SVOA Dentistry

ISSN:2753-9172

ScienceVolks Open Access

Case Report

Evidence-Based Dentistry Protocol used in the Formulation and Application of Mandibular Muscle Physiotherapeutic Exercises in the Non-Surgical Correction of Mandibular Deviation Associated with Hemi-Mandibulectomy

Subiya Huda[1] and Pradeep Sherigar[2*]

[1]*MDS, Department of Prosthodontics and Crown & Bridge, Manipal College of Dental Sciences, Manipal, Manipal Academy of Higher Education, Karnataka, India*

[2]*Professor and Head, Department of Prosthodontics and Crown and Bridge, Manipal, Manipal College of Dental Sciences, Manipal Academy of Higher Education, Karnataka, India*

Corresponding Author: *Dr. Pradeep Sherigar, Professor and Head, Department of Prosthodontics and Crown & Bridge, Manipal College of Dental Sciences, Manipal, Manipal Academy of Higher Education, Karnataka, India, Email: pradeep.s@manipal.edu*

Received: *June 14, 2021* ***Published:*** *July 01, 2021*

DOI: https://doi.org/10.58624/SVOADE.2021.02.036

Abstract

Dental literature demonstrates limited research on non-surgical management of hemi-mandibulectomy patients with completely edentulous arches and severe deviation. In this evidence-based case report, a 65 year old, Cantor Curtis Class III hemi-mandibulectomy patient presented to the Department of Prosthodontics with completely edentulous mandibular arch and chief complaint of difficulty in mastication and speech. Surgical correction was not possible due to patient's incompliance and history of radiation. Meanwhile, Prosthodontic prognosis was considered poor, due to severe deviation of the mandible and hence the patient was deemed unrehabilitable.

Objective: 1) To understand the unusual activity of mandibular muscles in a hemi-mandibulectomy patient and find the muscles involved in causing deviation. 2) To devise Mandibular muscle physiotherapeutic exercises based on the "5 Step Evidence-Based Dentistry Protocol," in order to train the muscles in obtaining a harmonic maxillo-mandibular relationship. 3) Demonstrate the use of an Orthopedic Chin cup appliance as an adjunct to physiotherapy.

Methodology: The "5 Steps of Evidence-Based Dentistry Protocol" were used to understand the unusual muscle activity in a hemi-mandibulectomy patient and formulate Mandibular Muscle physiotherapeutic exercises to limit deviation. The entire clinical scenario was translated into three answerable questions. Namely: 1) Which muscles cause the deviation of the mandible in hemi-mandibulectomy patients? 2) What are the recommended physiotherapeutic exercises to reduce deviation of the mandible in hemi-mandibulectomy patients along with the frequency and intensity of such exercises? 3) Would an extraoral appliance reduce mandibular deviation in edentulous patients?

Results: Stepwise Evidence based Practice led to a reduction in the mandibular deviation by guiding muscles to a harmonic position. Following which, fabrication of maxillary removable partial denture with palatal ramp and mandibular complete denture was possible in a hemi-mandibulectomy patient restoring mastication, speech and overall (QOL) Quality of life, whose initial prosthetic prognosis was poor and deemed unrestorable.

Conclusion: This evidence-based case report creates awareness among Dentists about the importance of knowledge of "Unusual muscle activity after hemi-mandibulectomy". In order to successfully rehabilitate such patients it is imperative for dentists to broaden their knowledge of the Stomatognathic system.

Keywords: *Hemi-mandibulectomy, Evidence-Based Dentistry Protocol, Mandibular muscle exercises*

Introduction

The Mandible is a crucial bone in the face that helps perform vital functions like mastication and speech, as well as significantly affects esthetics. Hemi-mandibulectomy is the resection of half of the mandible, causes structural, functional and sensory disturbances. Surgical intervention for mandibular reconstruction is not always possible, due to invasive nature of the procedure, increased cost, candidates unfit for surgery as well as post-surgical morbidity concerns.[1] In such cases, Prosthodontic rehabilitation is the considered treatment option which focuses on restoration of form, function, speech and esthetics.[2]

Prognosis of Prosthodontic rehabilitation in hemi-mandibulectomy patient depends upon many inter related factors such as the extent of resected bone, resected TMJ causing disarticulation and mandibular deviation, which in turn causes loss of occlusal plane and disruption of harmonic maxillomandibular relationship. Good prosthetic prognosis is seen in cases where remaining teeth are present in good condition, as this helps to support intra-oral Guiding Appliances. But, in unfortunate cases of complete edentulous arch, the prosthetic prognosis is poor. And such cases are often unrehabilitable especially if the scar contracture of the resected area is severe due to delayed initiation of guidance therapy.[2]

An electronic and a manual search was conducted in the PubMed, EMBASE and Scopus databases to search for case reports related to the non-surgical and prosthodontic rehabilitation of completely edentulous Cantor Curtis Class II, III and IV hemi-mandibulectomy patients with severe deviation. Most dental literature shows prosthetic management of partially edentulous Cantor Curtis Class II, III and IV hemi-mandibulectomy patients, where tooth-supported prosthetic appliances can help limit deviation.[3,4] While, dental literature lacks clear documentation on the prosthetic rehabilitation of completely edentulous Cantor Curtis Class II, III and IV hemi-mandibulectomy cases, mostly showing some surgical intervention.[5]

Case Report

A 65 year old Hemi-mandibulectomy patient was referred to the Department of Prosthodontics with chief complaint of difficulty in eating and speech. History revealed resection of right side TMJ and Ramus done 7 years back. Patient was classified as Class III (Cantor and Curtis, 1971 Classification). He had undergone radiation therapy for tumour suppression and had not used any prosthesis till date. Intraorally, maxillary anterior teeth were present and affected with radiation caries while mandibular ridge was completely edentulous. Patient's mandible deviated towards the right and caused facial asymmetry (Figure 1, 2).

In this case, surgical intervention was not feasible due to previous history of radiation therapy and patient's choice. Hence, prosthodontic rehabilitation with a maxillary palatal ramp prosthesis and mandibular complete denture was planned. But, tentative jaw relation recorded showed very poor prognosis of the prosthesis due to complete deviation of the mandible towards the right (Figure 3). The patient was deemed unrehabilitable.

Figure 1: *Pre-treatment*

Figure 2: *Pre-treatment Intra-oral*

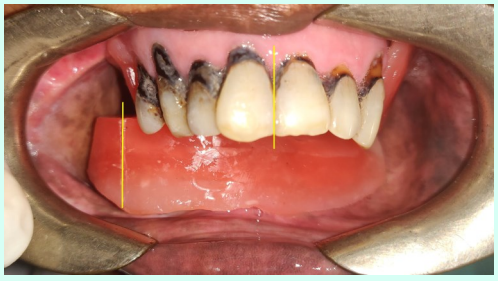

Figure 3: *Tentative Jaw Relation*

This led us to take a step back and Use the "5 Step Evidence-Based Dentistry Protocol" in order to understand the unusual activity of mandibular muscles in a hemi-mandibulectomy patient and then formulate Mandibular muscle physiotherapeutic exercises to train the muscles in obtaining a harmonic maxillo-mandibular relationship.

Objective

1) To understand the unusual activity of mandibular muscles in a hemi-mandibulectomy patient and find the muscles involved in causing deviation. 2) To devise Mandibular muscle physiotherapeutic exercises based on the "5 Step Evidence-Based Dentistry Protocol," in order to train the muscles in obtaining a harmonic maxillo-mandibular relationship. 3) Demonstrate the use of an Orthopedic Chin cup appliance as an adjunct to physiotherapy.

Material and Method

5 Step Evidence-Based Dentistry Protocol starts with:

1. Translation of clinical problems into answerable questions.
2. Conducting an efficient search for the best supporting evidence.
3. Critical Appraisal of the evidence for its validity and clinical applicability.
4. Applying the results of the Critical Appraisal.
5. Evaluating the outcome.[6]

1. Translation of clinical problems into answerable questions

The entire clinical scenario of a hemi-mandibulectomy patient is divided into these three main questions.

1. Which muscles cause the deviation of the mandible in hemi-mandibulectomy patients?
2. What are the recommended mandibular muscle physiotherapeutic exercises to reduce deviation of the mandible in hemi-mandibulectomy patients?
3. Would an extraoral appliance reduce mandibular deviation in edentulous patients?

2. Conducting an efficient search for the best evidence

1) Which muscles cause the deviation of the mandible in hemi-mandibulectomy patients?

Unusual muscle activity after hemi-mandibulectomy was demonstrated by Ian et al, using computer modelling and an inverse-modelling algorithm to understand the biomechanics of surgically altered musculoskeletal systems in hemimandibulectomy model. They compared the normal lateral movement of the jaw produced by the action of Ipsilateral temporalis and contralateral lateral pterygoids with that to lateral movement of the jaw in hemi-mandibulectomy model with missing lateral pterygoid on the resected side. And concluded that the posterior temporalis is recruited to provide a torque to move the mandible in a direction opposite to the defect to compensate for one side lateral deviation and the missing contralateral lateral pterygoid muscles. An important observation was Ipsilateral lateral pterygoids co-activate with posterior temporalis, which is atypical but necessary to generate medial forces at the condyle to balance the lateral forces generated by posterior temporalis. **This co-activation of Ipsilateral lateral pterygoids causes mandibular deviation towards the defect side**.[7]

2) What are the recommended mandibular muscle physiotherapeutic exercises to reduce deviation of the mandible in hemi-mandibulectomy patients?

No objective protocol of physiotherapeutic mandibular exercises are available for reduction in mandibular deviation specifically after hemi-mandibulectomy, in the Dental Literature. In order to formulate such exercises, we dived into Physiotherapy Literature. Three Basic Guiding Principles of Resistance exercises were studied.[8,9]

Namely, 1) Overload Principle, where Progressive load exceeding metabolic capacity of the muscle is applied in order to challenge the muscles, cause the fibres to spit and double in number. It forms the foundation of resistance exercises, improves muscle performance. 2) SAID Principle, which states that body makes "Specific adaptation to imposed demands", an extension of Wolff's Law (Body systems adapt over time to stresses placed on them). Hence, more specific the exercise, more specific is the adaptation. 3) Reversibility Principle, which states that detraining begins within a week or two after the cessation of resistance exercises and continues until training effects are lost which is reflected by reduction in muscle performance.

3) Would an extraoral appliance reduce mandibular deviation in edentulous patients?

Based on the available evidence in the management of Class III malocclusion, it is noted that orthopedic chin cup therapy induces craniofacial adaptations. Since no standard protocol has been followed in its use in orthodontics, it is evident that effectiveness of chin cup varies according to an individualized way of use.[10]

3. Critical appraisal of the evidence for its validity and clinical applicability

1) Which muscles cause the deviation of the mandible in hemi-mandibulectomy patients?

Through the study Ian et al. depicts that "Inclusion of lateral constraint at the joint, such as the lateral aspect of the articular fossa or the temporomandibular ligament, can reduce the need for lateral pterygoid co-activation", concluding that such predictions could be the basis for future muscle retraining in clinical cases. Hence the aim of muscle training in this hemi-mandibulectomy case is to limit the mandibular deviation by preventing the co-activation of Ipsilateral lateral pterygoids using Mandibular Muscle exercises.[7]

2) What are the recommended physiotherapeutic exercises to reduce deviation of the mandible in hemi-mandibulectomy patients along with the frequency and intensity of such exercises?

The fact that Resistance Exercises are "Not set in stone" and can be modified by the therapist based on patient's needs, give us an opportunity to construct a Mandibular muscle exercise regime for our hemi-mandibulectomy patient.[8,9] Overload principle is used to apply Progressive load manually by the patient as well as mechanically using orthopedic chin cup therapy onto the mandible towards the left side challenging the muscles of mastication and preventing the co-activation of Ipsilateral lateral pterygoids during lateral movement of the jaw. SAID Principle helps target the muscles of the mandible that help in closing of the jaw and maintaining the position by lateral movement. Concept of Reversibility Principle is used to formulate the Maintenance protocol for another 3 months.

3) Would an extraoral appliance reduce mandibular deviation in edentulous patients?

In this case report an Orthopedic Chin cup is employed as an Extra-oral Mandibular guidance therapy to control the co-activation of Ipsilateral lateral pterygoids during lateral movement of jaw. And help retain the jaw muscles by challenging them and increasing their endurance as well as limiting mandibular deviation.

4. Applying the results of the Critical Appraisal in our clinical case report

Evidence-Based Mandibular Muscle physiotherapeutic exercises were applied in our hemi-mandibulectomy patient, using both, Manual and Mechanical Method.

1. Manual method: Resistance is applied by the patient's hands in the opposite direction to the surgical site and position held for 30 Seconds before release. Repeated 10 times in each session of 5 sessions per day. Patient could apply progressively more pressure slowly in a matter of 3 months increasing displacement towards the left side (Figure 4).

2. Mechanical method: Orthopedic Chin cup is used to place the deviated mandible in the desired position in order to retrain the muscles. Orthopedic Chin cup is used for 2 hours in the morning and 2 hours in the evening, everyday. Patient could tighten the left side of the chin cup strap and apply progressively more pressure slowly in a matter of 3 months increasing displacement towards the left side (Figure 5).

Figure 4: *Manual Mandibular exercise*

Figure 5: *Chin Cup therapy*

5. Evaluating the outcome

Patient evaluation after 3 months revealed that the muscles had been trained to close the jaws in a more acceptable position (Figure 6). Jaw relations obtained after the Mandibular muscle exercises were satisfactory. Facebow record was obtained and transferred into an articulator. Teeth arrangement was done followed by try-in. Palatal ramp was recorded during elevation of the mandible, the left mandibular teeth touched the ramp first, finding their normal position in occlusion with the left maxillary teeth. A maxillary removable partial denture with a palatal ramp and mandibular complete denture prosthesis was fabricated to rehabilitate the patient (Figure 7). The patient was satisfied with the mastication, speech and esthetics achieved with the denture (Figure 8). The therapeutic exercises were continued for another 3 months as the maintenance protocol.

Figure 6: *After Mandibular muscle exercises*

Figure 7: *Final Prosthesis*

Figure 8: *Post Treatment*

Discussion

It is possible to retrain the musculoskeletal system using extra-oral appliances in completely edentulous hemi-mandibulectomy patients and improve their prosthodontic prognosis, bringing about an evident positive change in their masticatory system, speech and overall Quality of Life. Most of the dental literature shows hemi-mandibulectomy patients with partially edentulous mandibular arch, where tooth-supported prosthetic appliances can help limit deviation. Hence, this clinical case opens up doors of treatment possibilities for completely edentulous hemi-mandibulectomy patients. The pros are that the entire treatment process is non invasive, hence possibility of harm is reduced. The cons however include the limited amount of research available on this topic, hence the findings of this study need to be implemented on more clinical cases, as well as the mandibular exercises need to be made more objective.

Conclusions

This clinical report creates awareness among Dentists regarding:

1. The importance of knowledge of "Unusual muscle activity after hemi-mandibulectomy" in order to broaden the view of the Stomatognathic system when rehabilitating such patients.

2. Mandibular Muscle physiotherapeutic exercises show a promising future in the limitation of mandibular deviation associated with hemi-mandibulectomy cases. It should be further researched in order to provide objectivity on formulation and prescription (duration, frequency, intensity) of the exercises.

3. Application of Extra-oral mandibular guidance therapy is a crucial interdiscilpinary method in order to limit deviation in completely edentulous cases. In this case report, an Orthopedic chin cup is employed as a novel method. Many such innovative appliances can be further researched and demonstrated.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgment

We would like to thank Dr. Sauptik Ray and Dr. Gauri Shahi, Department of Prosthodontics, Manipal College of Dental Sciences, Manipal, Karnataka, India, for their constant support in the fulfillment of this clinical case.

References

1. Beumer III J, Marunick MT, Esposito SJ. Maxillofacial rehabilitation. 3rd ed., 2011, Quintessence. pp 87-9, 118-20.
2. Cantor R, Curtis TA. Prosthetic management of edentulous mandibulectomy patients. Part I. Anatomic, physiologic, and psychologic considerations. The Journal of prosthetic dentistry. 1971 Apr 1;25:446-57.
3. Bin Jamayet N, Yazdani Fard A, Husein A, Arifin Z, Alam MK, Jamayet NB, Fard AY, Ariffin Z. Combined Mandibular Guidance Therapy in the Management of a Hemimandibulectomy Patient. International Journal of Prosthodontics. 2015 Nov 1;28.
4. Tripathi A, Gupta A, Gautam V, Anwar M, Arora V. The efficacy of guiding flange appliance in correcting mandibular deviation in the hemi-mandibulectomy patient. A correlative study. Journal of Prosthodontics. 2015 Feb;24(2):121-6.
5. Watson RM, Welfare RD, Islami A. The difficulties of prosthetic management of endentulous cases with hemi-mandibulectomy following cancer treatment. Journal of oral rehabilitation. 1984 May;11(3):201-14.
6. McGivney GP. Evidence-based Dentistry Article Series. Journal of Prosthetic Dentistry. 2001 Jun 1;85:525-6.
7. Ian Stavnessa , Alan G. Hannamb , John E. Lloyda. Predicting muscle patterns for hemimandibulectomy models and Sidney Felsa, Computer Methods in Biomechanics and Biomedical Engineering Vol. 13, No. 4, August 2010, 483–491.
8. Kisner C, Colby LA, Borstad J. Therapeutic exercise: foundations and techniques. Fa Davis; 2017 Oct 18.
9. Magee DJ. Orthopedic physical assessment-E-Book. Elsevier Health Sciences; 2014 Mar 25.
10. Zurfluh MA, Kloukos D, Patcas R, Eliades T. Effect of chin-cup treatment on the temporomandibular joint: a systematic review. European journal of orthodontics. 2015 Jun 1;37:314-24.

Citation: Huda S, Sherigar P. "Evidence-Based Dentistry Protocol used in the Formulation and Application of Mandibular Muscle Physiotherapeutic Exercises in the Non-Surgical Correction of Mandibular Deviation Associated with Hemi-Mandibulectomy". SVOA Dentistry 2:5 (2021) Pages 174-179.