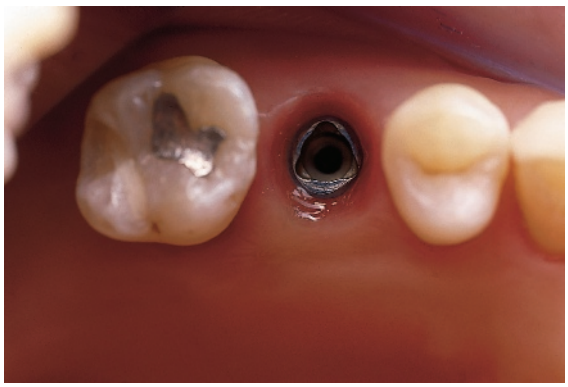

Figure 1.12 Immediate placement of implant fixture (Replace Select, Nobel Biocare) following atraumatic extraction.

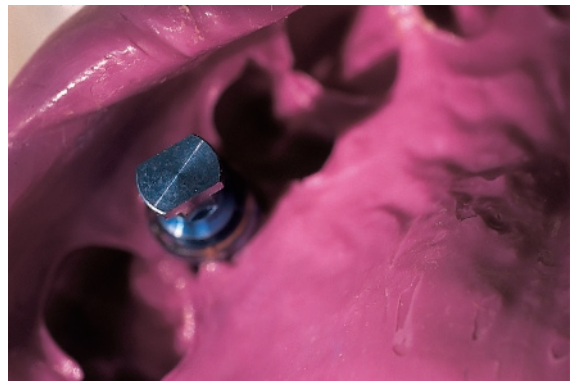

Figure 1.15 Impression with implant analogue for fabrication of definitive crown.

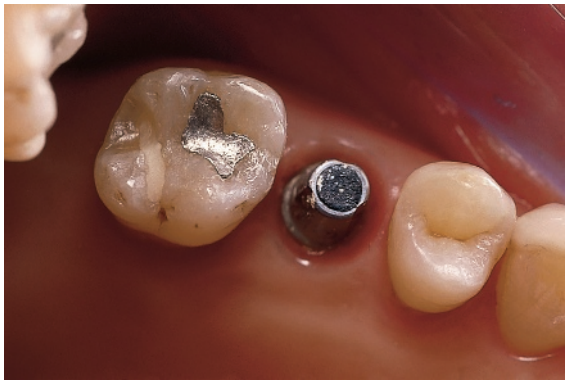

Figure 1.13 Abutment with occlusal plug prior to immediate provisionalisation.

Figure 1.16 Cemented implant-supported all-ceramic crown (compare with Figure 1.10).

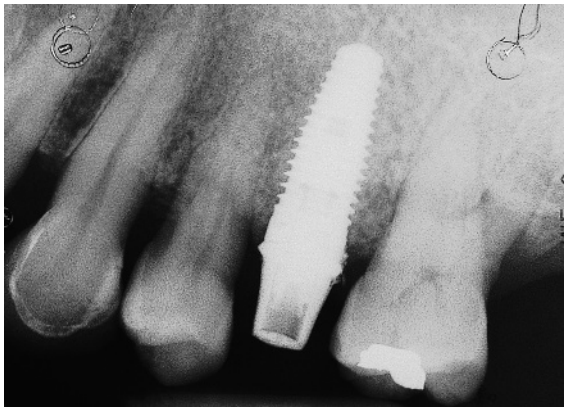

Figure 1.14 Four-month radiograph showing osseointegration.

pragmatic, incorporating clinical experience as well as respecting patients' preferences and desires.[10]

Presenting treatment plan proposals to the patient

A treatment plan is a proposal, not a military procedure. In fact, treatment can change due to a myriad of reasons, including the patient's ambivalence, prevailing clinical presentations, unforeseen complications, financial burdens, etc. At the onset, it is the clinician's duty to convey the flexibility and fluidity of the proposed treatment, indicating that as treatment

Figure 1.17 The patient was unaware of the defective anterior maxillary restorations, which are a potential site for a future disease process.

progresses, changes or alterations may be desirable or mandatory.

The presentation should encompass simple and clear verbal and written communication. Visual aids, such as radiographs, scans, study models and pictures, add credence to the written and spoken word. When starting a new aesthetic practice, it is often difficult to show treatment carried out by the clinician, and using information leaflets and dental journals is extremely helpful. However, over time, it is invaluable to build up a portfolio, especially for sceptics, who may question competence of the operator. Furthermore, showing one's own work further enhances confidence and convinces patients that what is proposed has been previously achieved by the treating dentist.

Many patients are oblivious of disease processes in their mouth, and visual aids are invaluable for raising awareness of potential or current problems (Fig. 1.17). Numerous visual aids are available, ranging from a face mirror to the latest computer software. For aesthetic treatment, intra- and extra-oral cameras are crucial at every stage of therapy, starting with pre-operative status, aesthetic analysis, shade analysis, potential complications, patient acceptance of aesthetics and post-operative results.[11] As well as a presentation tool, high-quality imagery is important for patient–dentist–specialist–ceramist communication and medico-legal documentation, especially if treatment does not proceed as anticipated. A checklist of items required, together with their diagnostic value is as follows:

- Extra- and intra-oral photographs – aesthetic and shade analysis, pathology and defective existing restorations
- Computer-generated simulations showing proposed treatment possibilities. Although useful, this form of simulation is potentially problematic since the simulation may not be clinically feasible. It is probably wiser to use a wax-up, a 'real' as opposed to a 'virtual' 3D object which can show the possibilities of a specific option
- Radiographs – infection, caries, defective margins, root fillings, bone loss, vital structures
- Scans showing bone quality and quantity if implants are considered
- Mounted study casts – occlusal assessment
- Diagnostic wax-up – intended design of the restorations (Figs. 1.18 & 1.19)
- Results of any bacteriological tests – modify periodontal therapy
- Technologically based caries and periodontal tests – verify clinical findings
- Practice internet web site – useful for showing patients the practice profile, and the type of work achievable by the treating clinician

Having gathered the visual aids, the next stage is conveying these to the patient in a logical and

Figure 1.18 Severe misalignment of maxillary anterior sextant.

Figure 1.19 Diagnostic wax-up showing proposed appearance for maxillary incisors and canines for patient in Figure 1.18 (laboratory work by Jason Kim, New York).

organised manner. Communication is both verbal and written. Verbal communication should take place in a serene, unfettered, relaxed, unrushed ambience. The choice of words should be non-technical, non-emotive and non-phobic.[12] For example, describing intricate details of an apicectomy, including suppuration and haemorrhage details, is likely to alienate patients. Conversely, describing an apicectomy as removing bacteria, improving function and appearance is more palatable. Cautionary discretion is required regarding the current craze for cosmetic 'extreme makeovers'. These trends are predominately media propagated, often prejudicing the layman into the belief that cosmetic wonders can fulfil and enrich their lives. These views are rapidly entering dentistry, with the result that treatment is often patient driven. There is also an emerging breed of clinicians prejudging patients' desires and influencing their decisions in favour of these makeovers. Unfortunately, the motive behind this influencing is purely fiscal, where marketing takes precedence over ethics and clinical necessity. Furthermore, dentistry is not the fashion industry. It is very easy to throw away a garment once its haute couture appeal has elapsed, which is not the case for 'cosmetic restorations' created by irreversible destruction of natural teeth. The morality of this dilemma resides with the clinician.

Ultimately, the written word forms a contract between the dentist and patient. Once again, the wording should be non-technical, outlining the present clinical situation, treatment options with benefits and risks of each procedure (with scientifically based prognosis for a specific treatment option), expected time scale, costs, methods of payments and practice polices (e.g. failed appointments), and guarantees. The treatment plan should also incorporate informed consent. Informed consent, as required by most US states, has the following six elements:[13]

- Correct diagnosis of symptoms and findings
- Nature and purpose of proposed treatment
- Risks of treatment
- Likelihood of success
- Alternative options
- Prognosis

Treatment

The last part of APT is treatment. Treatment is influenced by biological, clinical, psychosocial and economic factors.[14] The biological factors include systemic and nutritional health, as well as local factors, such as periodontal biotype. Clinical aspects include knowledge, techniques and manual dexterity of the operator, while economic constraints determine the degree of sophistication of the proposed treatment. As stated above, an evidence-based approach is proactive intervention, promoting oral health, reducing tooth loss and minimising the need for future complex therapy.[15]

As well as using an evidence-based approach, aesthetic treatment also relies on the clinician's and ceramist's artistic flare. At the outset, the operator should exercise clinical self-deprecation, stepping back and asking whether he or she possesses the technical competence, experience, psychological knowledge and artistic ability to perform aesthetic treatment. One must appreciate individual limitations, professional responsibilities, effective communication and a collaborative effort when delivering quality care. Furthermore, aesthetic treatment is not the remit of every dental practice. Some practices provide routine, stereotypical, run-of-the mill treatment.

If this is the case, then referral to a specialist is prudent; the specialist should have an individual, 'more than just a restoration' approach. As a concluding comment: perfection takes time and experience, but optimal dentistry is, and should be, a tangible goal for every practice.[16]

Once a treatment plan is accepted, the stages of execution can be considered. Most aesthetic treatment plans are multiphase and multidisciplinary. The following is a summary of the chronological stages. Every stage may not be applicable for every patient, but is listed for the sake of completion. When moving from one stage to the next, it is important to remember that therapy should follow the health, function and aesthetics (HFA) triad discussed in Chapter 2.

(1) Alleviate pain and stabilise active disease
(2) Restore oral health by prophylactic measures
(3) Perform APT (assessment, planning, treatment)
(4) Ensure medical diseases are controlled or under supervision
(5) Liaise with specialist(s) for advice or treatment of skeletal, orthodontic, mucogingival or osseous anomalies
(6) Liaise with ceramist regarding shade analysis and feasibility of proposed aesthetic treatment
(7) Commence treatment

Clinical case study

The clinical case study below illustrates a systematic approach to treatment using APT.

Assessment

Initial consultation

The patient was referred by an implantologist for improvement of anterior aesthetics. The lady was 40 years old, intelligent, elegant, sophisticated and affable. She was distraught and very concerned about her dentition, recalled previous unpleasant dental experiences and failures and was sceptical about future treatment.

Histories

- Medical history – no systemic illness or medication
- Risk history – no genetic predisposition to periodontal disease, high socio-economic status, no occupational hazards, non-smoker, regular exercise, health conscious
- Nutritional history – healthy diet
- Dental history – regular attendance, visits to hygienist, poor-quality previous dental treatment, no records available from former dentist

Examination

- Chief complaint – improve anterior dental aesthetics
- Visual – no lymph swellings, low lip line (upper lip concealed maxillary incisors – Fig. 1.20)
- Intra-oral – no soft or hard tissue pathology. Retained deciduous canines, congenitally missing maxillary lateral incisors, with mesial drifting of the canines distal to the central incisors
- Triangular-shaped, chipped maxillary centrals lacking dominance due to the wide pseudo-lateral incisors. Thin scalloped periodontal biotype. Defective and chipped porcelain laminate veneers on the secondary canines (to simulate the missing laterals) and deciduous canines (to simulate secondary canines). Plaque and calculus build-up, staining and discolouration of anterior teeth. Gingival zeniths of pseudo-lateral incisors apical to central incisors (Figs. 1.21–1.23)
- Occlusion – steep anterior guidance, resulting in fractured laminates on secondary canines. Right and left group function, no eccentric working or non-working contacts, and absence of parafunctional activity
- Tactile – no muscular spasm or TMJ dysfunction
- Written – aesthetic evaluation questionnaire revealed that patient was enthusiastic about restoring her smile, but cynical due to previous poor-quality treatment

Figure 1.20 Low maxillary lip line concealing cervical margins of maxillary anterior teeth.

Figure 1.21 Pre-operative status in centric occlusion (see text for details).

Figure 1.22 Pre-operative status in anterior protrusive excursion (see text for details).

Figure 1.23 Pre-operative status: occlusal view (see text for details).

Technological

- Radiographs – periapicals showed complete root absorption of retained deciduous canine and local inflammation necessitating immediate extraction (Figs. 1.24 & 1.25).
- Upper and lower pre-operative impression with facebow and jaw registrations for mounting on semi-adjustable articulator for detailed occlusal assessment
- Diagnostic wax-up to assess feasibility of treatment options for improving anterior aesthetics (Figs. 1.26 & 1.27)
- Photographic – facial, dentofacial and detailed dental images with 35 mm camera
- Scans – none
- Shade analysis – using two shade guides, Vita Classic and Vita 3D (Figs. 1.28 & 1.29)
- Pulp vitality – all anterior teeth vital, with no periapical lesions
- Bacterial and biopsy tests – none

Planning

Diagnosis

Poor-quality dental restorations, poor anterior aesthetics, calculus and plaque deposits, staining, fractured and defective laminates on pseudo-laterals, chipped incisal edges on central incisors. Resorbed and deficient (bucco-palatal) alveolar ridge at extracted deciduous canine sites.

Figure 1.24 Extraction of retained deciduous canines (facial view).

Figure 1.25 Extraction of retained deciduous canines (occlusal view).

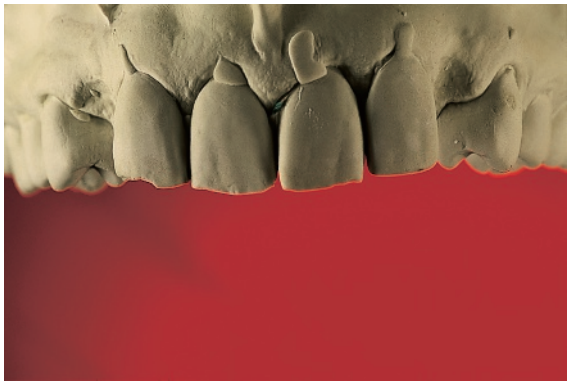

Figure 1.26 Pre-operative study cast.

Figure 1.27 Diagnostic wax-up for anterior maxillary sextant.

Figure 1.28 Shade analysis using the Vital Classic shade guide.

Figure 1.29 Shade analysis using the Vita 3D shade guide.

Mesial-distal space between pseudo-laterals and first premolar = 4 mm on each side of the arch, insufficient for implant placement. A minimum of 1.5 mm implant-to-tooth distance required, and even using a small platform fixture (3.5 mm), the prevailing 4 mm space is inadequate.

Treatment objectives

- Maintainance of existing occlusal scheme
- Dominance of maxillary centrals
- Narrower maxillary pseudo-laterals
- Resolving apically located gingival zeniths of pseudo-laterals
- Replacement of missing canines
- Improvement of colour of mandibular teeth

Risk assessment

Low risk of periodontal disease due to shallow pockets, no systemic illness, no genetic predisposition to periodontitis, regular dental attendance, healthy diet. However, the thin scalloped periodontal biotype necessitates care with restorative or surgical procedures to prevent gingival recession.

Evidence-based decision making and treatment

The treatment options presented to the patient were as follows:

(1) Removable upper denture
   - Benefits – expedient, non-invasive, economical
   - Risks – anti-social, onerous, food trapping, temporary solution, future replacement dentures, accelerated wear and staining of acrylic artificial teeth

(2) Bleaching mandibular teeth
   - Benefits – predictable, immediate gratification, economical
   - Risks – sensitivity, may require repeated application(s) to achieve desired result

(3) Orthodontics to increase space between pseudo-laterals and first premolar to allow endosseous fixtures (with bone grafting) and eventual implant-supported crowns. The apically located gingival zenith on the pseudo-laterals could also be rectified by orthodontic extrusion or soft tissue grafts
   - Benefits – refined, complicated, state-of-the-art treatment, minimally invasive
   - Risks – protracted, bone or root absorption due to orthodontic movement, orthodontic retainers, surgical complications, such as infection, bone loss and unpredictable soft tissue contours, costly

(4) The prosthodontic solution consisting of porcelain laminate veneers (PLVs) on the centrals, with a fixed partial denture (either two distal cantilevers from the pseudo-laterals, or two three-unit bridges from pseudo-laterals to first premolars)
   - Benefits – excellent aesthetics, expedient, predictable
   - Risks – highly invasive, technique-sensitive, possible future endodontic involvement of prepared teeth, costly

In isolation, none of the above options resolves all the treatment objectives. In order to arrive at a definitive treatment plan, more than one of the above options is necessary. After considering these four options, the patient opted for option (2) (bleaching) with option (4) (prosthodontic solution). Using an evidence-based approach, the following require consideration:

- Clinical erudition – knowledge, skill and experience. It was decided to adhere to the existing occlusal scheme, group function on both sides. Additionally, PLVs were chosen instead of full coverage crowns because of the steep anterior guidance, and a protrusive slide on natural tooth surfaces would ensure better long-term function
- Sound scientific research – bleaching is a predictable modality if judicially applied. PLVs are also predictable using an adhesive protocol for cementation. In order to maximise aesthetics, an all-ceramic alumina bridge was selected (In-Ceram, Vita), which has a reasonable short- to medium-term success rate for anterior regions of the mouth (see Chapter 3)
- Patient's needs and wants – the treatment plan was finalised once the patient expressed her wishes. The lady was totally against sur-

gical intervention and refused protracted treatment duration due to previous dental failures. Since the lip line was low, it was decided to accept the apical zeniths of the pseudo-laterals. She was also adamant about improving the tooth colour of her anterior mandibular teeth

Treatment

The treatment sequence is as follows:

(1) Achieve periodontal health and stability by prophylaxis and oral hygiene instructions
(2) Provide bleaching trays and allow 3–4 weeks for colour stabilisation before final shade determination
(3) Liaise with ceramist for detailed shade and aesthetic analysis using wax-up, photographs and discussions with patient
(4) Tooth preparations for PLVs on central incisors, and two fixed partial dentures from pseudo-laterals to first premolars. Use temporary restorations to assess health, form, occlusion, phonetics and creating ovate pontic sites for missing canines (Figs. 1.30–1.32)
(5) Verify shade after tooth preparation, especially for PLV on central incisors (Fig. 1.33)
(6) Once gingival margins are healthy and stable, make final impressions with facebow and jaw registrations (Fig. 1.34)
(7) In the dental laboratory, pour two plaster models; leave one untrimmed to confirm emergence profile and cervical contours; the second trimmed dies are mounted on an articulator for fabrication of the definitive prostheses (Figs.1.35 & 1.36)
(8) Try-in restorations, check fit, occlusion, phonetics and aesthetics (Figs. 1.37 & 1.38). In this instance the following anomalies were apparent (Fig. 1.39):
    (i) Incorrect axial inclination of the right canine pontic and left pseudo-lateral
    (ii) Marginal discrepancies on mesiobuccal and palatal aspects of abutment 14, and palatal aspects of abutments 22 and 24
    (iii) Patient requested removal of interproximal staining between pseudo-laterals and canines and a reduction in the cervical chroma stains
(9) Since the marginal discrepancies of the alumina framework cannot be corrected by adding porcelain, new bridges were fabricated. The result is shown in Fig. 1.40, correcting the aberrations listed above
(10) The restorations were cemented by using an adhesive technique with a resin luting agent
(11) The post-operative status shows impeccable periodontal health and aesthetic integration of the PLVs and fixed partial dentures (FPDs) (Figs. 1.41–1.43). The original treatment objectives are achieved as follows:
    (i) Maintenance of existing occlusal scheme
    (ii) Dominance of maxillary centrals
    (iii) Narrower maxillary pseudo-laterals
    (iv) Apically located gingival zeniths of pseudo-laterals are hidden by the low lip line
    (v) The missing canines have been replaced
    (vi) Improvement of colour of mandibular teeth

The treatment plan above has followed three sequential steps, achieving periodontal health, occlusal and phonetic function, and anterior aesthetics (the HFA triad), which is the theme of the next chapter.

Figure 1.30 Right lateral view of tooth preparations.

Figure 1.31 Left lateral view of tooth preparations.

Figure 1.32 Occlusal view of tooth preparations.

Figure 1.33 Shade analysis after tooth preparation using the Vital Classic shade guide.

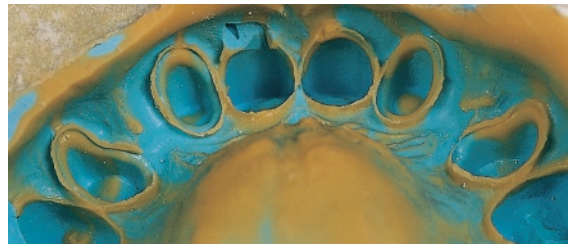

Figure 1.34 Definitive maxillary arch impression using an addition silicone material (Provil Novo, Heraeus Kulzer).

Figure 1.35 Untrimmed master cast.

Figure 1.36 Trimmed model and dies mounted on semi-adjustable articulator.

Figure 1.37 Try-in of definitive restorations (facial view).

Figure 1.38 Try-in of definitive restorations (occlusal view).

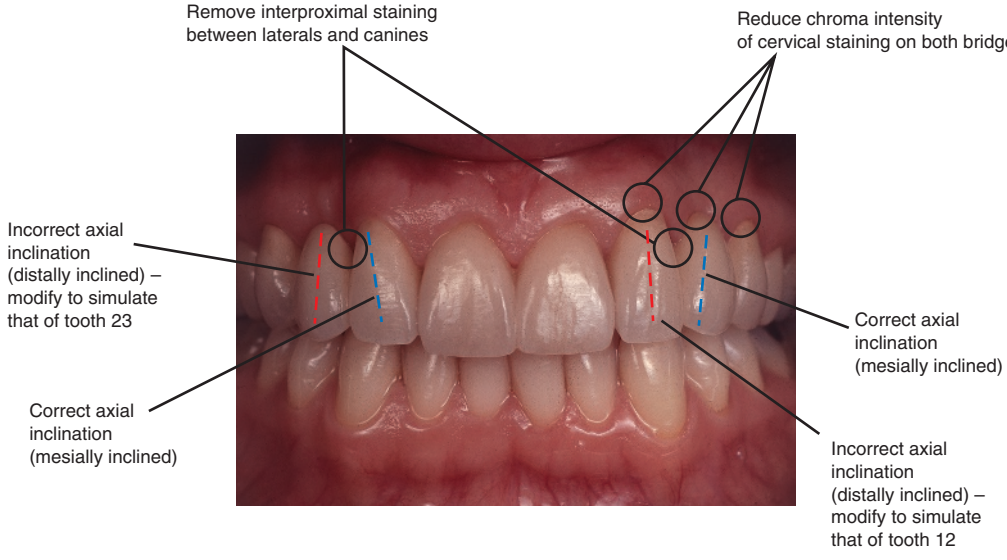

Figure 1.39 Evaluating aesthetic and technical faults at try-in stage.

Figure 1.40 Post-operative view after correcting faults at try-in stage.

Figure 1.41 Post-operative 1:1 view showing aesthetic improvement, and immaculate integration of laminates and ceramic bridges with a healthy surrounding periodontium.

Figure 1.42 Pre-operative lateral dento-facial view.

Figure 1.43 Post-operative lateral dento-facial view.

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