

Issue 006 | June 2023

QUARTERLY MAGAZINE
HONG KONG & MACAU EDITION

 DENTAL
DIARIES

Lifestyle

Coffee: One of the most popular
beverages in the world



DEMYSTIFYING EMERGENCY PROFILE:

LOOKING AT IMPLANT SUCCESS FROM THE RIGHT ANGLE!



CLINICAL MANAGEMENT OF
SEVERE IMPACTED
MAXILLARY CANINES

PROGRESSIVE

2-STEP
CLEAR ALIGNER
SOLUTION



CLINIC
START-UP
PACKAGE

TAKE A BREAK SIT BACK Relax

What Is **DENTAL DIARIES?**

Practicing dentistry at the highest standards today is a challenge. As dentists we have to stay on top of a rapidly changing science, decide among growing technological innovations and new products and serve patients with ever changing needs and expectations. All these, while striving to maintain work-life balance in difficult times for all can be tough and it is no surprise that dentistry is among the most stressful professions.



At the Dental Diaries, we aspire to support dentists of Hong Kong and Macau on every step. Every quarter, our editorial team will gather the most up-to-date news in the dental field, short scientific articles and case studies, together with lifestyle information, suggestions and ideas to balance a busy working life with some fulfilling personal time. We also want to foster a network, by sharing messages, news and classified ads for the local dental community.

We hope that every time you receive the latest Dental Diaries, you will not only gain professional knowledge, but it would also make your break a little bit more relaxing!

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UPCOMING COURSES

ITI SC Meeting

Significance of The Smooth Collar: Tissue Level VS Bone Level Implant

SPEAKER Dr. Ho King Lun, Dominic

BDS (HK), MDS (Perio) (HK), AdvDipPeriodont (HK), MRD RCSEd (Perio), FCDSHK (Periodontology), FHKAM (Dental Surgery), FDS RCSEd, FDS RCPS (Glasg.)

DATE

5th July 2023

TIME

7:30pm - 9:30pm
HKT

VENUE

Center of
Dental Education

Pending
CME
Points

FEE

FOC for ITI Members and HKUDAA Members
HKD500 for Non-ITI Members

(In Collaboration with The
University of Hong Kong
Dental Alumni Association)



Learn More

Webinar

Digital Strategies for Sagittal Corrections with ClearCorrect

SPEAKER Dr. Gabriel Dolci

DATE

12th July 2023
(Wednesday)

TIME

7:30pm - 9pm
HKT

FEE

FOC

VENUE

ZOOM



Learn More

ITI SC Meeting

Aesthetics Considerations for Dental Implants

SPEAKERS Dr. Cheung Chi Hang, Alex

BDS (HK), MDS (Pros) (HK), MPros RCSEd, FCDSHK(Pros), FHKAM(Dental Surgery)

Dr. Hui Sheung Yu, Bosco

BDS(HK), MDS(OMS)(HK), MOMS RCSEd, FCDSHK(OMS), FHKAM(Dental Surgery)

DATE

13th July 2023

TIME

7:30pm - 9:30pm
HKT

VENUE

Meta Stages

FEE

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Learn More

Hosted by:  ITI
Campus Hong Kong 

ITI SC Meeting

Hands-on Workshop

Surgical Protocol for Placement of Tissue Level / Bone Level Implant

SPEAKER Dr. Ho King Lun, Dominic*BDS (HK), MDS (Perio) (HK), AdvDipPeriodont (HK), MRD RCSEd (Perio), FCDSHK (Periodontology), FHKAM (Dental Surgery), FDS RCSEd, FDS RCPS (Glasg.)***DATE**

19th July 2023

TIME7:30pm - 9:30pm
HKT**VENUE**Center of
Dental Education**Pending
CME
Points****FEE** FOC for ITI Members and HKUDAA Members
HKD500 for Non-ITI Members*(In Collaboration with The
University of Hong Kong
Dental Alumni Association)*

Learn More

Lecture and Hands-on

High Aesthetic Demanding Immediacy Case

SPEAKER Dr. Ricardo Kern*BDS, DCLINDENT (Periodontics), MSC (Oral
Rehabilitation) Periodontics, Oral Rehabilitation***DATE**

26th July 2023

TIME9am - 6pm
HKT**VENUE**Center of
Dental Education**Pending
CME
Points****FEE** Please review the detailed course fee at CDE website*(In Collaboration with The
University of Hong Kong
Dental Alumni Association)*

Learn More

Lecture, Live Surgery & Hands-on

2nd ROUND - International Australia Clinical Residency Program

SPEAKER Dr. Alex Fibishenko*Oral Implantology & Dento Alveolar Surgery***DATE** 30th July - 4th August 2023**FEE** Please contact peak dental solutions sales representative
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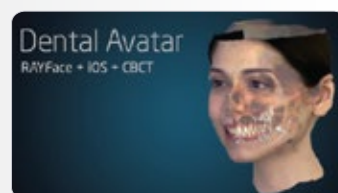
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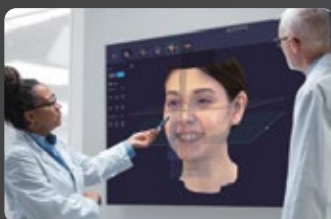
Face Driven

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Consultation

3D smile design simulation to improve consultation outcome



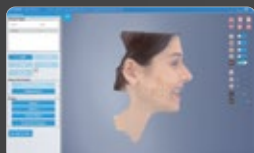
Diagnosis

Auto landmark creation for accurate and rapid diagnosis



Communication

Interactive communication of the treatment plan through RAYTeams platform



Open System-3rd party Integration

Integration with various 3rd party CAD and 3D viewers for expanded clinical experience



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DEMYSTIFYING EMERGENCE PROFILE: LOOKING AT IMPLANT SUCCESS FROM THE RIGHT ANGLE!



Pro. Nikos Mattheos



Dr. Martin Janda



Designing the optimal emergence profile is among the “hottest” areas in Implant Dentistry, with much ongoing research and debate. Although some studies have connected the contour of the abutment / prosthesis with inflammation and peri-implantitis, little is understood about where to look and what to avoid when designing an implant prosthesis. A recent clinical study from the team of Drs Mattheos and Janda utilising 3D imaging technology comes to shed light to this topic, showing how specific angles of the prosthesis can increase x30 the risk for inflammation!

Dental Diaries talked to the authors and brought today some important messages for your Implant practice and guidelines for the next time you design an implant crown!

Can the prosthetic design of an implant prosthesis influence the long-term health of peri-implant tissue?

Yes, it can, and this is some fundamental clinical knowledge we have long had from prosthodontics on teeth. Implant Dentistry however has been initially so focused on osseointegration, that it took several decades to awaken to the importance of the prosthesis-tissue interface and how the design of the transmucosal complex can influence both aesthetics and long-term tissue health. This was our main drive to introduce the concept of the Implant Supracrustal Complex some years ago, aiming to study the close interrelation of tissue and components in what we often call as “emergence profile” ^[1].

The first evidence pointing to this direction came with 3 cross-sectional studies ^[2-4] which suggested that prosthesis contour of more than 30° as it appears in peri-apical radiographs, is correlated with increased risk for peri-implantitis in bone level implants. Furthermore, convexity of the prosthesis profile has been correlated with increased recession ^[5], marginal bone loss ^[6] and peri-implantitis when combined with over contouring of the prosthesis ^[3]. This was the first time that there was an attempt to “quantify” elements of the prosthetic design at implants relate them with pathology. Although these results pointed to a certain direction, it was difficult to extract some concrete suggestions as to what the optimal design should be.

Why was it difficult to come up with specific design guidelines?

Although a tiny anatomical area, the transmucosal part of the implant-abutment-prosthesis is a highly complex structure. Trying to approach this complex 3-dimensional structure solely by means of the 2-dimensional interproximal projection on periapical radiographs is insufficient. Utilising a periapical radiograph to describe the 360° profile of an implant crown, is like taking a screenshot to describe a movie: it only shows one out of the many very different aspects. Furthermore, a major limitation was that the peri-implant soft tissue is not visible in periapical radiographs, thus

there was no possibility to relate the crown contour to the actual position and shape of the healthy or inflamed mucosa. The mesial and distal contour was referred to as “Emergence Angle”, but in reality, there can be no “emergence” without the soft tissue which the crown is emerging from. Emergence Profile (EP) and Angle (EA) based on the Glossary of Prosthodontic Terms 9th Edition, can only be defined in relation to the “circumscribed soft tissues”, which cannot be accounted for in periapical radiographs. Finally, one of the difficulties with previous studies was that the angles were calculated using “tangent” lines. Geometry defines “tangent” as the

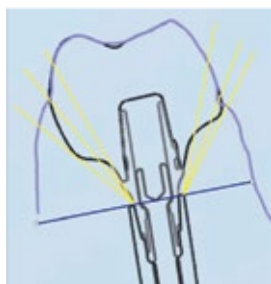


Figure 1. In the complex morphology of the transmucosal profile, where areas of convexity are often interchanged with areas of concavity, defining "tangent" lines can be very imprecise without defining a consistent point on the prosthesis. Different lines (yellow) will correspond to different angles and different configuration of convexity or concavity based on which point of the prosthesis is selected.

line which can be drawn perpendicular to the diameter of a perfect circle, but in the complex and irregular curves of the implant crown a precise tangent is next to impossible to define precisely, seriously limiting the reproducibility of measurements [Fig 1]. So, although these early studies pointed towards a serious interrelation between prosthetic contour and tissue health, the exact features that affect this relation could not be defined. Also, the threshold of 30° is more of a statistical cut-off point that describes the specific sample, rather than a biological fact. We should note that 2 lesser-known cross sectional studies which followed similar methodology did not confirm the correlation of $>30^\circ$ contour and peri-implantitis ^[7,8].

What new does your recent study bring?

We have thought a lot on the above limitations, and we have discussed extensively how we could come up with a methodology that can overcome much of these boundaries.

The first thing we decided was to move away from the periapical radiographs. Thus, we utilised CBCT matched with intraoral scans, where we could see in detail the full contour of the components in relation to the position, shape, and size of the soft tissue. We then selected six representative sites for each crown 45° apart for our measurements, thus we can see the contour from different angles [Fig 2]. We excluded the directly mesiodistal view, because that is the site under the contact point of the crown, the only site where probing is not possible. It is a paradox that in research we often measure mesial-distal marginal bone loss in peri-apical radiographs and then correlate it with mesial-distal probing depth, when in 3D reality the site of probing and the site of bone loss are far apart. The second important decision was to move away from the "tangent" lines. Instead, we used a methodology from Cephalometry, by defining specific and reproducible points and planes, such as the most coronal point of contact between the soft tissue and the crown [true emergence], or the most apical point of contact between the abutment surface and the implant [Fig 3]. The methodology was rather complex, we would not get into all details to prevent your readers from getting bored. However, by following a pedantic process we increased precision and reproducibility to the level that two independent observers would come to the same result more than 95% of the times and when not the deviation was minimal.

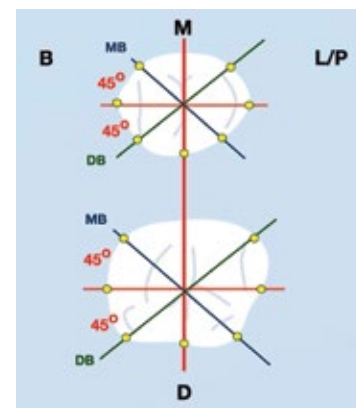


Figure 2. Six sites (Mesiobuccal MB, Midbuccal BB, Distobuccal DB and respective Midlingual/midpalatal LL, Distolingual DL and MesiLingual ML) were defined based on 3 planes for each implant crown. Clinical examination data and (Plaque Index, Bleeding on Probing, Probing Depth, Keratinised Width) and 3D imaging measurements were conducted at all six sites.

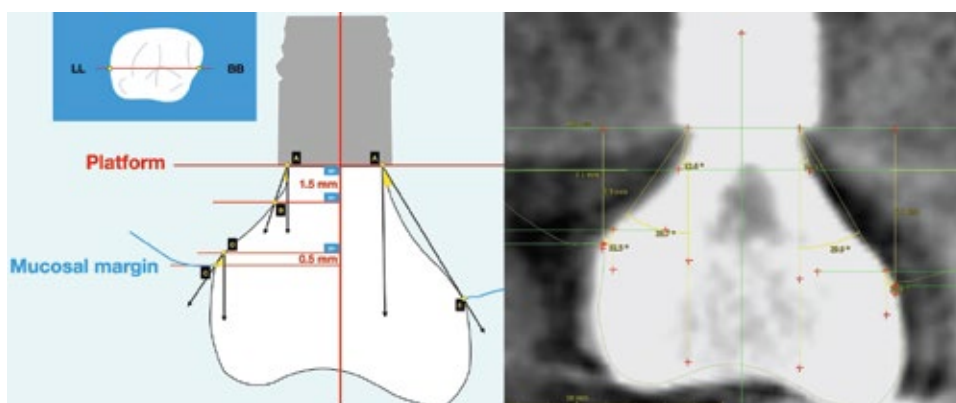


Figure 3. left: Schematic representation of Buccal-Lingual slice and definition of 4 horizontal planes perpendicular to implant axis, 5 points (A-E) and the respective 3 angles measured on each side A-B: Deep Angle, D-C: Mucosal emergence Angle, A-E: Total Angle (control). Right: Actual 3D imaging screen of the respective Buccal-Lingual slice drawn left.

Finally, we moved away from one single line to define "contour". Instead, we defined two different angles: The Mucosal Emergence Angle (MEA), the point where the true emergence through the soft tissue takes place and the Deep Angle (DA), at the apical part of the implant supracrustal complex, where the abutment ascends from the implant platform and the bone level. We also measured the total contour angle (TA) as previously done in periapical radiographs as a control.

Furthermore, we used a patient sample as homogenous as possible: we only included posterior single crowns at bone level implants, and we excluded cases where the prosthesis axis was more than 10° divergent from implant axis. We also excluded all probing depth measurements in sites where the crown contour preventing proper insertion of the probe. This is a very important point, as we all know in clinical practice that it is very difficult to probe over-contoured implants without underestimating the probing depth [Fig 4]. We ended up excluding about 4% of the measurements, but we have increased this way the validity of the results, by securing that the analysis did not include mistaken or underestimated probing depths. We also used some sophisticated statistics, accounting for three analysis levels: site, implant and patient.

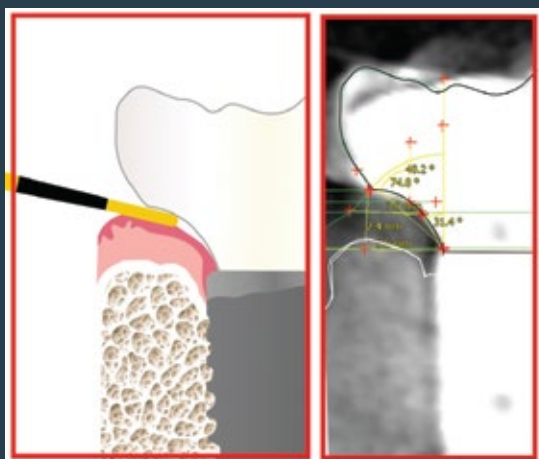


Figure 4. Over contouring of the crown can seriously inhibit proper probing and typically lead to underestimation of the probing depth. In this study we excluded probing depth measurements from the analysis, when the probe could not be inserted properly, leaving out approximately 4% of the measurements. Interestingly, the corresponding MEA at these sites was 70.1° (range 67°–79°).

What was the main result of the study?

The first important finding was - maybe not surprisingly - a very clear and strong correlation of the Mucosal Emergence Angle with inflammation. The risk for inflammation increased in proportion to the widening of the MEA, somewhat slower up to angles of 40° but rising steeper with angles of 50°, 60°, and 70°. As an indication, sites with mucosal angle of $\geq 70^\circ$ had 33 times higher risk for bleeding. When all 6 sites of an implant prostheses had MEA $\geq 40^\circ$, the risk of having bleeding at all 6 sites was 9.5 times higher. At the same time, no such association was found for the Deep Angle. There was a strong message there: when it comes to inflammation, it's the emergence that matters, not the entire contour. Thinking of how inflammation starts as a reaction to the biofilm, it makes absolute sense. The deep angle on the other hand is at the bottom of the Implant supracrustal complex and was not associated with inflammation. This is not surprising either, this area is far from the reach of biofilm at least under healthy conditions. It could be an angle that relates with the early marginal bone loss, or "remodelling" in the short period after the implant placement. But this is something for another discussion.

So, what was the main clinical message from your study?

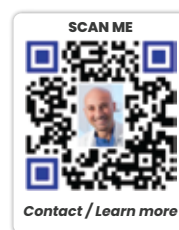
The message is simple, as much as it is powerful: Inflammation starts from the top of the soft tissue. The relation of the implant crown with the soft tissue margin is of strategic importance, as this is the very point of initial plaque accumulation. A narrow angle of the crown at this point will facilitate oral hygiene, 360° removal of the biofilm and will reduce the risk for inflammation. The wider this angle the higher the risk. Is there a cut-off threshold? I would not think so. Such thresholds are more statistics than actual biological findings. Statisticians typically would choose the number that gives the highest statistical significance and use it as a threshold, e.g., $\geq 30^\circ$, but this does not necessarily reflect a biological phenomenon. So complex and multifactorial phenomena as inflammation would be more correctly approached by a range, rather than one single cut-off value or an average. Looking at the risk curve we can say that the risk rises mildly from a MEA of 20° to 40°, then steeper towards 50° to 70°. There is no absolute safety zone, but maintaining MEA no wider than 30°–40° is advisable, while the aim should be to keep this angle as narrow as clinically feasible.

And now what next?

This was our first set of clinical data pointing out to the importance of design for clinical outcomes. The data we have compiled from patients included many more parameters, analysis of concavity or convexity, marginal bone levels, detailed tissue measurements. We even got some more ideas while analysing the data. This is the beauty of 3D imaging, once the reconstruction of the implant supracrustal complex is done, the data is saved and can be accessed and measured again and again with different approaches or methods. We are grateful to have the support of a great multidisciplinary team at Chulalongkorn University as well as a multicontinental team of experts, so we are on the way to bring up much more soon! For now, you can read the first paper for more details which is available open access thanks to Karolinska Institute and Chulalongkorn University. We are looking forward to your thoughts, suggestions, and comments!

Read the paper now: <https://onlinelibrary.wiley.com/doi/epdf/10.1002/cre2.750>

Association of Prosthetic Angles of the Implant Supracrustal Complex with Peri-implant Tissue Mucositis.
Runthanakiat et al. *Cin Exper Dental Res* 2023



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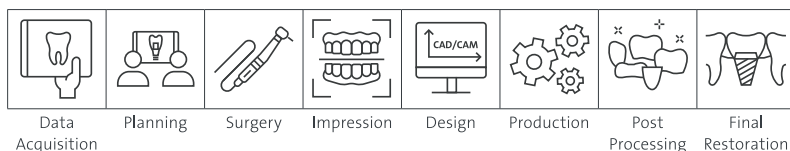
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CASE STUDIES

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 SOFT	7 days	~0.5mm	- Eases the patient in with greater comfort - Flexible and easy to insert / remove - Stretches ligaments - Stimulates bone remodelling
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* Each step's changing time may vary at the dentist's discretion, subjected to good compliance and fit as the patient progresses.

Reference:

- Schupp, W., & Haubrich, J. (2023). Aligner Orthodontics and Orofacial Orthopedics (2nd ed.). Quintessence Publishing.
- Elkholy, F., & Lapatki, B. G. (2018). Recommendation of a novel film-thickness sequence, 0.4, 0.5 and 0.75 mm, for aligner systems. Journal of Aligner Orthodontics, 2(4), 295–304.

CASE 1

PATIENT INFORMATION

Age: 26 Gender: Male

CASE DESCRIPTION

- Slight Deepbite
- Slight Midline Discrepancy
- Minor Crowding

TRIOCLEAR™ TREATMENT

Complete

TOTAL TREATMENT TIME

8 months

RETENTION

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Mandibular Ecodont™ Retainers

Pre-Treatment



Post-Treatment



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CASE 2

PATIENT INFORMATION

Age: 37 Gender: Male

CASE DESCRIPTION

- Crowding on front upper and lower teeth
- Midline Discrepancy

TRIOCLEAR™ TREATMENT

Complete

TOTAL TREATMENT TIME

12 months

RETENTION

Maxillary Ecodont™ Retainers
Mandibular Ecodont™ Retainers

RESULT ACHIEVED

- Class I relationship maintained
- Functional canine guidance on both sides
- Deepbite improved
- Midline corrected
- Proper axial inclination of incisors
- Arches aligned and coordinated
- Alignment of both arches through derotation and IPR
- Arch form improved
- Aesthetic smile line was achieved
- All treatment goals were achieved case
- Harmonic arches were achieved

COMMENTS

- In this treatment, minimal attachments were used
- Patient was compliant with chewing exercises

Pre-Treatment



Treatment in Progress



Post-Treatment





New Design Software - Trio iDesign

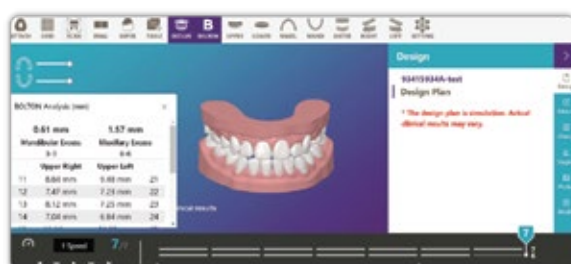
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Clinical Management of Severe Impacted Maxillary Canines



Prof. Kong Weidong



Dr. Kevin NG

CASES REPORTS & LITERATURE REVIEWS

“

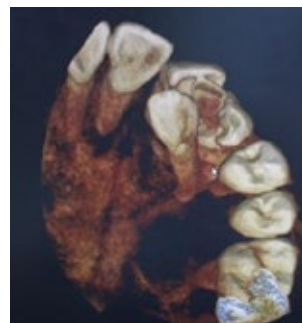
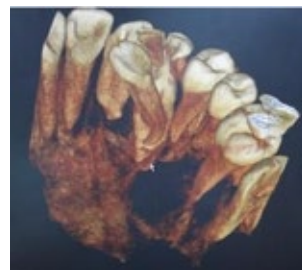
Maxillary canines are the most commonly impacted teeth after the third molar and affect approximately 1-3% of the population. Maxillary canine impaction commonly occurs at a young age in between 1% and 3% of patients and is more common in females than males. Canine impaction is twice as likely to occur in the maxilla than in the mandible, and 8% of patients affected by maxillary canine impaction have bilateral impaction. About one-third of maxillary canine impaction is located labially, whereas two-thirds are located palatally. The main causes of canine impaction are genetic, localized, or systemic. The treatment options for impacted canines include no treatment, surgical exposure, orthodontic treatment, and extraction.

Canines play an important role in the appropriate appearance of teeth, facial features, and functional occlusion. Therefore, orthodontists have proposed different techniques to recover impacted maxillary canines.

CASE 1

Young male patient aged 15, complained of crowding of anterior teeth. Patient presented with upper severe crowding and anterior reverse bite. 22 and 23 were impacted with malposition roots formation. Facial profile was concave and Class III molars relationship on the left side. Treatment plan was to locate and align the impacted lateral and canine and to correct the reverse bites with wires and brackets. Total treatment time took 24 months and the results was satisfied and 21 required root canal therapy and porcelain crowns when patient reach 18 years old.

Clinical Pictures



Before & After Treatment OPGs



CASE 2

Female patient aged 11 when she first came in for routine check-up. OPG revealed horizontally impacted 13 with retained deciduous canine. Treatment Options were discussed with parents either wait for 18 years old to remove c then replaced with implant or surgical exposure of 13 and use elastic traction to pull 13 down to occlusion, Risk and benefits were mentioned with possible complication and chances of failure. Parents selected the second option and the Buccal bone of the tooth were removed after an apically positioned surgical flap were opened. The traction was by an e elastic chain which were changed fortnight, hooked to the button cemented on the crown surface. The crown was seen clinically after 5 months. The whole treatment time by traditional wire and brackets to align the dentition was about 18 months. There were no root resorption observed and no other complications.

Clinical Pictures



Before & After Treatment OPGs



DISCUSSION

The prevalence of canine impaction was reported about 0.8-3.6%, no gender difference was found. ^[8,11]

The common etiology factors include: Tooth size discrepancies, failure of primary canine root resorption, early loss and prolong retention of deciduous canine, ankylosis of permanent canine, neoplasm or cyst, root dilaceration, absence of permanent canine, peg shaped lateral, lateral root formation variation of timing, iatrogenic and idiopathic factors, endocrine deficiency, Febrile disorder irradiation, heredity, presence of alveolar cleft, and malposed tooth germs.

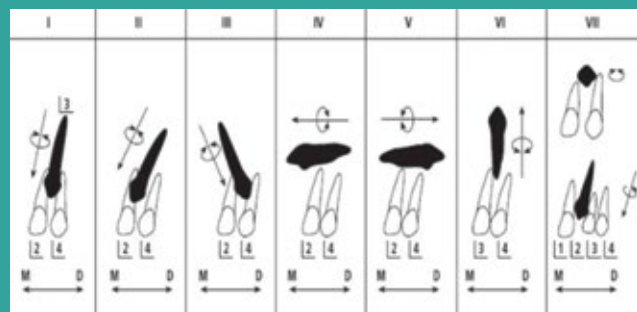
Early treatment of palatally erupting maxillary canines by extraction of the primary canines was suggested. ^[1]

Classification of impacted Canine by Ericson and Kurol ^[2]

Sector

- I. The cusp of canine is between mesial aspect of the first premolar and the distal aspect of the lateral.
- II. The cusp tip of canine is between the distal aspect of the lateral and the long axis of the lateral.
- III. The cusp tip is between the long axis of the lateral incisor and the mesial aspect of the lateral.
- IV. The cusp tip is between the mesial aspect of lateral and long axis of the central incisor.
- V. The cuspid of the canine is between the long axis of the central and the inter-incisor median line.

Yamamoto in 2003 proposed 14 classifications of impacted canines: Type I was reported to be 55% in female, male was 44% and II was 55% for male and 44% for female. IV was seldom found. VII was found to be 66% and male 33%. ^[11,12]



Canine impaction classification from panoramic dental radiographic images ^[6]

Lai in 2013 reported that: "There was a significant correlation between root resorptions on adjacent teeth and localization of the impacted canine in relation to the bone, as well as vertical localization of the canine. Interrater agreement showed values of 0.546–0.877. CBCT provides accurate information about location of the impacted canine and prevalence and degree of root resorption of neighboring teeth. There was a significant correlation between root resorptions on adjacent teeth and localization of the impacted canine in relation to the bone, as well as vertical localization of the canine. Interrater agreement showed values of 0.546–0.877. CBCT provides accurate information about location of the impacted canine and prevalence and degree of root resorption of neighboring teeth." ^[6]

Ericson et al suggest that extraction of the primary canine is the treatment of choice in young individuals to correct palatally ectopically erupting maxillary canines provided that normal space conditions are present, and no incisor root resorptions are found. ^[2]

Maxillary incisor root resorption in relation to the ectopic canine: No relationship could be found between resorption and the retention or loss of the deciduous canine. ^[5]

In severe cases, surgical exposure and orthodontic alignment should be considered. ^[7]



Factors affect surgical treatment:

Age, General Health, can consider use 4 to replace canine, Medical contra-indications, X ray position, canine angulation, Vertical height of canine crown, antero-posterior of canine apex, crown overlap adjacent teeth, Labial palatal position of canines root, adequate width of attached gingival.

George et al suggested using orthodontic extrusion after surgical expose the impacted canine by an apically positioned flap. The goal was to provide means for correct position for orthodontic anchorage, to ensure favorable tissue anatomy to permit long term maintenance of periodontal health and aesthetic. ⁽⁴⁾

Francis in 2017 advocated the use of tunnel technique to ensure aesthetic and periodontal outcome. These include: 1. Window exposure 2. Apically re-positional flap 3. Flap closed eruption technique and 4. Tunnel traction. The tooth that requires orthodontics re-rotation also had transection of supra alveolar fibers to prevent rotation relapse.

The surgery involving the impacted canine compromised alveolar bone integrity. Grafting may be necessary, and implant replacement is advised. Post operative complication includes swelling and pain, hematoma, osteitis, suppuration, paresthesia, unaesthetic, maxilla sinus communication and adjacent tooth pulp necrosis. ⁽⁹⁾

The use of CT yields information which is much more detailed than that observed on conventional X-rays, such as: pathological resorption on adjacent teeth caused by aberrant canines; the localization of the injury and the position of the canine in relation to one or both incisors. ⁽¹⁰⁾

CONCLUSION

1. Maxillary Impacted canine cause esthetic and complications problems which require early diagnosis and careful treatment planning at the early stages.
2. OPG ray and CBCT are useful tools to locate and surgery plannings.
3. Orthodontic treatment to provide necessary anchorage and stability for periodontal and soft tissue.
4. Good communication with patient and co-operations from patient is most important for satisfactory outcome.

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Funding for clinic set up

***Example for a 600 sq ft clinic with 2 treatment rooms.**

Item	Expense	Market Price	Discount	Net Cost	Savings
Equipment	Complete Set-up for 2 Treatment Rooms	\$ 1,000,000	30%	\$ 700,000	\$ 300,000
	<i>Including: CBCT x 1, Dental Chair x 2, Compressor & Suction x 1, X-Ray x 1, Autoclave x 1</i>				
Consumables	Initial Stock of Daily Consumables	\$ 200,000	30%	\$ 140,000	\$ 60,000
	<i>Including: Instrument, Handpiece, Restorative, Endo, PPE & Disposables</i>				
Finding Location	Property Agent Commission (Assuming \$80,000 rent)	\$ 40,000	50%	\$ 20,000	\$ 20,000
Design & Renovation	Cost of Design & Renovation	\$ 700,000	10%	\$ 630,000	\$ 70,000
Clinic Branding	Design & Production Fee	\$ 10,000	100%	\$ 0	\$ 10,000
IT Support	Supply and installation of computers including network set-up	\$ 45,000	30%	\$ 31,500	\$ 13,500
Software	Annual Package of "ClinicSolution" Management System & "YOOV" Booking System 3 Months Trial on "YOOV" Booking System	\$ 14,400	30%	\$ 10,080	\$ 4,320
Company Registration Fee	Application & Cost for Clinic's Business Registration	\$ 6,500	100%	\$ 0	\$ 6,500
Total	Estimated Set Up Cost	\$ 2,006,500	Save 24%	\$ 1,525,000	\$ 481,500

* Applicable to Hong Kong market only

High Quality at High Altitude in China's Shangri-La Region

cult WINE INVESTMENT

Written by: Joe Alim and Mengyan Zhu | Cult Wines Ltd

It is well known that China is a behemoth of a market with regards to wine consumption. What is less known, however, is that the country is home to a myriad of small wineries producing exceptional quality wines. The most prominent and exciting of these regions is Shangri-La – a county in Yunnan province. This region is renowned for its high-altitude vineyards, situated in the foothills of the Tibetan Himalayas; some 2000-2400m above sea level. In fact, the latitude of the region is the same as the Sahara Desert, but this elevation is vital in keeping the climate cool enough for effective viticulture. The most prevalent grape varieties are Cabernet Sauvignon and Merlot for the reds and Chardonnay for the whites.

In 2013 LVMH released their first vintage of Ao Yun, probably the region's most well-known wine. After years of searching across China, they decided that Shangri-La provided the ideal location to launch their inaugural China-based winery project; convinced that the terroir could produce wines to rival those produced anywhere else in the world.

The winery's greatest achievement to date has undoubtedly been their latest release – the 2019.

This was rated at 96 pts by Edward Ragg at The Wine Advocate, the highest score ever given to a Chinese wine. Trading at £200-£300 per bottle, Ao Yun's price is just as impressive as the wine in the bottle.

But Shangri-La is more than just this one wine. XiaoLing is another highly regarded winery in the region, and Cult Wines recently spoke with winemaker Feng Jian about their work and the wider Shangri-La region.



"It just needs time and more attention from the press," Feng Jian said about the international profile of the region. "We need an association which could represent the region with fundamental things like regional maps, articles and a website. It is such a tiny region in terms of quantity, but surely it could become the jewel in the crown for China's wine regions if things can be done properly."

Although its wines primarily use Cabernet Sauvignon, XiaoLing's roots are in the Cote d'Or. Bertrand Cristau (estate CEO) is related to the family of Domaine Bouchard Pere et Fils, and Sylvain Pitiot (former wine maker at Clos de Tart) is the lead consultant and second largest shareholder. The estate blends its wines with grapes grown in different villages across the region, all with distinct characteristics.

"There is no big difference between now and when we started (in 2014), but we are turning to more reductive handling for the whites and building up texture while improving the overall balance of wine," he explained. "In

addition, we are putting every effort to improve overall cellar cleanliness and are gradually shifting to spontaneous fermentation for all our wines." XiaoLing's philosophy is deeply entrenched in the local area, and they are committed to supporting the local Tibetan population.

"Absolutely crucial," said Feng Jian about the local expertise. "The growers own and work in the vineyard, so the quality of fruit largely depends on our communication about the requirements. It is more than just a working relationship; there is also a cultural and religious respect; very complicated and unique management is adopted here."

This relationship is a big reason why the future for the region and XiaoLing looks bright. In keeping with the estate's Burgundian ethos, XiaoLing plans to release a 'Terroir Series', a range of five single village cuvees, which fits with their overall plans for the next five years: "Simple. Keep making wine from as many plots as we can and select the best ones for our holdings. This will place us in a better position in long term."

Implementing a More Effective Recruitment Strategy in the Dental Practice

Recruitment has been a major challenge for many employers over the past year. This is particularly true of dental nurses; it is estimated that around 40% of whom are looking to leave the profession in the next few years which is concerning when they are one of the main employees of most dental practices.

Consequently, it is important to get the recruitment process right! Before hiring anyone, practice owners should take time to consider the gaps in the workforce, why a new person is needed, and what specific skills are required to fulfil the role. Once these identifications have been made, practices should analyse their current recruitment strategy and assess whether it provides the most effective results. An in-depth review can help understand whether they're meeting candidates' needs and expectations and standing out from the crowd in a competitive recruitment market. Moreover, salary transparency and flexible working arrangements have been seen to be two of the priorities for applicants. While home working won't be appropriate for most of the dental roles, practices can still promote flexibility with working hours and patterns.

And unemployment rate tends to be higher for youngster. As such, employers should take into consideration the lack of experience and/or qualifications of younger workers when completing recruitment exercises and not automatically



dismiss individuals who don't fit the traditional job requirements. Practices can also benefit from offering trainee programmes or apprenticeship, to build long-term working relationships and be involved in the shaping of young careers.

Similarly, there's been significant attention placed on encouraging 'unretirement' and return to employment for those who had left their careers due to caring responsibilities or other personal commitments. Ultimately, this will enhance recruitment strategies and should boost retention rates.

Oak Dental Partners Selects VideahHealth as AI Partner

Oak Dental Partners will now use Videah Assist's AI-powered X-ray image analysis for both adult and paediatric cases. This enhances diagnostic recommendations so clinicians can deliver better patient outcomes and experiences.

It highlights areas of interest that may require intraoral investigation to help dentists and hygienists verify diagnoses and drive additional confidence in their treatment recommendations. Based on their data, case acceptance rates for patients can go up by as much as 45%, signalling meaningful improvements in patient confidence and trust.

"Transparency and ethics should always be at the focus of clinical decision-making, and AI is really helping to bring that to the forefront of dentistry. As a paediatric provider, I want to have every parent involved in terms of what's going on with their child's health," said the representative from Oak Dental Partners. "Having AI in the office brings so much clarity when showing parents radiographs and caries progression. It allows me as a provider to justify why something needs or doesn't need to be done and at the same time help educate the parents about oral health and connect verbal information with a visual representation."

"Oak Dental Partners invests heavily in its affiliated dentists so they can focus on delivering exceptional patient care. We're thrilled that Videah Assist is now a valuable tool in their clinical toolbox so providers can detect diseases more effectively while offering families transparency into their treatment plans, fostering greater trust, and improving oral health," said Miss Hillen of VideahHealth.

BAN Toxics Calls for No More Mercury Dental Fillings in Children

Amalgam is a dental filling material that is 50% mercury, a neurotoxin and pollutant. Recently, BAN Toxics marked an historic milestone in the effort to protect children from amalgam's mercury: the one-year anniversary of winning the Children's Amendment to the Minamata Convention on Mercury. More than 100 governments including the Philippines decided unanimously to call for the end of amalgam use in children and pregnant and breastfeeding women. The Philippines has enacted several policies consistent with the Amendment. The amendment represents a worldwide consensus that dental amalgam is not safe for children and other vulnerable populations – it is not safe in their mouths, and it is not safe in their environment. Entering into legal force on 28 September 2023, the Children's Amendment will protect children from exposure to toxic dental mercury, prevent amalgam's mercury from polluting our environment, and improve oral health by preserving tooth structure that must be removed to insert amalgam fillings.

"As we celebrate the first anniversary of the landmark Children's Amendment, BAN Toxics calls for the end of all mercury amalgam use in children. We will continue to advocate for mercury-free dentistry in and outside of the Philippines. Our children deserve a toxics-free future, and this is amplified in our call to stop the manufacture, trade, and use of dental amalgam and the promotion of safer and more accessible alternatives," the group said.

Dental Industry News

Medit Launches New Occlusion Analyzer App



Medit, a leading provider of 3D intraoral scanners and digital dentistry solutions, has recently announced the release of its new app, the Medit Occlusion Analyzer. It allows dental professionals to perform occlusion analysis quickly and easily without the need to return to the Medit Scan for Clinics or reprocess data. With the app's automatic detection and analysis of occlusal interferences, users can explore the occlusal relationship and review results through annotations and colour maps.

The app's section view feature enables users to create section planes to examine specific areas of interest and use multi-View to compare sections of multiple planes. Additionally, the app allows users to measure distances by one or two points for greater accuracy.

The app also includes a colour map, available in both opened and closed states, to provide a visual representation of the occlusal relationship. With alignment and edit modes, users can realign jaw data to occlusal bite based on selected areas or points and edit data by trimming, sculpting, or filling holes. The app also allows users to replay mandibular movement recordings.

"We are thrilled to launch the Medit Occlusion Analyzer, which is an essential tool for dental professionals who are looking for an accurate and efficient way to analyse occlusion," said Mr Michael Lee, CTO of Medit. "Our app will help users save time and effort, allowing them to focus on delivering high-quality care to their patients."



GOAT STORIES

It is believed that root of coffee came from a bedtime story about a goatherd named Kaldi, who lived in the land of Arabia Felix, and his goats; however, if this story is told by an Ethiopian, then the place which Kaldi lived will be in Ethiopia. One day, Kaldi's goats did not come back to him, then in the next morning he found his goats dancing beside a shiny, dark-leafed shrub with red berries. He then started dancing with his goats and came up with a thought that red berries on the shiny, dark-leafed shrub aroused the eccentric behavior of goats.

Afterwards, an imam came by, he always felt sleepy when praying, but after he saw Kaldi and goats dancing near the shiny, dark-leafed shrub with the red berries, his coming act made neither he nor his fellows from monastery fall asleep while praying. He subjected the red berries, then did a lot of experiments. One of which was parching and boiling, then this method became popular in monastery and spread throughout the place, then to the rest of the world.

COFFEE REACHES EUROPE

From there, coffee quickly spread throughout the Middle East, where it became a popular beverage among scholars and intellectuals. It wasn't until the 16th century, however, that coffee made its way to Europe, thanks to the efforts of a Venetian trader named Prospero Alpini. Alpini brought back coffee beans from his travels to the Middle East, and soon coffeehouses began popping up all over Europe.

But coffee was not without its detractors. In fact, there were many who saw it as a dangerous and subversive beverage. In 1674, the Women's Petition Against Coffee was published in England, in which it was claimed that coffee led men to become impotent and lazy, neglect their duties at home, and spend all their time in coffeehouses. The petition was signed by over 1,000 women, and while it didn't succeed in banning coffee altogether, it did lead to the creation of new laws that restricted the opening hours of coffeehouses.

ROOTS IN ETHIOPIA

European first found coffee cultivated in Yemen, near the southern tip of the Arabian Peninsula. Therefore, most of the Europeans assumed that coffee was initiated in Yemen. However, botanical evidence shows that coffee should be initiated in Ethiopia. *Coffea arabica*, which is the most original shape of coffee, were found originated on the plateaus of central Ethiopia. It grows in a wild area which is shaded by rainforest.

COFFEE

ONE OF THE MOST POPULAR BEVERAGES IN THE WORLD

I believe it is undeniable that coffee is not only a beverage, but also an artwork for its fragrancy and attractiveness. For centuries, people have relied on this caffeinated beverage to help them wake up, stay alert, and power through the day. However, have you ever wondered how coffee became such an integral part of our lives? The story of coffee is a fascinating and often hilarious one, full of twists, turns, and unexpected developments. Let's dive into the history of coffee!



SPREADING AROUND THE WORLD

Despite these seatbacks, coffee continued to gain popularity around the world. In the 18th century, coffeehouses became hotbeds of political and social activity, with thinkers and activists gathering to discuss the issue of the day. In fact, some of the most important events in history have been planned and plotted in coffeehouses, from the French Revolution to the American Civil War.

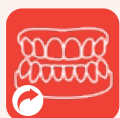
Of course, coffee's popularity wasn't limited to the world of politics. In the early 20th century, coffee became a symbol of modernity and progress, with companies like Folgers and Maxwell House launching massive ad campaigns to convince Americans that coffee was an essential part of the "American way of life." And with the rise of Starbucks and other high-end coffee shops in the 21st century, coffee has become more than just a beverage—it's a lifestyle.

But perhaps the most heart-warming aspect of coffee's history is the role it has played in bringing people together. From first dates to business meetings, coffee has been a social lubricant for centuries, helping people to connect and communicate with one another. And in many cultures, the act of sharing a cup of coffee is a symbol of hospitality and friendship.

So, there you have it—the hilarious, heart-warming story of how coffee became the world's favorite beverage. From its humble origins in Ethiopia to its status as a global phenomenon, coffee has come a long way in its 1,500-year history. And whether you prefer your coffee black, with cream and sugar, or a fancy latte, there's no denying that this little bean has had a big impact on our world.



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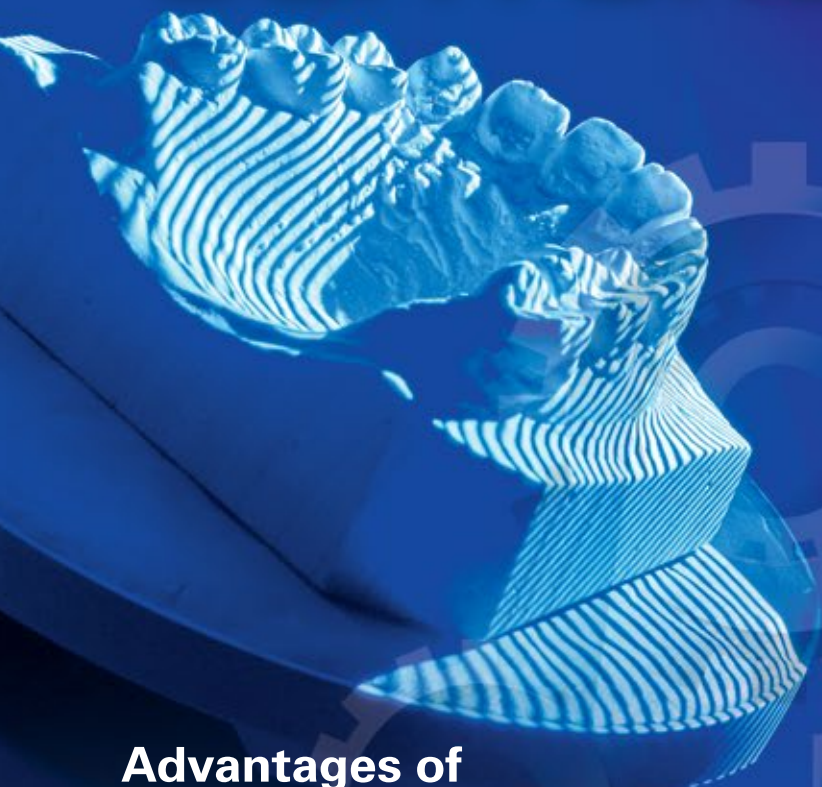
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Complications and treatment errors in implant positioning in the aesthetic zone: Diagnosis and possible solutions

Dr. Stephen T. Chen

Dr. Daniel Buser

Dr. Anton Sculean

Dr. Urs C. Belser

INTRODUCTION

Dental implants today provide reliable and predictable treatment modalities for replacing missing teeth. The last 2 decades have seen a rapid expansion of implant therapy in general dental practice, with an increased focus on single tooth implants in the aesthetic zone and partially edentulous patients.¹ In a recent systematic review, 18 studies reporting on 10-year survival of titanium implants with micro-roughened surfaces were identified. A total of 1123 patients received 2688 implants. After 10 years, the summary estimate for the 10-year survival rate was 96.4% (95% CI: 95%-98%) with the associated prediction interval ranging from 92% to 99%.² This predictability has led to confidence in dental implant therapy as a viable treatment modality and its increased utilization in dentistry over the last 2 decades. In data from the USA, the prevalence of dental implants in the population increased from 0.7% in 1999 to 2000 to 5.7% in 2015 to 2016. When adjusted for covariates, there was an average 14% increase in the prevalence of dental implants each year, with a 13-fold increase in implant prevalence in the 65- to 70-year-old age cohort compared with the 18- to 34-year-old cohort. On current trends, the projected increase in prevalence of dental implants in 2026 would be 17%, with less conservative projections suggesting the prevalence could reach 23%.³ There are no doubts that these projections would be similar in many countries around the world.

With this increase in the number of patients receiving implants, there will be an inevitable rise in complications. Implant complications are related to four factors: the patient, the biomaterials used, the treatment approach, and the clinicians involved (Figure 1).⁴ The clinician has responsibility for (i) evaluating the patient and assessing their risk profile, (ii) selecting the appropriate biomaterials to be used, (iii) selecting the most appropriate treatment approach to provide predictable outcomes with a low risk of complications, (iv) undertaking the procedural aspects of the treatment, and (v) monitoring and maintaining peri-implant health and managing complications if they arise. It is clear that the clinician bears significant responsibility for outcomes, including complications. It follows, therefore, that human factors resulting in errors of judgment represented the primary cause of complications in implant therapy.⁵ In other words, the clinician is the main cause of implant complications and the biggest risk factor for the patient.

A common clinician-related error is incorrect implant positioning, which can lead to functional and aesthetic compromise. The concept of three-dimensional implant placement to ensure that implants are placed in the correct position according to the prosthodontics needs was already established over 2 decades ago.^{6,7} Despite this well described concept, errors in implant positioning remain a common occurrence today.⁸ Malpositioned implants can result in significant aesthetic complications with loss of peri-implant soft tissue volume and recession of the peri-implant mucosa and papillae,⁹ and may also complicate successful prosthodontic rehabilitation.¹⁰

IMPLANT POSITIONING ERRORS

At the Third ITI Consensus Conference in 2003 in Gstaad, Switzerland, the concept of "comfort" and "danger" zones for positioning of dental implants in the aesthetic zone was established.¹¹ Implants placed in the danger zone were regarded as being malpositioned and increased the risk for aesthetic complications. The comfort and danger zones may be defined in three dimensions: mesiodistal, coronal-apical, and orofacial (Figure 2). The following will describe the etiology and outcomes of implant positioning errors in these three dimensions. This will be followed by a subsection on possible treatment strategies.

■ Mesiodistal malposition

When an implant is placed too close to an adjacent tooth, there is a risk of a reduced height of the tooth-implant papilla because of resorption of the proximal bone at the adjacent tooth. This phenomenon was originally described for implants designed with an external hexagon abutment connection.¹² The micro gap at the implant-abutment junction results in localized bone remodeling that forms a crater- or saucer-like defect within the bone 1.0-1.5 mm lateral¹³ and 1.5-2.0 mm apical to the implant-abutment junction.¹⁴ This crater forms circumferentially around the implant (Figure 3A). If the facial bone wall is thin, the crater does not form in this region; rather, the bone is resorbed on the facial aspect (Figure 3B). If the implant is placed greater than 1.5 mm from the adjacent teeth, the crater forms without loss of

the proximal bone at the adjacent teeth (Figure 3C). If, however, the implant is placed less than 1.5 mm from the adjacent teeth, the bone remodeling causes loss of height of the proximal bone at the adjacent tooth. Because the proximal bone supports the papilla, it therefore follows that loss of proximal bone height at the adjacent teeth will result in reduction in the height of the tooth-implant papilla. The situation is often further compromised by recession of the gingiva and exposure of the root surface on the adjacent natural tooth (Figure 4A,B). This concept was corroborated in a study that found that the apical position of the proximal bone crest correlated with reduced height of the tooth-implant papilla.¹⁵ More recently, implants with an internal

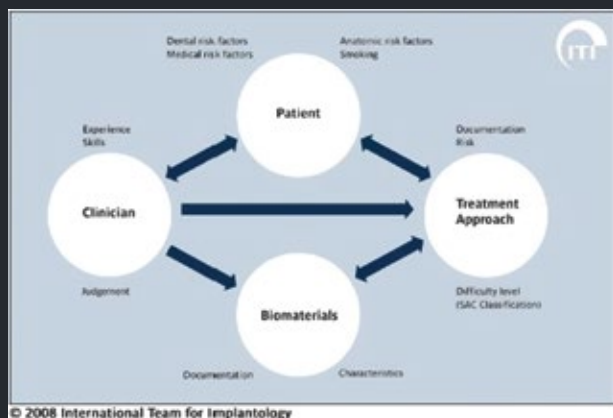


FIGURE 1 The four factors related to implant complications: the patient, the biomaterials used, the treatment approach, and the clinician. (Image from ITI Treatment Guide Vol. 3, *Implant Placement in Post-Extraction Sites*, 1st Edition, 2008 [p. 18, Figure 1] and *The SAC Classification in Implant Dentistry*, 1st Edition, 2022 [p. 10, Figure 2] used with permission from the International Team for Implantology and Quintessenz Verlags-GmbH). SAC, Straightforward, Advanced, Complex

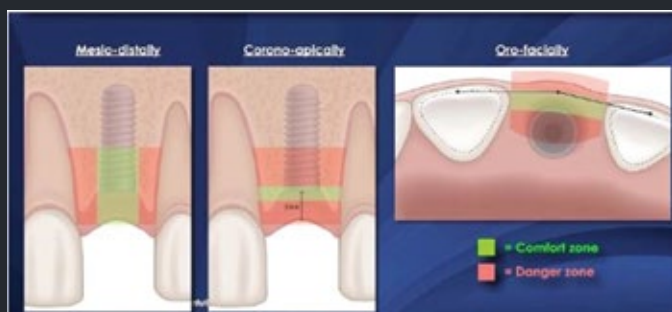


FIGURE 2 The concept of comfort and danger zones for positioning of implants in three dimensions: mesiodistally, corono-apically, and orofacially. Implants that are placed with the shoulder within the danger zones are more likely to be associated with compromised outcomes

conical connection have been designed to minimize crestal bone remodeling.¹⁶ These implants retain marginal bone by creating a “platform switch”, in which the micro gap at the junction of the implant to the abutment is shifted internally away from the outer shoulder of the implant. Although it has been claimed that these implants can be placed closer than 1.5 mm to the adjacent teeth with only minimal proximal bone loss,¹⁷ the proximity can be difficult to manage prosthodontically and reduces the space for the tooth-implant papilla to develop properly.

Proximity to adjacent teeth may arise if the osteotomy is not prepared correctly in the mesiodistal center of the gap. This may be a result of an unrecognized positional error at the time of surgery, or sometimes because of a correction made at the time of surgery to avoid local anatomic structures, such as a prominent nasopalatine canal (Figure 5). Oversized implants for the space can result in the same type of complication.

Because of the cratering effect described previously, it has previously been recommended that a minimum 3 mm distance between the shoulder of adjacent implants be maintained to minimize proximal bone loss and to provide adequate support to the interimplant soft tissues.¹³ These recommendations were based on implants designed with external hexagon abutment connections. Even with sufficient separation between implants, however, maintaining inter-implant soft tissue height can be challenging. The papilla can still be deficient, even in the presence of adequate interimplant bone. An average soft tissue height of 3.5 mm over the crestal bone between two implants may be insufficient to completely fill the interdental space^{18,19} (Figure 6A,B).

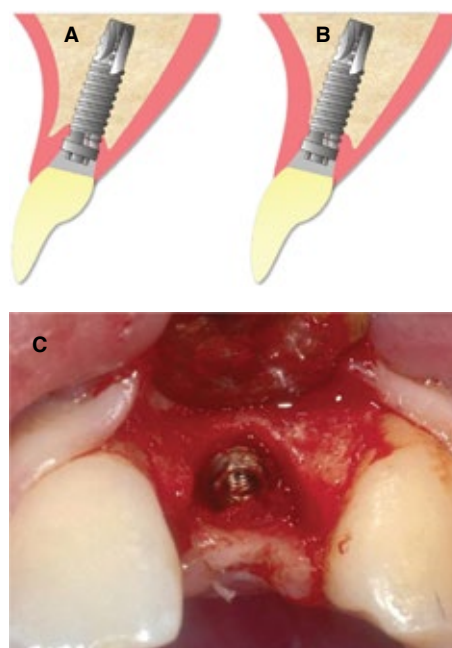


FIGURE 3 The formation of a crater- or saucer-like defect around implants with an external hexagon connection is depicted in these diagrams. A, If the facial wall is thick, a crater forms on the facial aspect. B, If the facial bone is thin, the bone resorbs to the first thread, leaving the facial soft tissue unsupported. C, A bone crater or saucer has formed around the neck of this implant with an external hexagon abutment connection. The crater extends 1.5 mm laterally from the implant to the proximal bone walls mesially and distally. As the distance from the implant to the adjacent teeth was > 1.5 mm, the proximal bone on the adjacent teeth have been preserved. Where the bone wall was thin on the facial aspect, a shallow crater has formed with loss of facial bone height



FIGURE 4 A, The papilla between the maxillary left central incisor and the lateral incisor implant has reduced in height. In addition, there has been recession of the gingiva on the distal and disto-facial aspect of the central incisor. B, The radiograph shows the proximity of the implant to the maxillary left central incisor. The peak of bone on the distal aspect of the tooth has receded

In contrast to implants with external hexagon abutment connections, many contemporary implants are designed with an internal conical abutment connection. These designs have been shown to minimize crestal bone loss and formation of circumferential bone craters at the implant shoulder.¹⁶ Several preclinical and clinical studies have demonstrated that these implants may be placed 2 mm apart without a detrimental effect on the interimplant bone peak.^{20,21} However, this degree of proximity may reduce the space available for the interimplant papilla to properly form, thereby adversely affecting the aesthetic result (Figure 7A,B). Therefore, the recommendation to maintain a minimum 3 mm of space between two adjacent implants in the aesthetic zone remains valid.

The aesthetic outcomes with two adjacent implants placed close together may also compromise the emergence profile and outline of the mucosal margin (Figure 8).

■ Coronoapical malposition

In a coronoapical dimension, positioning errors may result in an implant shoulder being placed too shallow or too deep in relation to the comfort zone. For an implant crown to look natural, it needs to emerge from the shoulder of the implant through the transmucosal soft tissue cuff with a proper emergence contour. In the aesthetic zone, implants are generally placed slightly palatally so that the axis of the implant aligns with the cingulum of the restoration to facilitate screw retention of the prosthesis. From this slightly palatal position of the implant, sufficient vertical and horizontal distance are needed to create the proper emergence contour. The recommended vertical distance from implant shoulder to the midfacial mucosal margin is 3–4 mm. If an implant is placed with dimensions less than this, there is a risk that the abutment or even the implant shoulder may become visible (Figure 9A,B). There may also be a need for a ridge lap design in the prosthesis to provide sufficient tooth volume in the cervical region (Figure 10A–C).

A deeply placed implant is a common complication with immediate implants. This is usually associated with attempts to achieve primary stability by “driving” the implant deeper into the osteotomy. Deeply placed implants increase the complexity of restoration, and may have long-term implications for adequate plaque control. If the extraction socket has a thin or damaged facial bone wall, then the subsequent bone remodeling may lead to soft tissue recession.

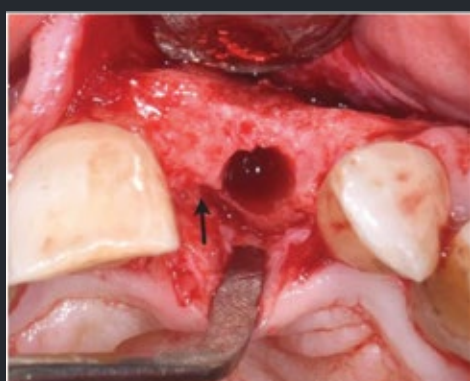


FIGURE 5 The position of the nasopalatine canal (black arrow) necessitated the osteotomy being placed slightly distally in the mesiodistal midline of the ridge. At this position, 2 mm of bone was maintained between the osteotomy and the adjacent lateral incisor



FIGURE 6 A, The papilla between the two implants in the maxillary right and left central incisor sites has flattened because of remodeling of the bone between the two implants. B, The corresponding periapical radiograph shows the flattening of the bone between the two implants. There is approximately 3.5 mm of soft tissue thickness over the interimplant peak of bone

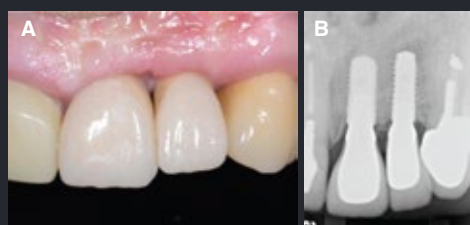


FIGURE 7 A, The interimplant papilla has failed to form because of the proximity of the two implants in the maxillary left central and lateral incisor sites. B, The corresponding radiograph shows that the two implants with an internal conical abutment connection design have been placed about 2 mm apart at the shoulder. Despite the peak of bone present between the two implants, the interimplant papilla failed to form a proper morphology

■ Orofacial and axial malposition

Errors in the orofacial position of an implant can lead to the implant being placed too far palatally, or too far facially. Implants can also be axially inclined too far to the facial or palatal side (Figure 11). Orofacial and axial malposition may often occur together.

An implant may be placed too far palatally because of preexisting bone loss. This is a relatively uncommon complication. In the presence of lack of tissue volume of the facial aspect, a palatal implant malposition can lead to significantly adverse aesthetic outcomes (Figure 12A–C). If, however, the palatal malposition occurs with adequate facial contour of the ridge, it may be difficult to obtain a proper emergence profile in the final crown because of the thickness of the facial soft tissues. For this reason, ridge lap designs are often used to compensate for the palatal positioning.

Facial malposition of an implant is by far the most common implant positioning error (Figure 13A,B). The implant may be either positioned or axially inclined too far facially. Often, positional and axial errors occur together (Figure 14A,B).

Another cause for a facial malposition is the insertion of an over-sized implant, as was often recommended in the late 1990s. The large diameter (≥ 6 mm) results in a facial malposition (Figure 15A,B). Implants that are facially malpositioned are strongly associated with mucosal recession. Two studies calculated the odds ratios of mucosal recession at facially positioned implants compared with correctly placed implants as 14.7 and 17.2, respectively.^{8,22} Facial malposition is often encountered with immediate implant placement.^{23,24} The osteotomy is usually prepared in the apico-palatal region of the socket of an upper anterior tooth. When the implant is inserted, the dense cortical bone of the palatal socket wall can cause the implant to “move” slightly towards the facial side. The axis of the implant may also divert more towards the facial side. It has been shown that a small deviation of about 1 mm to the facial side of the socket is sufficient to increase the risk of soft tissue recession.²⁵ Axial malposition to the facial side is often seen in sites with developmentally missing teeth. Lack of development of the alveolar process routinely results in a significant facial concavity in the midfacial region of the alveolar process. To place the implant within bone, a clinician may inadvertently angle the implant to the facial side.

■ Inappropriate use of multiple adjacent implants

Multiple adjacent implants in extended edentulous spaces can also lead to positional errors and aesthetic complications. This complication arises when the clinician has either prescribed too many implants for the available space, or has adopted the treatment philosophy to place one implant for every missing tooth. When multiple adjacent teeth in the anterior maxilla are extracted, the alveolar ridge resorbs from the facial side, resulting in a flattening of the ridge. The mesio-distal dimension of the flattened ridge is less than the original mesiodistal dimension prior to tooth extraction (Figure 16). If multiple adjacent implants are placed, there is a risk that the implants may be placed too close together (Figure 17A). To avoid implant proximity, the implants may instead be facially positioned and/or axially inclined to the facial side (Figure 17B). In either scenario, the result is usually an unaesthetic soft tissue outcome.



FIGURE 8 Two implants replacing maxillary central incisors have been placed too close together. As a consequence, the emergence profile of the individual crowns appears unnatural. The zenith of the mucosal margins are mesial rather than distal to the midline of each crown because of the malposition of the implants



FIGURE 9 A and B, The implant in the maxillary first premolar site has been placed with the shoulder too far coronally. In addition, the implant has been placed with a slight facial malposition. The result is recession of the peri-implant mucosa and an aesthetic disaster

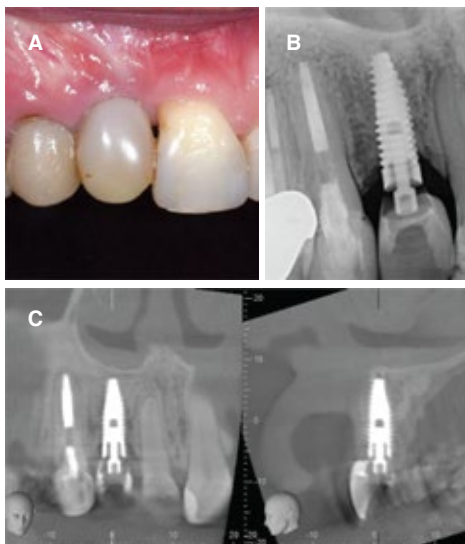


FIGURE 10 A, The implant in the maxillary right lateral incisor site has been restored with a provisional crown. The prosthesis has a ridge lap on the facial aspect. B, A periapical radiograph of the implant suggests that the implant has been placed with the shoulder positioned too far coronally. C, CBCT analysis confirmed that the shoulder of the implant has not been placed deeply enough. The implant is also in a palatal malposition. The consequence is that the prosthesis requires a ridge lap on the facial aspect. CBCT, cone beam computed tomography

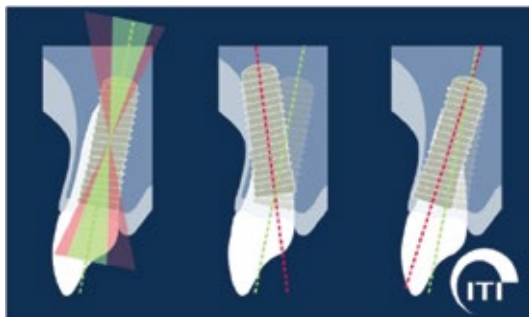


FIGURE 11 Diagrammatic representation of facial and axial malposition of implants that result in the implant shoulder being positioned in the facial and palatal danger zones, respectively. (Image from ITI Treatment Guide Vol. 10, Implant Therapy in the Esthetic Zone - Current Treatment Modalities and Materials for Single-tooth Replacements, 1st Edition, 2017 [p. 357, Figure 4B] used with permission from the International Team for Implantology and Quintessenz Verlags-GmbH)

DIAGNOSIS AND SOLUTIONS

The treatment solutions to manage adverse outcomes through positioning errors require an understanding of the underlying conditions and of those factors that may have led to the error being committed in the first place. Before discussing treatment solutions, prevention of such errors should be foremost in the minds of clinicians.

■ Prevention of positioning errors by proper diagnosis and planning

The primary objective of implant treatment should be to provide the patient with a predictable long-term outcome with the least risk for complications during the healing period and during implant function. Because positioning errors can result in significant aesthetic complications in the anterior maxilla, the clinician should aim to eliminate the risk of this type of implant malposition by first undertaking a proper examination and diagnosis to understand the underlying situation with the alveolar bone and soft tissues, and then setting out an appropriate treatment plan that minimizes risk. An aesthetic risk assessment is therefore strongly recommended to determine the risk of adverse aesthetic outcomes with a given case.²⁶ With respect to the risk of positioning errors, the following categories within the aesthetic risk assessment should be closely examined:

1. **Width of the edentulous space.** The dimension of the implant selected should be consistent with the mesiodistal width of the edentulous space. As discussed previously, the shoulder of an oversized implant may become too close to the adjacent tooth and risk the proper development of a tooth-implant papilla. Clinicians should aim to maintain a minimum 1.5 to 2 mm of distance between the shoulder of the implant and adjacent teeth.
2. **Gingival phenotype.** Thin gingival phenotypes are associated with a greater risk of recession of the facial mucosa margin. Thin gingival phenotypes tend to have longer papillae than thick gingival phenotypes, and are more prone to posttreatment reduction in the height of the tooth-implant papillae, which can be compounded if an implant is placed too close to the adjacent tooth.
3. **Bone anatomy at the alveolar crest.** Bone volume deficiencies at the alveolar crest may lead to positioning errors. If there is a significant orofacial or horizontal deficiency on the facial aspect, the implant may be positioned with a shoulder too far to the palatal side. In the case of a vertical bone deficiency at the crest, the implant shoulder may be positioned deeper than the recommended 3-4 mm from the anticipated midfacial mucosal margin. If the alveolar ridge has a deep concavity on the facial aspect, there is a risk that the implant may be inclined too far to the facial aspect as the clinician attempts to keep the implant within the bony envelope. Today, this potential complication can be avoided with high-quality three-dimensional radiographic imaging. With the advent of cone beam computed tomography, which is readily available to clinicians, the potential for the underlying bone anatomy to create an implant malposition can be assessed as part of the treatment planning process.

If the conditions for optimal implant positioning are not met, then the clinician should consider steps to mitigate the risk of adverse outcomes. With reduced mesiodistal width, narrow diameter implants may be a solution, provided the minimum distance between implant and adjacent teeth is observed. When the mesiodistal width is too small, alternative prosthodontic options should be considered (eg, a resin-bonded fixed partial denture).

Besides the correct three-dimensional positioning of the implant, a successful bone augmentation of the facial bone wall of sufficient thickness and height is necessary in most cases to provide good bony support for aesthetically pleasing peri-implant soft tissues. Implant placement can be differentiated into postextraction and healed sites. In postextraction sites, the thickness of the facial wall of the extraction socket is an important selection criterion for the most appropriate treatment option,²⁷ because preclinical and clinical studies have clearly shown various degrees of vertical bone loss, mainly on the

facial aspect within a few weeks postextraction because of bundle bone resorption.²⁸⁻³¹ At risk are extraction sites with a thin or no facial bone wall and these sites are prone to mucosal recessions in the short term and midterm³² if the facial bone wall is not successfully augmented with a simultaneous bone augmentation procedure using guided bone regeneration. In such a case, this implant is at risk for the development of a biologic complication such as peri-implant mucositis or peri-implantitis, because it will have an exposed micro-rough implant surface in the transcrestal/peri-implant sulcus area. A recent systematic review reported 5.43 higher odds for the future development of peri-implantitis at implants with early bone loss of 0.5 mm or more within the first year of function. Furthermore, the probability of peri-implantitis developing over a 10-year observation period was 52% when early bone loss of ≥ 0.5 mm was combined with the risk factors of cigarette smoking and a history of periodontitis.³³ In the anterior maxilla, > 90% of patients present with a thin or no facial wall, as shown in several radiographic studies using cone beam computed tomography,^{30,34,35} and they all require a bone augmentation procedure (Buser et al 2021)³⁶. In sites with a thick facial wall (> 1 mm), immediate implant placement is favored by our group.²⁷ Therefore, flapless computer-assisted implant placement and internal grafting with a low-substitution bone filler are clearly preferred today, and offer the patient attractive and predictable outcomes with the least surgical morbidity.^{37,38}

In healed sites, there is frequently a buccal flattening of the alveolar ridge on the buccal aspect. If an implant cannot be placed into the correct three-dimensional position because of a bone deficiency, then the feasibility of bone augmentation procedures should be evaluated using a simultaneous or staged approach. As a general consideration, simultaneous bone augmentation is feasible if the implant can be placed in the correct three-dimensional position and the resultant peri-implant bone defect has at least two intact bone walls.³⁶ If the peri-implant bone defect has less than two intact bone walls, commonly observed at implants placed into deficient healed sites, a staged approach with a bone augmentation first is recommended. The site would be reconstructed with an autogenous block graft as a first step, followed by implant placement 4-6 months later following consolidation of the graft.³⁹ Another surgical technique is the sausage technique with a mixed composite graft and membrane fixation with pins.⁴⁰

Today, implant positioning errors can be avoided by utilizing digital software planning and three-dimensional printed surgical templates to ensure accurate positioning of implants. During the planning stage, deficiencies in bone and soft tissue can readily be identified. This provides the clinician with the opportunity to consider options to manage these deficiencies before proceeding with surgery. This also facilitates discussion with the patient in case of a risk of adverse aesthetic outcomes. If a compromise is likely to eventuate, then consent from the patient prior to proceeding is of paramount importance. Nonimplant treatment options to replace teeth should also be offered in case the patient is unable to accept the aesthetic compromise.



FIGURE 12 A, This implant in the upper right maxillary central incisor site has been placed in a palatal malposition. B, Following removal of the provisional crown, the palatal malposition can be observed clinically. There is also lack of tissue volume on the facial aspect. C, The CBCT scan confirmed the palatal malposition of the implant in relation to the axis of the provisional crown. Axially, the implant has also been tilted too far to the palatal side. CBCT, cone beam computed tomography

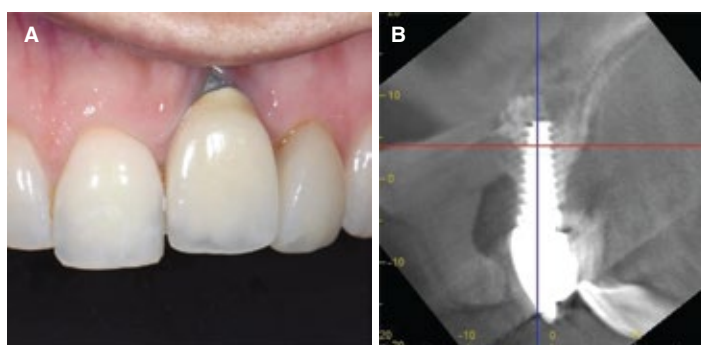


FIGURE 13 A, The implant in the maxillary left central incisor site has been placed in a facial malposition. This has resulted in recession of the facial mucosa. The implant was placed about 10 years previously, and vertical growth changes have accentuated the incisal edge and mucosal margin discrepancy. B, The corresponding CBCT scan confirms the facial malposition of the implant. The sagittal view has been rotated so that the blue vertical line coincides with the central long axis of the implant. With this orientation, it can be observed that the incisal edge of the prosthesis is palatal to the axis of the implant. CBCT, cone beam computed tomography

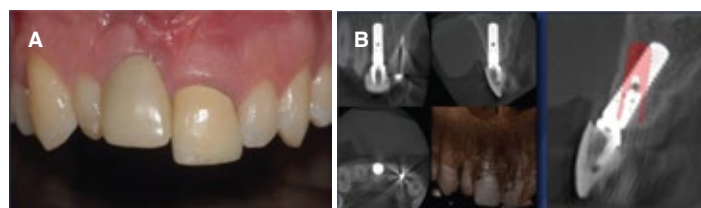


FIGURE 14 A, In this case, the implant in the maxillary right central incisor site is both positioned and inclined too far facially. B, In the sagittal view, an outline of an implant (red image) in the correct position has been overlaid on the CBCT scan of the implant. This highlights the combined facial position and facial inclination of the implant. CBCT, cone beam computed tomography



FIGURE 15 A, An implant with a shoulder diameter of 6 mm has been placed in the maxillary right central incisor site. The oversized implant has resulted in a facial malposition of the implant, and subsequent recession of the midfacial mucosa. B, The corresponding periapical radiograph of the implant

FIGURE 16 When multiple adjacent teeth in the anterior maxilla are extracted, the alveolar ridge resorbs from the facial side, resulting in a flattening of the ridge. The mesiodistal dimension of the flattened ridge (continuous line) is less than the original mesiodistal dimension prior to tooth extraction (dotted line)



FIGURE 17 A, Because of insufficient mesiodistal space, three implants have been placed that are too close together. B, In this case, the three adjacent implants have been correctly separated. To increase the space required to accommodate the implants, they have been facially positioned and/or axially inclined to the facial aspect



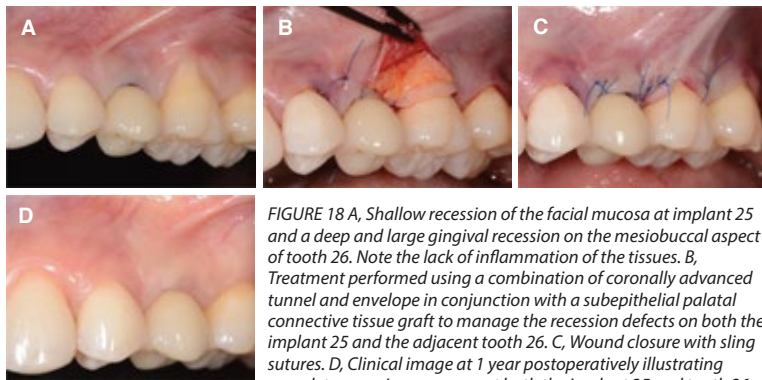


FIGURE 18 A, Shallow recession of the facial mucosa at implant 25 and a deep and large gingival recession on the mesiobuccal aspect of tooth 26. Note the lack of inflammation of the tissues. B, Treatment performed using a combination of coronally advanced tunnel and envelope in conjunction with a subepithelial palatal connective tissue graft to manage the recession defects on both the implant 25 and the adjacent tooth 26. C, Wound closure with sling sutures. D, Clinical image at 1 year postoperatively illustrating complete recession coverage at both the implant 25 and tooth 26. Please observe the absence of a gray titanium "shine through" of the facial mucosa at the 25 implant



FIGURE 19 A, The implant in the maxillary right central incisor has been placed in a facial malposition. The facial aspect of the healing abutment is at the limit of the curvature of the arch at the level of the gingival margin. B, From the facial aspect, the mucosal margin at the implant is approximately 1.5 mm apical to that of the contralateral central incisor. C, The corresponding sagittal view of the CBCT scan clearly demonstrates the facial and axial malposition of the implant. The central axis of the implant in (red dotted line) shows the implant emerging facial to the incisal edge of the anticipated restoration (white outline of the crown). The red dot marks the IMM located 1.5 mm coronal to the CMM. The clinician then has to determine whether a crown, abutment, and minimum 1 mm soft tissue thickness can be accommodated at the level of the red dot without extending facially to it. In this case, it was determined that the facial and axial malposition was too severe, and the decision was therefore made to remove and replace the implant. CBCT, cone beam computed tomography; CMM, current mucosal margin; IMM, ideal midfacial mucosal margin

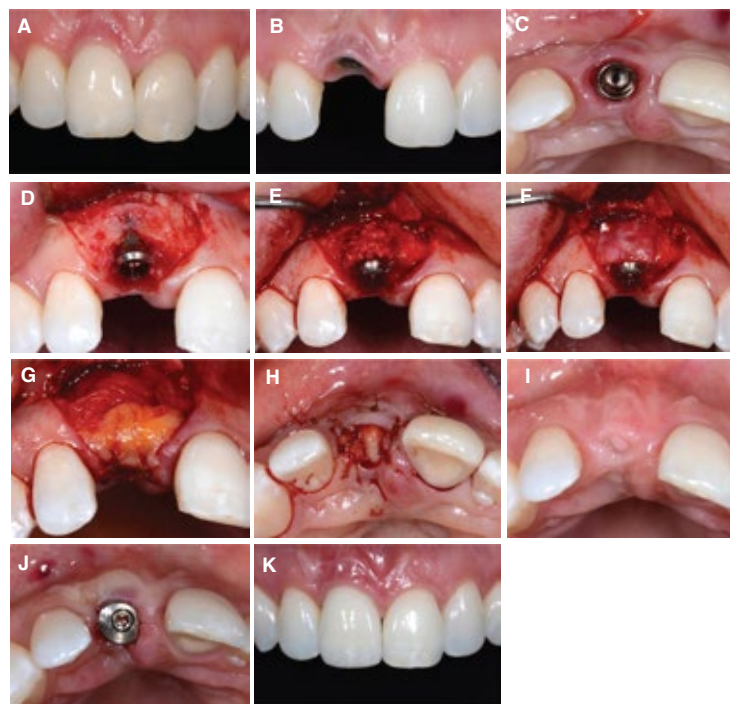


FIGURE 20 A, The implant replacing the right maxillary central incisor was placed as an immediate implant 8 years previously. Over time, there was a gradual recession of the midfacial mucosal margin, compounded by ongoing dentofacial growth. B, Following removal of the crown, the relatively thin mucosa on the facial aspect was evident. C, An occlusal view of the implant confirmed that it was positioned within the natural contour of the ridge. Soft tissue volume was lacking on the facial aspect. D, Following flap reflection, a dehiscence of the facial bone was observed in the shoulder of the tissue level implant. E, deproteinized bovine bone mineral was grafted over the defect to improve contour of the ridge. F, The graft was covered with a resorbable barrier membrane. G, A connective tissue graft harvested from the palate was then placed over the implant and the coronal facial aspect of the ridge. H, The facial flap was closed leaving the connective tissue graft over the implant exposed. I, After 4 months of healing, the soft tissues had healed with complete epithelialization of the connective tissue graft at the crest of the ridge. J, A transmucosal healing abutment was then connected to the implant. K, A new implant crown was then constructed. This image was taken 4 years after completion of the treatment

■ Treatment options for mesiodistal and coronal malposition

As a general observation, it is not possible to correct a deficient or missing tooth-implant papilla because of a mesiodistal malposition. In most cases, it is also not feasible to remove the implant, as this may risk attachment loss or damage to the adjacent tooth. The unfortunate situation is that the compromise of a mesiodistal implant positioning error may need to be accepted. The prosthodontic option of incorporating soft tissue-colored ceramic into the prosthesis to replicate the missing soft tissue could be considered.

In relation to an implant being placed with the shoulder too shallow, a ridge lap prosthesis may be the only option if the implant is to be retained. If the coronal malposition is not too extreme, soft tissue grafting can sometimes be used to increase soft tissue height and volume to hide the metal margin and mask the color of the underlying metal components (Figure 18A-D). The alternative is to remove the implant and replace it with one that is in the correct coronal position.

For implants placed too deep, the compromise could be accepted, or the implant removed and replaced. However, implant removal and replacement are only feasible if there is sufficient alveolar ridge height. It does not make sense to remove and replace the implant if there is preexisting loss of alveolar ridge height. Vertical bone augmentation in the maxillary anterior region is challenging and unpredictable.

■ Treatment options for orofacial and axial malposition

If an orofacial and/or axial malposition results in recession of the midfacial mucosa, soft tissue correction utilizing connective tissue grafts may be considered. However, connective tissue grafts to manage recession defects on implants can be unpredictable.⁴¹⁻⁴³ The predictability is dependent upon the degree of malposition.⁹ The main limiting factor is the natural contour of the dental arch at the level of the gingival margin of the adjacent teeth.⁴² If the implant and prosthesis extend facially to this contour, it becomes more difficult to achieve a predictable outcome with soft tissue grafting. The treatment is often complex, frequently requiring removal of the implant crown, bone augmentation if bone is deficient facially, and modification of the implant restoration emergence profile.⁴⁴

A careful analysis is therefore required to determine this. As a general rule, the implant crown cannot extend facial to the natural curve line of the arch at the level of the midfacial mucosal margin of the adjacent teeth. In the region of the affected implant, this is an imaginary line that connects the profile of the arch of the adjacent teeth⁴² and may be clinically visualized from the occlusal aspect, or on axial views of cone beam computed tomography scans. The position of the implant/abutment/crown can sometimes be estimated in the parasagittal plane. For the soft tissue graft to be successful, there needs to be sufficient space within the curvature of the arch to accommodate the crown, abutment, and at least 1 mm thickness of the mucosa. This is illustrated in Figure 19. This patient was

referred to manage recession of the mucosa that was observed following connection of a healing abutment and prior to construction of the definitive crown. From an occlusal view, it could be seen that the facial edge of the healing abutment already extended facial to the curvature of the dental arch at the level of the gingival margins of adjacent teeth (Figure 19A). A frontal view demonstrated that the mucosal margin had already receded approximately 1.5 mm apical to that of the gingival margin of the contralateral central incisor (Figure 19B). The corresponding cone beam computed tomography scan illustrates that, at the level of the ideal midfacial mucosal margin position, there would be insufficient orofacial space to accommodate the crown, abutment, and 1 mm of soft tissue thickness (Figure 19C). The outcome of a connective tissue graft to correct the recession would therefore be unpredictable.

If the conditions described above are met, then connective tissue grafts may be a predictable means for correcting the soft tissue recession. Soft tissue grafting may be combined with bone augmentation when alveolar ridge deficiencies are identified (Figure 20A-K).

In cases when the facial and/or axial malposition is too severe, several options may be considered, including accepting the aesthetic compromise, incorporating pink ceramic at the cervical region of the crown, and removal/replacement of the implant in the correct three-dimensional position. Removal and replacement of the implant often requires adjunctive hard and soft tissue augmentation (Figure 21A-Z).



FIGURE 21 A, There has been severe recession of the facial mucosa at this maxillary right central incisor implant. The recession has resulted from facial and axial malposition of the implant. Note the absence of keratinized mucosa. B, The CBCT scan confirms the facial and axial malposition of the implant. In addition, there is no facial bone wall. C, The implant crown was removed, revealing the shoulder of the implant. From this occlusal view, it can clearly be seen that the shoulder of the implant is in a facial malposition. D, An implant removal device using reverse torque (BTI Implant Removal Kit, BTI Biotechnology Institute, Vitoria, Spain) was used to remove the implant. In this image, an extender connected to a counterclockwise threaded extractor has been inserted into the top of the implant. The axial malposition is clearly demonstrated. E, The implant was removed following application of counterclockwise torque. F, The residual defect in the bone was grafted with DBBM (Bio-Oss, Geistlich Pharma AG, Wolhusen, Switzerland). G, A free gingival graft harvested from the palate was used to protect the graft and to restore keratinized mucosa. H, A removable partial denture provided the patient with an interim replacement of the right maxillary central incisor. I, The clinical situation 2 months after implant removal. Note the increased volume of keratinized mucosa on the facial aspect. J, Following elevation of a triangular, full thickness flap, the bone defect in the alveolar crest is visible. The bone defect is located on the facial aspect, but also the palatal bone wall is reduced in height by approximately 2 mm. K, The first step following flap elevation is the local harvesting of autologous bone chips from the cortical bone surface in the vicinity with a sharp bone scraper. The chips are stored in a sterile dish with a 1:1 mixture of blood and sodium chloride (0.9%). L, Following implant bed preparation, a tissue level implant was selected and inserted (12 mm regular neck RN 4.1 Straumann SLActive implants, Straumann Group, Basel, Switzerland) with the micro-rough implant surface about 1 mm subcrestally in relation to the palatal bone wall. The facial view in the mirror shows the implant shoulder about 3 mm apically to the CEJ of the left central incisor. M, The occlusal view, following insertion of a 1.5 mm healing cap, shows the extended two-wall defect. The goal of grafting is a so-called contour augmentation with a two-layer composite graft using the GBR technique. N, The first layer is made of autologous bone chips to cover the exposed implant surface and to fill the entire bone defect. The bone chips are applied to the rim of the healing cap. O, The second layer is a thick layer of DBBM particulate (Bio-Oss). Before application, the DBBM particles have been activated in BCM. BCM is a solution of blood and sterile saline, into which the bone chips have released growth factors, in particular TGF- β -1. P, The graft is then protected by a double layer of a resorbable collagen membrane (Bio-Gide, Geistlich Pharma AG, Wolhusen, Switzerland). Q, The surgery was completed with a tension-free, primary closure of the flap using mattress and single sutures. For that, a release of the periosteum is always necessary to avoid tension in the flap closure. R, This is the clinical situation 8 weeks following implant surgery. The wound healing was uneventful without wound dehiscence for the duration of the healing period. S, At 8 weeks, a reopening procedure is conducted with a mucosal punch excision. The short healing cap is replaced by a 4.5 mm healing cap. Note the facial contour of the ridge that has been significantly augmented in comparison with the original clinical situation. T, This is the final crown at the 1-year follow-up examination. The aesthetic outcome is satisfactory when considering the initial status with the severe mucosal recession. U, The corresponding periapical radiograph of a well-integrated tissue level implant. The fidelity of the implant crown is excellent. V, At the 5-year follow-up, the clinical status shows good mucosal stability. However, soft tissue scars are visible, resulting from the mucosal graft performed when the implant was removed. W, The smile line exhibits no exposure of the midfacial mucosa. Therefore, the patient is reluctant to correct the observed scar lines. X, The peri-apical radiograph at the 5-year examination shows a well-integrated implant and the typical bony saucers at the implant neck with a smooth, machined surface. Y, The corresponding CBCT scan confirms a fully intact facial bone wall, which was regenerated with the GBR technique. The thickness of the facial wall measures approximately 2 mm. Z, The horizontal CBCT cut confirms the bone regeneration at the facial bone defect, which was present at the time of implant placement. BCM, bone conditioned medium; CBCT, cone beam computed tomography; CEJ, cemento-enamel junction; DBBM, deproteinized bovine bone mineral; GBR, guided bone regeneration; TGF- β -1, transforming growth factor beta 1

■ Treatment of positional errors with adjacent implants

The options for treating these types of errors are limited. It may be possible to remove one implant if one or other implants are in the correct position. In most cases, correction of the malposition can only be achieved by the removal of all implants, reconstruction of the ridge, and replacement of the implants. This often involves multiple and complex procedures over an extended period of time. If the implants can be maintained with good peri-implant health, prosthodontic options to mask the malposition may be considered. In cases of vertical and/or horizontal bone deficiencies, the utilization of pink ceramic to replace the missing hard and soft tissues may be considered. A removable prosthesis is sometimes the only option.

CONCLUSIONS

Complications because of positioning errors of dental implants in the anterior maxilla can result in significant adverse aesthetic outcomes. In almost every case, the complication has occurred because of an error in judgment by the clinician. It is the clinician's responsibility to evaluate patient and site-related factors, and to determine if implant therapy is a suitable option. The excuse that there were preexisting factors such as a narrow gap or bone deficiencies that led to the malposition cannot be accepted in modern implant therapy today. Positioning errors can be eliminated with the use of cone beam computed tomography and digital technology to assist with planning and subsequent production of three-dimensional printed surgical templates. If errors do occur, the adverse aesthetic outcomes are difficult and sometimes impossible to correct. Connective tissue grafting to reverse recession defects is only feasible in defined situations. The option to remove and replace the implant may be the only recourse, provided the removal process does not further compromise the site. With the projected increase in the number of clinicians providing implant therapy and the rise in the number of patients treated, an increase in complications seems inevitable. The profession has a responsibility to mitigate this risk by emphasizing the need for proper implant education and training. Clinicians embarking upon a career in implant dentistry should seek appropriate mentors to support their learning.

ACKNOWLEDGMENT

Open access publishing facilitated by The University of Melbourne, as part of the Wiley - The University of Melbourne agreement via the Council of Australian University Librarians.

CONFLICT OF INTEREST

The authors report no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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