EMERGING TRENDS IN DENTISTRY

8B-4

9/30/2020

ROUNDS TEAM

- Group Leader: Dr. Toburen
- Specialist: Dr. Meza
- Project team leader: Charlie Krenzke
- Project team participants:
  - D3: Nichele Wada
  - D2: Jayson Wiernik
  - D1: Tyler Osterday

PATIENT W.

- 80 year old
- Male
- Chief complaint: “I want to fill the missing space in my mouth with an implant
- Transfer exam: 9/24/2020

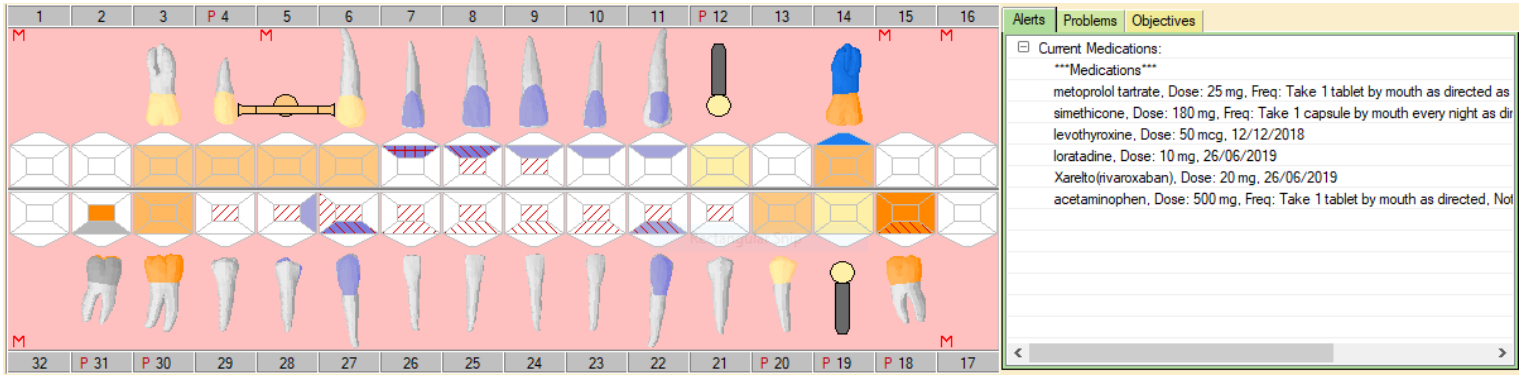
MEDICAL HISTORY

- Controlled Hypertension, history of squamous cell carcinoma on scalp, and sleep apnea
- Current medications:
  - metoprolol tartate 25mg
  - simethicone 180mg
  - levothyroxine 50mg
  - loratadine 10 mg
  - Xarelto 20 mg
  - acetaminophen 500mg as needed.
- No Known dental allergies

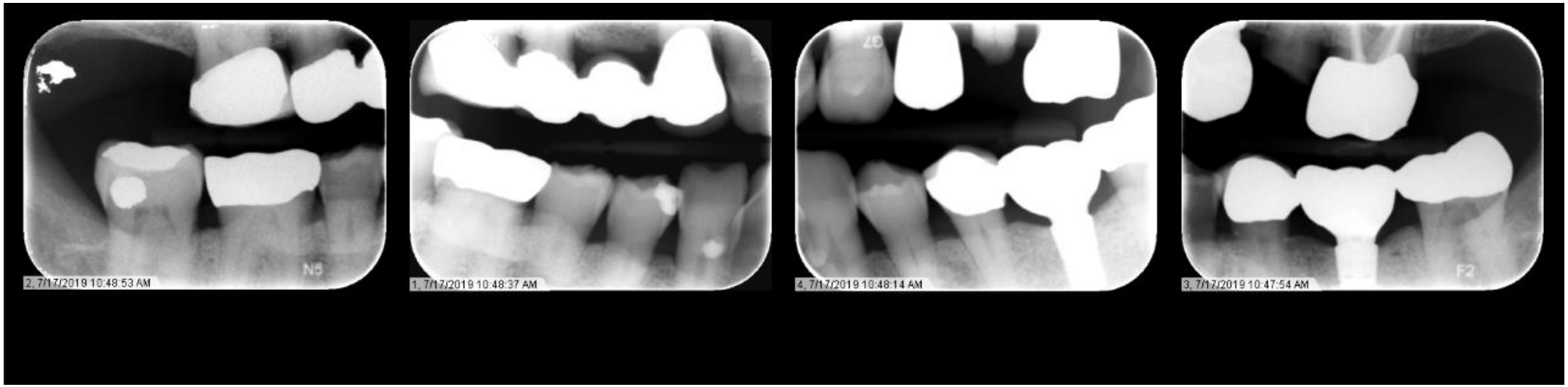
DENTAL HISTORY

- Long term patient of record at Marquette University School of Dentistry
    - Has received regular 6 month cleanings
- History of extractions, root canals, bridges, and implants.
- Brushes twice a day and flosses once a day.

CURRENT ODONTOGRAM



RADIOGRAPHS



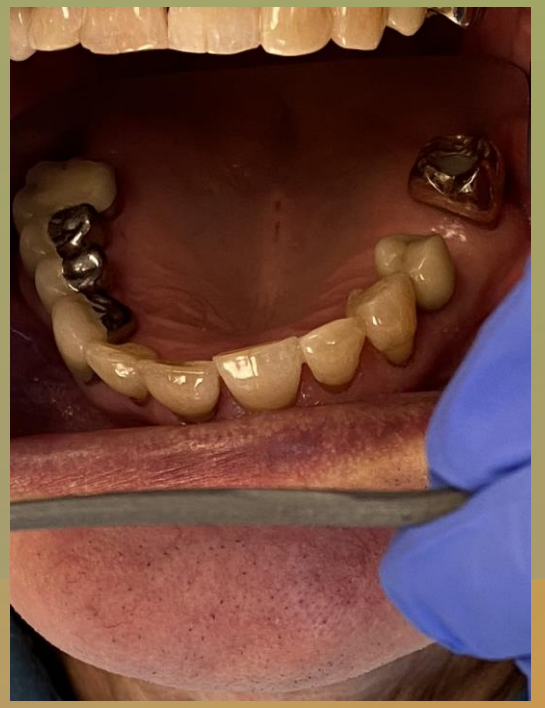
RADIOGRAPHIC FINDINGS

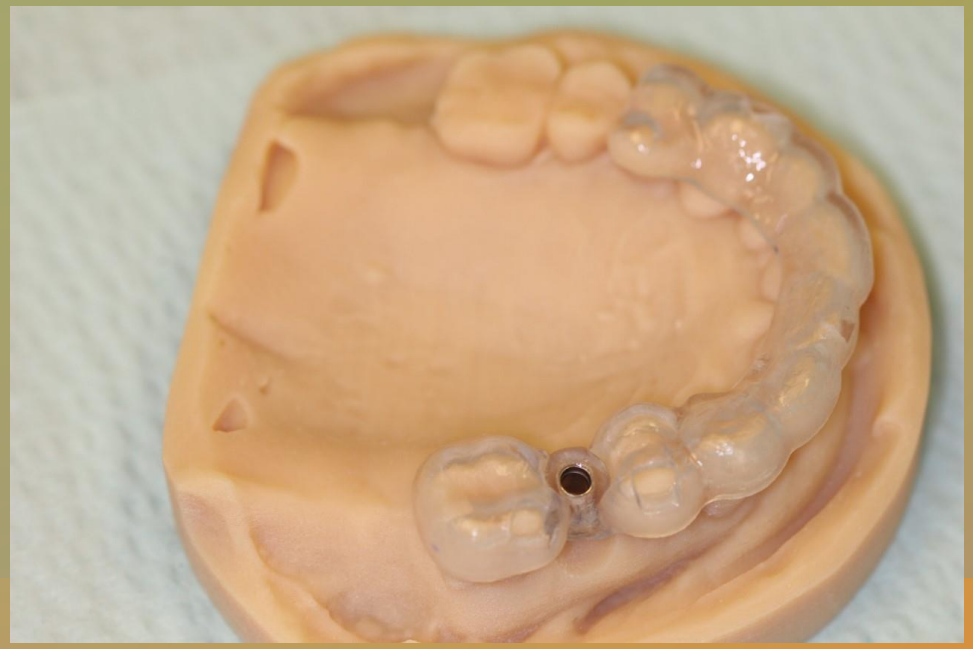
- No problems proceed with implant

CLINICAL FINDINGS

- Delaminated buccal resin fillings on #7, #8, and #27. Non-carious lesions that can be retreated for aesthetics.

CLINICAL PHOTOS





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PERIO CHART

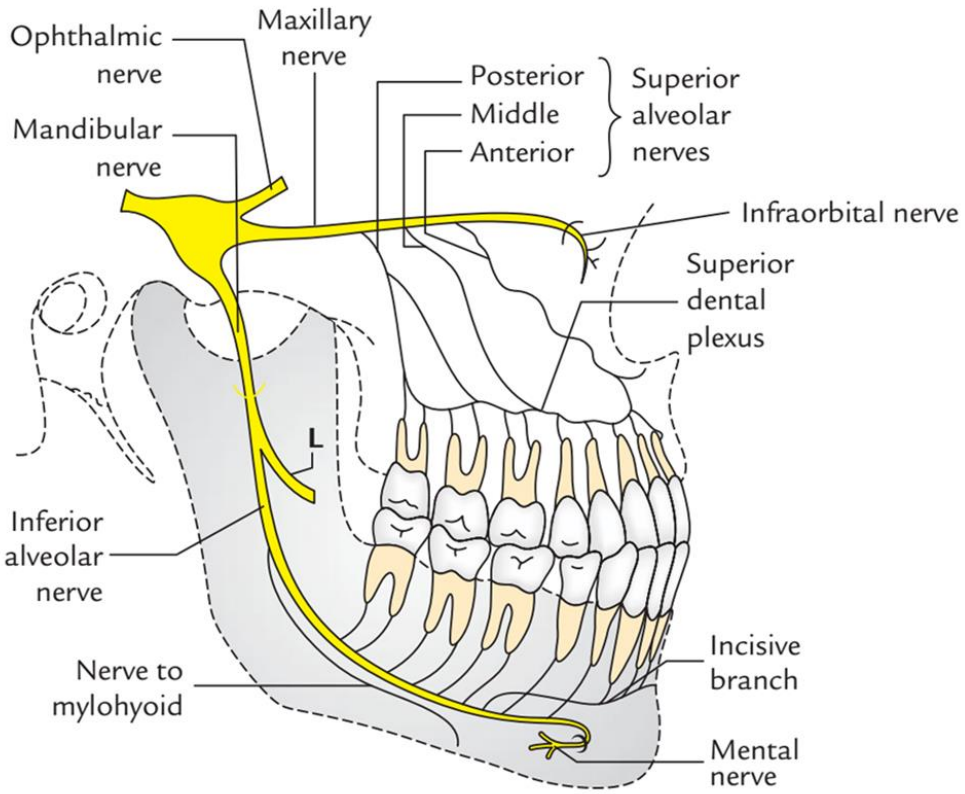
PROBLEM LIST

- Keep an eye on other restorations to make sure that he does not have future tooth loss
- Missing tooth #13

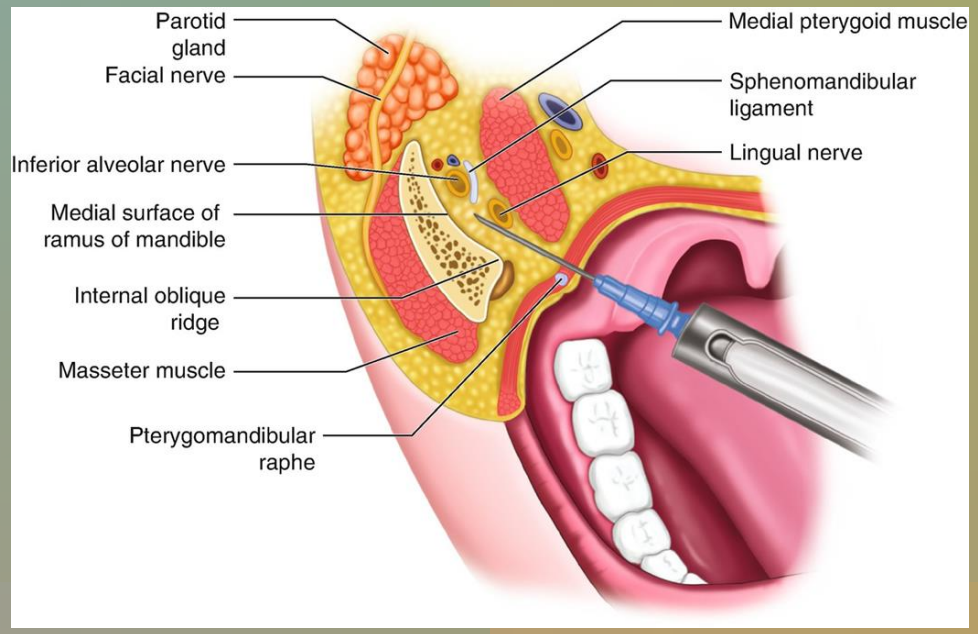
WHAT IS THE INFERIOR ALVEOLAR NERVE?

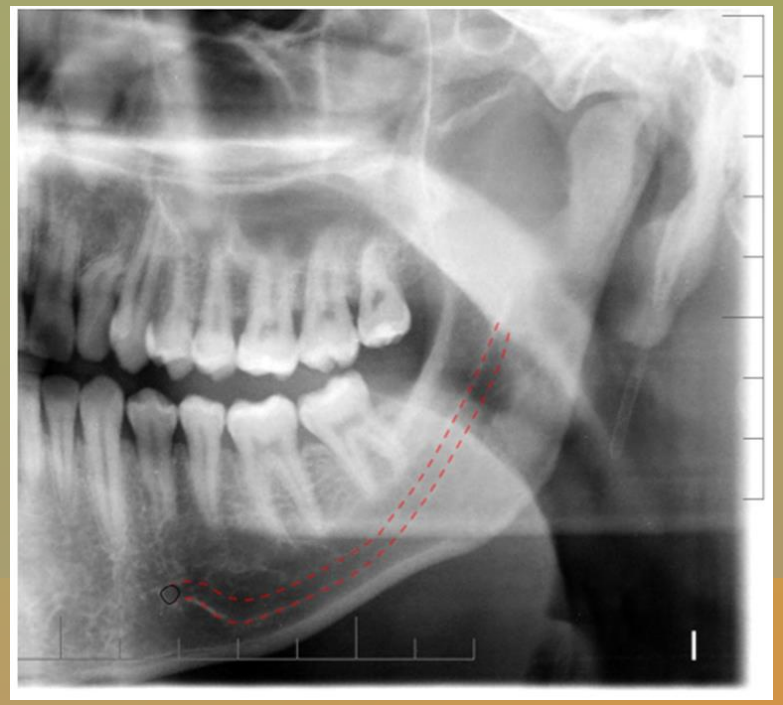
BASIC ANATOMY, STRUCTURE, AND FUNCTION

- The inferior alveolar nerve is a branch of the trigeminal nerve's mandibular division (CN V3)
- Two terminal branches
- Mylohyoid nerve
- Mental Nerve
- General function is to provide sensory innervation to the gingiva and teeth of the mandible



GENERAL CLINICAL CONSIDERATIONS



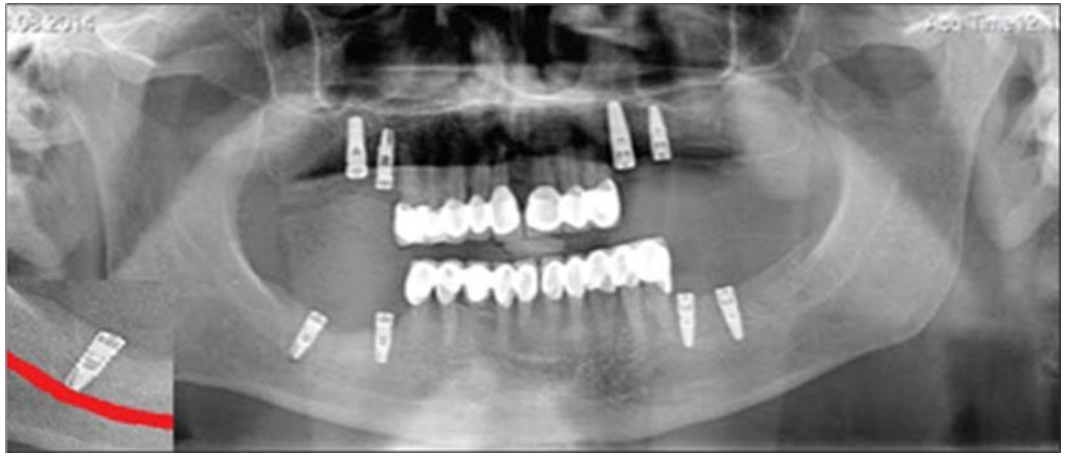


D2 PATHOLOGY

- What are Potential Complications in Implant Placement?

POTENTIAL COMPLICATIONS

- Nerve damage during placement
  - Incorrect implant depth
  - Incorrect implant width
    - Leads to sensory disturbances
- Perforation into maxillary sinus
  - Incorrect implant depth
  - Incorrect implant angulation
    - Can cause chronic sinusitis



An, J.-H., Park, S.-H., Han, J. J., Jung, S., Kook, M.-S., Park, H.-J., & Oh, H.-K. (2017). Treatment of dental implant displacement into the maxillary sinus. *Maxillofacial Plastic and Reconstructive Surgery*, *39*(1). https://doi.org/10.1186/s40902-017-0133-1

Shavit, I., & Juodzbalys, G. (2014). Inferior Alveolar Nerve Injuries Following Implant Placement - Importance of Early Diagnosis and Treatment: A Systematic Review. *Journal of Oral & Maxillofacial Research*, *5*(4). https://doi.org/10.5037/jomr.2014.5402

POTENTIAL COMPLICATIONS CONTINUED…

- Perforation of lingual or buccal cortical plate
  - Incorrect implant angulation
    - Potential infection
    - Poor osseointegration
      - Potential implant failure
- Damage to roots of adjacent teeth
  - Incorrect angulation
    - Can make adjacent tooth non-vital
      - Requires additional treatment

Wang, T.-Y., Kuo, P.-J., Fu, E., Kuo, H.-Y., Nie-Shiuh Chang, N., Fu, M.-W., Shen, E.-C., & Chiu, H.-C. (2019). Risks of angled implant placement on posterior mandible buccal/lingual plated perforation: A virtual immediate implant placement study using CBCT. *Journal of Dental Sciences*, *14*(3), 234–240. https://doi.org/10.1016/j.jds.2019.03.005

Yoon, W.-J., Kim, S.-G., Jeong, M.-A., Oh, J.-S., & You, J.-S. (2013). Prognosis and evaluation of tooth damage caused by implant fixtures. *Journal of the Korean Association of Oral and Maxillofacial Surgeons*, *39*(3), 144–147. https://doi.org/10.5125/jkaoms.2013.39.3.144

AVOIDING COMPLICATIONS

- Extensive preoperative analysis
- Nearby anatomical structures must be identified and avoided
- Precision is key!
    - Correct angulation and depth
- Fabrication and use of an accurate implant surgical guide can help prevent many complications during placement

D3 PICO

- Clinical Question:
    - How is CAD/CAM and 3D printing used in implant planning?

PICO FORMAT

- P: People in need of an implant
- I: Fully guided implant placement
- C: Free handed implant placement
- O: Accuracy of implant placement

PICO FORMATTED QUESTION:

- “For patients in need of an implant, what is the accuracy of fully guided implant placement compared to free handed implant placement?”

SEARCH BACKGROUND:

- Dates of Search: 9/22/20, 9/23/20, 9/24/20
- Database Used: PubMed
- Search Strategy/Keywords: Dental implants, Guidance, Implant template, Computer-assisted surgery, Free handed implantation
- MESH terms Used: Dental implant, Accuracy, Surgery, Computer-assisted

ARTICLE 1 CITATION, INTRODUCTION:

- Citation:
  - Chen S, Ou Q, Lin X, Wang Y. Comparison Between a Computer-Aided Surgical Template and the Free-Hand Method: A Systematic Review and Meta-Analysis. Implant Dent. 2019 Dec;28(6):578-589. doi: 10.1097/ID.0000000000000915. PMID: 31205270
- Study Design:
  - Systematic Review and Meta-Analysis
- Study Need/ Purpose:
  - The aim of this meta-analysis was to assess the results of implantation with or without an implant template based on accuracy, survival rate, and other considerations.

ARTICLE 1 SYNOPSIS:

- Method: In 2018, a systematic review was undertaken for randomized controlled trials and retrospective and prospective cohort studies in regards to implant accuracy and the survival rate between the implant template and the free handed method. The odds ratios (ORs) of the survival rate and the mean difference of accuracy deviation from the selected studies were estimated using meta-analysis.
- Results: Of the 362 articles that were initially screened, 6 studies were included in the meta-analysis. Comparison of the survival rate of implant surgery with or without an implant template revealed no significant result (OR=1.71, 95% confidence interval [CI] 0.65-4.51). Significant differences in accuracy were observed in angular deviation (mean difference= -5.45 degrees, 95% CI -0.66 to -4.24 degrees) and apical deviation (mean difference= -0.83 mm, 95% CI -1.12 to -0.54).

ARTICLE 1 SYNOPSIS: CONTINUED

- Conclusions:
  - Implant placement can be more accurate with the use of computer-aided surgical templates as compared to the free handed method. There is no significant difference observed in survival rates between the two methods.
- Limitations:
  - Only 3 out of the 6 studies compared the accuracy between the two implantation methods
    - 1 Clinical randomized intros trial
    - 1 in vivo-in vitro study
    - 1 in vitro study

ARTICLE 1 SELECTION:

- Reason for selection: This article discusses how CAD/CAM technology plays a part in implant placement, and contains useful data directly related to the PICO question.
- Application to our patient: There are various methods and techniques to achieve placing an implant. This article compares the accuracy of implant placement between a computer-aided surgical template and the free handed method. Knowing which method yields the highest accuracy is information the patient should be aware about.

ARTICLE 2 CITATION, INTRODUCTION

- Citation:
  - Kühl S, Zürcher S, Mahid T, Müller-Gerbl M, Filippi A, Cattin P. Accuracy of full guided vs. half-guided implant surgery. Clin Oral Implants Res. 2013 Jul;24(7):763-9. doi: 10.1111/j.1600-0501.2012.02484.x. Epub 2012 May 3. PMID: 22551385.
- Study Design:
  - Randomized Controlled Trial
- Study Need/ Purpose:
  - The aim of this study is to compare the benefits in terms of accuracy for full guided implant surgery with half-guided surgery.

ARTICLE 2 SYNOPSIS:

- Method: A total of 38 identical implants were inserted into five human cadaver jaws after virtual planning with the coDiagnostiX device. All cavities were drilled using templates equipped with tubes for guidance. At random, 19 implants were placed using the free handed method (half-guided), whereas 19 implants were place guided through template tubes (full guided). Postoperative CBCT's were performed and based on image fusion, the total deviations between the virtual implant positions at the implants base and tip were determined and compared between the two implantation methods.
- Results: The mean difference in accuracy between both implantation modalities at the implants bases was 0.72 mm (range: 0.16-1.17 mm, SD: 0.45). The mean difference in accuracy between both modalities at the implants tips was 0.46 mm (range: 0.16-1.23 mm, SD:0.49). Although full guided implantation showed a generally higher accuracy (mean tip: 1.54 mm, Range: 0.33-3.64 mm; mean base: 1.52 mm, Range: 0.4-3.54 mm) than half guided implantation (Mean tip: 1.84 mm, Range: 0.84-3.22 mm; Mean base: 1.56 mm, Range: 0.49-3.43 mm), the differences were not statistically significant.

ARTICLE 2 SYNOPSIS: CONTINUED

- Conclusions:
  - The accuracy of half-guided implant surgery is comparable with full guided implant surgery.
- Limitations:
  - Bone quality was not determined
  - No maxilla studies were included
  - Low number of implants used

ARTICLE 2 SELECTION

- Reason for selection: This article discusses how CAD/CAM technology plays a part in implant placement, and contains useful data directly related to the PICO question.
- Application to our patient: Full guided implantation tends to be more costly. If finances were to be an issue to the patient, half guided surgery might represent a good alternative with comparative accuracy to full guided implantation.

ARTICLE 3 CITATION, INTRODUCTION

- Citation:
  - Varga E Jr, Antal M, Major L, Kiscsatári R, Braunitzer G, Piffkó J. Guidance means accuracy: A randomized clinical trial on freehand versus guided dental implantation. Clin Oral Implants Res. 2020 May;31(5):417- 430. doi: 10.1111/clr.13578. Epub 2020 Jan 31. PMID: 31958166. S
- Study Design:
  - Randomized Controlled Trial
- Study Need/ Purpose:
  - The aim of this study was to compare all three known static guided protocols (pilot, partial, and full) with each other and with free hand surgery in terms of accuracy, under the same conditions.

ARTICLE 3 SYNOPSIS:

- Method: A total of 207 implants of the same brand and type were placed in 101 partially edentulous volunteers in need of an implant in the mandible, maxilla, or both. All cases were digitally planned, and the comparison of the planned and actual implant positions was performed using a medical image analysis software with dedicated algorithms. The primary outcome variable was angular deviation (AD, degrees). The secondary outcome variables were coronal global deviation (CGD, mm), apical global deviation (AGD, mm), and voxel overlap (VO, %).
- Results: AD showed stepwise improvement in significant steps as the amount of guidance increased. The highest mean AD (7.03° ± 3.44) was obtained by freehand surgery and the lowest by fully guided surgery (3.04° ± 1.51). As for the secondary outcome variables, all guided protocols turned out to be significantly superior to freehand surgery, but they were not always significantly different from each other.

ARTICLE 3 SYNOPSIS: CONTINUED

- Conclusions:
  - Static guided implantation improves accuracy of dental implant surgery as compared to free hand surgery.
  - Any degree of guidance yields better results than free hand surgery, and increasing the level of guidance increases accuracy.
- Limitations:
  - For coronal and apical deviations, horizontal and vertical opponents were not separated.

ARTICLE 3 SELECTION

- Reason for selection: This article discusses how CAD/CAM technology plays a part in implant placement, and contains useful data directly related to the PICO question.
- Application to our patient: This article discusses the importance of implant positioning. Incorrect implant positioning can lead to peri-implantitis as well as poor aesthetics. Discussing the risks and complications of implant placement with the patient is important prior to surgery.

LEVELS OF EVIDENCE:

☒ **1a** – Clinical Practice Guideline, Meta-Analysis, Systematic Review of Randomized Control Trials (RCTs)

☒ **1b** – Individual RCT

☐ **2a** – Systematic Review of Cohort Studies

☐ **2b** – Individual Cohort Study

☐ **3** – Cross-sectional Studies, Ecologic Studies, "Outcomes" Research

☐ **4a** – Systematic Review of Case Control Studies

☐ **4b** – Individual Case Control Study

☐ **5** – Case Series, Case Reports

☐ **6** – Expert Opinion without explicit critical appraisal, Narrative Review

☐ **7** – Animal Research

☐ **8** – In Vitro Research

STRENGTH OF RECOMMENDATION TAXONOMY:

☒ **A** – Consistent, good quality patient oriented evidence

☐ **B** – Inconsistent or limited quality patient oriented evidence

☐ **C** – Consensus, disease oriented evidence, usual practice, expert opinion, or case series for studies of diagnosis, treatment, prevention, or screening

CONCLUSIONS:

- How does the evidence apply to this patient?
    - Evidence shows that the use of a computer-aided surgical template (fully guided template) improves implant placement in terms of accuracy compared to the free handed implantation method.
- Based on the above considerations, how will you advise your D4?
    - I will advise the D4 to move forward with implant surgery for #13 using the fully guided template.

D4 CONCLUSION

- Based on the evidence provided we will be using a fully guided surgical technique to place the implant in site number 13.

QUESTIONS