BALANCING ACT: UNVEILING THE LINK BETWEEN DENTAL OCCLUSION AND POSTURAL STABILITY – A CASE SERIES.

ABSTRACT

This case series demonstrates the connection between dental occlusion and postural stability in patients with chronic musculoskeletal pain and instability. Assessments including dental examination, postural analysis, and gait evaluation revealed that occlusal abnormalities directly influenced postural alignment and vice versa. Pain levels improved following posture correction and occlusal adjustments.

The findings highlight the importance of interdisciplinary collaboration between dental professionals and physical therapists. By exploring mechanisms underlying the occlusion–posture relationship, this report contributes to evidence supporting a holistic view of health. Greater awareness among healthcare providers is needed regarding the impact of dental occlusion on postural balance and overall well-being.

In conclusion, dental occlusion plays a critical role in maintaining postural stability, advocating integrated, system-wide patient care.

KEYWORDS: Dental Occlusion, posture stability, interdisciplinary approach, occlusion – posture relationship.

INTRODUCTION

Posture and occlusion are closely linked. Occlusion—the alignment and contact of teeth—can influence posture by affecting the stomatognathic system, including teeth, jaw muscles, and TMJs.[1] In ideal occlusion, the TMJ is in centric relation, anterior teeth align with the lips, tongue, and functional envelope, and posterior teeth remain free of interferences to ensure balanced force distribution.[3] Poor occlusion, such as malocclusion, can lead to forward head posture, increasing strain on the cervical spine and muscles.[1]

Uneven occlusal contacts may create a maxillary cant that transmits down the kinetic chain, causing asymmetric loading of the spine and shoulders and predisposing to discomfort or early degenerative changes.[3] Disturbed occlusion can over activate neck and scapular muscles, disrupting swallowing and visual coordination as head alignment shifts. Disrupted periodontal ligament feedback further provokes compensatory muscle activity, producing forward neck posture, uneven shoulders, and altered spinal curvature with functional consequences.[3]

CASE SERIES

Case 1

A 32-year-old female presented to the neuromuscular dentistry department with a two-month history of chronic, gradually progressive bilateral facial pain of moderate intensity. Episodes

lasted 1–2 hours, occurring 7–8 times daily, aggravated by mastication and relieved with analgesics. No swelling, paraesthesia, or dental mobility was noted, and medical, surgical, and dental history was non-contributory.

Clinical Findings: Extraoral examination revealed postural deviation with head tilt to the left and ipsilateral shoulder drooping. Bilateral temporomandibular joint tenderness was elicited without joint sounds. Tenderness was observed in temporalis, masseter, trapezius, and sternocleidomastoid muscles. Intraoral examination showed pterygoid tenderness, anterior proclination, and deep bite.

Investigations: Blood tests revealed deficiencies in Vitamin D, Vitamin B12, and calcium. Radiographs showed no dental pathology but mild spinal curvature. Electromyography demonstrated hyperactivity in temporalis, masseter, sternocleidomastoid, and trapezius muscles (except right trapezius). T-Scan revealed uneven left-sided occlusal loading. Cephalometry confirmed forward head posture, and pressure mapping indicated dominant left foot load. Diagnosis: **Myofascial Pain Dysfunction Syndrome.**

Management: A multidisciplinary protocol was initiated. Pharmacological therapy included vitamin and calcium supplementation with muscle relaxants. Physiotherapy (ultrasound and TENS twice weekly for four weeks) and Disclusion Time Reduction (DTR) therapy were performed to optimize occlusion and reduce muscle hyperactivity. Postural correction was achieved using a support belt for three months.

Outcome: Post-treatment electromyography showed reduced muscle hyperactivity. T-Scan demonstrated balanced occlusal forces, and postural assessment revealed corrected shoulder alignment. At three-month follow-up, the patient reported significant reduction in pain intensity and frequency, confirming the effectiveness of integrated management.

CASE 2:

A 50-year-old female presented to the neuromuscular dentistry department with a one-year history of chronic, severe bilateral facial pain radiating to the head and cervical regions. Episodes lasted ~30 minutes, occurring 4–5 times weekly, aggravated by mastication and subsiding spontaneously. The patient reported habitual lifting of a water pot on the left side, suggesting contributory postural strain. No relevant medical or dental history was noted.

Clinical Findings: Extraoral examination revealed left shoulder drooping and postural asymmetry. Temporomandibular joints showed no clicks, but bilateral tenderness was present in temporalis, masseter, sternocleidomastoid, and trapezius muscles. Generalized hyperflexibility was observed. Intraoral examination revealed mild occlusal attrition and tenderness in lateral and medial pterygoids.

Investigations: Blood tests showed deficiencies in vitamin D, vitamin B12, and calcium. Orthopantomogram revealed no dental pathology. Electromyography demonstrated hyperactivity in temporalis, masseter, sternocleidomastoid, and trapezius muscles bilaterally (except right trapezius). T-Scan analysis indicated excessive force in the left molar region.

Cephalogram confirmed forward neck posture, spinal radiography showed rightward deviation, and foot pressure mapping revealed dominant right-sided load. Diagnosis: **Myofascial Pain Dysfunction Syndrome.**

Management: A multidisciplinary protocol was initiated. Pharmacological therapy included muscle relaxants and supplementation with calcium, vitamin D, and vitamin B12. Activity modification advice was given to avoid left-sided lifting. T-Scan-guided occlusal adjustments were performed to balance bite forces. Physiotherapy (ultrasound and TENS twice weekly for four weeks) was administered to reduce muscular tension. Postural correction was achieved using a supportive belt for three months.

Outcome: Post-treatment electromyography showed reduced muscle hyperactivity. T-Scan demonstrated balanced occlusal forces, and clinical observation confirmed corrected shoulder alignment. At follow-up, the patient reported significant reduction in pain intensity and frequency, indicating successful integrated management.

DISCUSSION

Asymmetrical dental occlusion can have profound implications on muscle symmetry, particularly affecting the masseter and sternocleidomastoid muscles. Prolonged asymmetrical occlusion, often observed in conditions like unilateral mastication or chewing side preference (CSP), may also extend its influence to distal muscle groups, such as the lateral gastrocnemius.[2] Such functional imbalances can disrupt postural homeostasis, underscoring the necessity for early intervention in adolescents to mitigate long-term musculoskeletal sequelae.[4] This occlusal scheme diminishes electromyographic (EMG) activity in the elevator muscles, such as the masseter and temporalis, minimizing parafunctional habits like bruxism and associated soft tissue trauma.[5]

Neuromuscular and sensory feedback mechanisms mediated via the periodontal ligament (PDL) mechanoreceptors play a pivotal role in regulating the central masticatory pattern generator (CPG).[4] These mechanoreceptors provide critical real-time data to ensure harmonious occlusal function. Any discrepancies, such as occlusal disharmony, perturb this feedback loop, leading to aberrant activation patterns in the masticatory and cervical musculature, and consequently, postural asymmetry.[7] Properly equilibrated occlusal contacts are essential for maintaining balanced muscle activation, optimizing craniovertebral alignment, and ensuring symmetry in the shoulder girdle.[8] Conversely, malocclusions can precipitate compensatory adaptations, such as mandibular deviation, head tilt, and uneven shoulder levels. Over time, these adaptations may contribute to cumulative biomechanical stress along the spinal axis, resulting in musculoskeletal discomfort and degenerative pathologies.[9] Historical clinical observations, such as those by Schwartz in 1926, underscore the cascading biomechanical impact of occlusal imbalances, which remain a critical focus in contemporary dental and orthopaedic practice.[10]

As demonstrated in Case 1, A compensatory mechanism was activated by a comparable occlusal disparity, where the spine shifted to the other side while the head and shoulder

slanted to the same side. Furthermore, the occlusion led to a forward position of the neck and increased pressure on the opposite side of the foot.

Forward head posture (FHP), clinically referred to as anterior head translation, is characterized by the anterior displacement of the cranium relative to the shoulders and cervical spine. This condition disrupts normal biomechanical alignment and is closely associated with occlusal disharmony.[11] Class II malocclusions, where the mandible is retruded relative to the maxilla, often induce compensatory anterior positioning of the head to achieve functional occlusal contacts.[12] Conversely, in Class III malocclusions, where the mandibular dentition is positioned mesial to the maxillary dentition, the craniocervical alignment tends to shift posteriorly. These patterns underscore the integral role of dental occlusion in influencing cranio-cervical and overall postural alignment.[13]

FHP imposes excessive mechanical load on the cervical spine, with the axial load increasing incrementally by approximately 4–5 kg for every inch of anterior displacement of the head. This additional strain can result in chronic hypertonicity of the cervical extensor musculature, myalgia, and predisposition to temporomandibular disorders (TMDs).[14] The neuromuscular system compensates for imbalanced occlusal contacts through hyperactivation of the anterior neck and scapular stabilizing muscles, perpetuating the postural imbalance. Furthermore, the altered biomechanics of FHP may impair essential functions such as deglutition and oculomotor coordination, emphasizing the necessity of addressing occlusal discrepancies in both preventive and therapeutic contexts to restore optimal musculoskeletal and functional health.[15]

The spine's natural curvatures—cervical lordosis, thoracic kyphosis, and lumbar lordosis—are crucial for shock absorption and energy-efficient posture. However, occlusal disharmony, such as that caused by malocclusion, can disrupt this balance, leading to cascading postural effects.[16] Over time, compensatory mechanisms may result in hyper lordosis, hyper kyphosis, or even scoliosis due to asymmetric occlusal contacts altering force distribution along the vertebral column. These postural changes contribute to chronic musculoskeletal pain, increased stress on vertebral discs and joints, reduced mobility, and impaired functional performance, emphasizing the need for early occlusal correction to prevent degenerative outcomes.[17]

As demonstrated in Case 2, the habitual activity of consistently lifting a water pot on one side led to postural imbalance, manifesting as shoulder drooping on the same side. This repetitive strain induced a compensatory curvature of the spine toward the opposite side. The resultant musculoskeletal adaptation contributed to hyperactivity in the orofacial musculature, culminating in occlusal imbalance predominantly on the side of shoulder deviation. Additionally, foot pressure analysis revealed increased loading on the side opposite to the occlusal imbalance

Repetitive asymmetrical activities, such as habitual lifting on one side, can trigger both intrinsic and extrinsic compensatory mechanisms that alter spinal curvature. These adaptations often result in thoracic hyperkyphosis and lumbar lordosis, contributing to

muscular dystonia and postural imbalance. The body strives to maintain equilibrium by activating these mechanisms, which, while adaptive, may lead to long-term musculoskeletal strain and pain.[18]

To preserve sagittal balance in the presence of spinal misalignment, the body employs compensatory strategies across the spine, pelvis, and lower limbs. These include hyperextension of adjacent spinal segments and pelvic tilt adjustments. While these mechanisms help maintain upright posture, they can induce muscular overuse and contribute to chronic discomfort, especially when postural deviations like forward head posture or shoulder drooping are present.[19]

There is a strong association between sagittal spinal curvature—specifically kyphosis and lordosis—and displacement of the centre of pressure (CoP), which reflects postural control efficiency. Increased curvature angles were linked to greater CoP shifts, indicating compromised balance and asymmetrical foot pressure distribution. These findings validate the observation that spinal misalignment affects plantar loading patterns and overall postural stability.[20]

Spinal misalignments, particularly within the cervical and thoracic regions, often trigger compensatory changes in head positioning and mandibular orientation. These biomechanical adaptations can lead to an imbalance in occlusal force distribution, typically manifesting as unilateral dominance across the dental arch. Such postural asymmetry, resulting from underlying spinal curvature, has been shown to disrupt occlusal harmony and contribute to masticatory muscle overload and myofascial pain.[21]

One of the limitations in the present cases was the method employed for foot pressure analysis, which involved ink-coated impressions on a graph sheet. This approach lacks precision and reliability for quantifying plantar load distribution. For enhanced diagnostic accuracy, more advanced tools such as a Harris mat or digital podoscan are recommended to evaluate postural alignment and foot pressure dynamics with greater detail and objectivity.

CONCLUSION

The relationship between occlusion, shoulder line posture, spine curvature, and foot pressure highlight the connectivity of the musculoskeletal system. Understanding these connections is crucial for comprehensive patient care, particularly for those with chronic pain or postural issues.

REFERENCES:

1. Sutter BA, Girouard P. Posture Stability and Forward Head Posture Before and After Disclusion Time Reduction (DTR). A Five-Year Cohort Study. Advanced Dental Technologies & Techniques. 2021 Jul 20.
2. Zhang Y, Liu K, Shao Z, Lyu C, Zou D. The effect of asymmetrical occlusion on surface electromyographic activity in subjects with a chewing side preference: a preliminary study. InHealthcare 2023 Jun 12 (Vol. 11, No. 12, p. 1718). MDPI.
3. 1

4. Sforza C. Evidence of an influence of asymmetrical occlusal interferences on the activity of the sternocleidomastoid muscle. Journal of Oral Rehabilitation. 2003; doi:10.1046/J.1365-2842.2003.00986.

5. Goel R, Jain V, Gupta C, Srivastava AK. Effect of Hard and Soft Occlusal Splints on Electromyographic Activity of Masseter and Anterior Temporalis in Patients with Moderate to Severe Occlusal Wear: A Randomized Controlled Trial. International Journal of Prosthodontics and Restorative Dentistry. 2023 Sep 29;13(3):137-44.

6. Lund JP, Kolta A. Generation of the central masticatory pattern and its modification by sensory feedback. Dysphagia. 2006 Jul;21(3):167-74.

7. Thumati P, Thumati R, Thumati PP. Understanding the Influence of Static and Dynamic Occlusal Forces on the Musculoskeletal System With Digital Occlusal Analysis. InHandbook of Research on T-Scan Technology Applications in Dental Medicine 2025 (pp. 1723-1858). IGI Global Scientific Publishing.

8. Vincent L, Janardanan K, Kumar H, Ravichandran R. OCCLUSAL INDICATORS: KEY FOR THE EQUILIBRATION OF FUNCTIONAL OCCLUSION.

9. Melsen B, Athanasiou AE, editors. Dentofacial and occlusal asymmetries. John Wiley & Sons; 2024 Aug 28.

10. Arroyo F. Biomechanics of occlusion – implications for oral. doi:10.1111/JOOR.12345

11. L. Blum C. The many faces of forward head posture: the importance of differential diagnosis. CRANIO®. 2019 May 4;37(3):143-6.

12. Yassaei S, Vakil F, Nasr N. Evaluation of natural head position changes in the treatment of class II malocclusions with functional appliance.

13. Dipalma G, Inchingolo AD, Pezzolla C, Sardano R, Trilli I, Di Venere D, Corsalini M, Inchingolo F, Severino M, Palermo A, Inchingolo AM. Head and Cervical Posture in Sagittal Skeletal Malocclusions: Insights from a Systematic Review. Journal of Clinical Medicine. 2025 Apr 11;14(8):2626.

14. Page P, Frank CC, Lardner R. Assessment and treatment of muscle imbalance. (No Title). 2010.

15. Debucean D, Mihaiu J, Maghiar AM, Marcu F, Marcu OA. A multidisciplinary approach to swallowing rehabilitation in patients with forward head posture. Medicina. 2023 Aug 31;59(9):1580.

16. Langella F, Fusini F, Rossi G, Villafañe JH, Migliaccio N, Donzelli S, Berjano P. Spinal deformity and malocclusion association is not supported by high-quality studies: results from a systematic review of the literature. European Spine Journal. 2019 Jul 1;28(7):1638-51.

17. Głogowska K, Wojtas M, Kapica M, Momot K, Żmijewska A, Sztybór M, Krzyżanowska M, Maleszewska M, Piątkiewicz J, Nowak G. The association between body posture and malocclusion-a literature review. Journal of Education, Health and Sport. 2024 Feb 22;62:240-52.

18. Briggs AM, Van Dieën JH, Wrigley TV, Greig AM, Phillips B, Lo SK, Bennell KL. Thoracic kyphosis affects spinal loads and trunk muscle force. Physical therapy. 2007 May 1;87(5):595-607.

19. Shimizu T, Cerpa M, Lenke LG. Understanding sagittal compensation in adult spinal deformity patients: relationship between pelvic tilt and lower-extremity position. Journal of Neurosurgery: Spine. 2021 Aug 13;35(5):616-23.

20. Żurawski AŁ, Kiebzak WP, Kowalski IM, Śliwiński G, Śliwiński Z. Evaluation of the association between postural control and sagittal curvature of the spine. PloS one. 2020 Oct 27;15(10):e0241228.

21. Dipalma G, Inchingolo AD, Pezzolla C, Sardano R, Trilli I, Di Venere D, Corsalini M, Inchingolo F, Severino M, Palermo A, Inchingolo AM. Head and Cervical Posture in Sagittal Skeletal Malocclusions: Insights from a Systematic Review. Journal of Clinical Medicine. 2025 Apr 11;14(8):2626.

Fig 1: showing the head tilt and drooping of shoulder

Fig 2: anterior proclination and deep bite

Fig 3: orthopantomograph

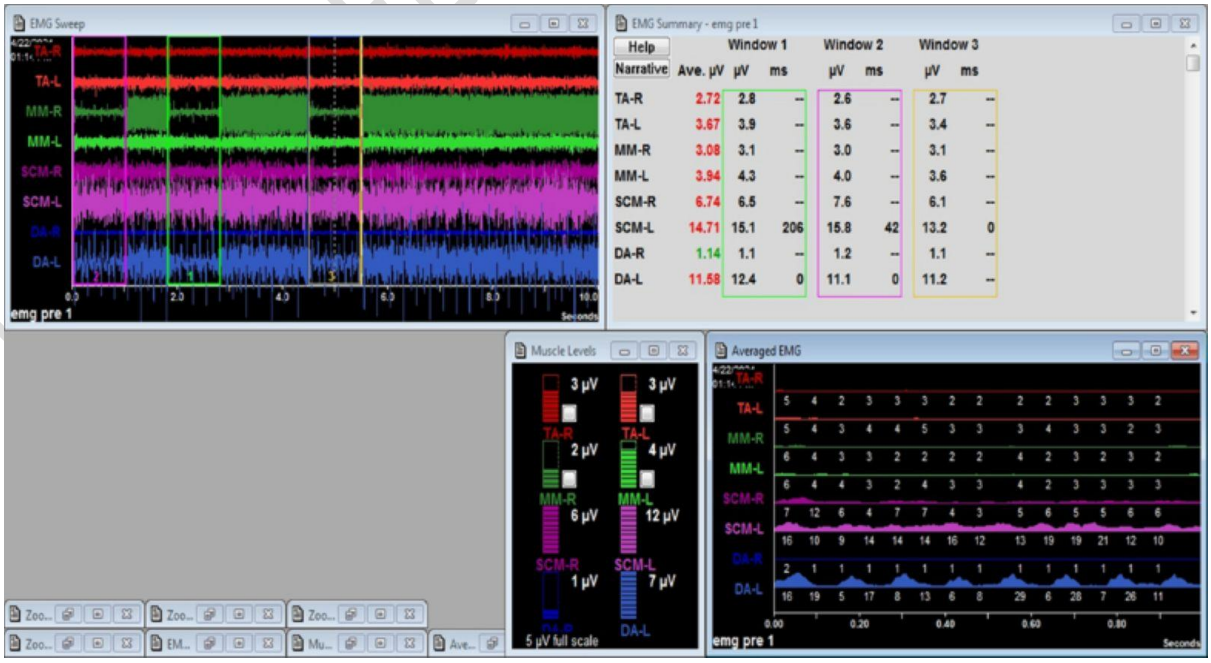


Fig 4: electromyograph

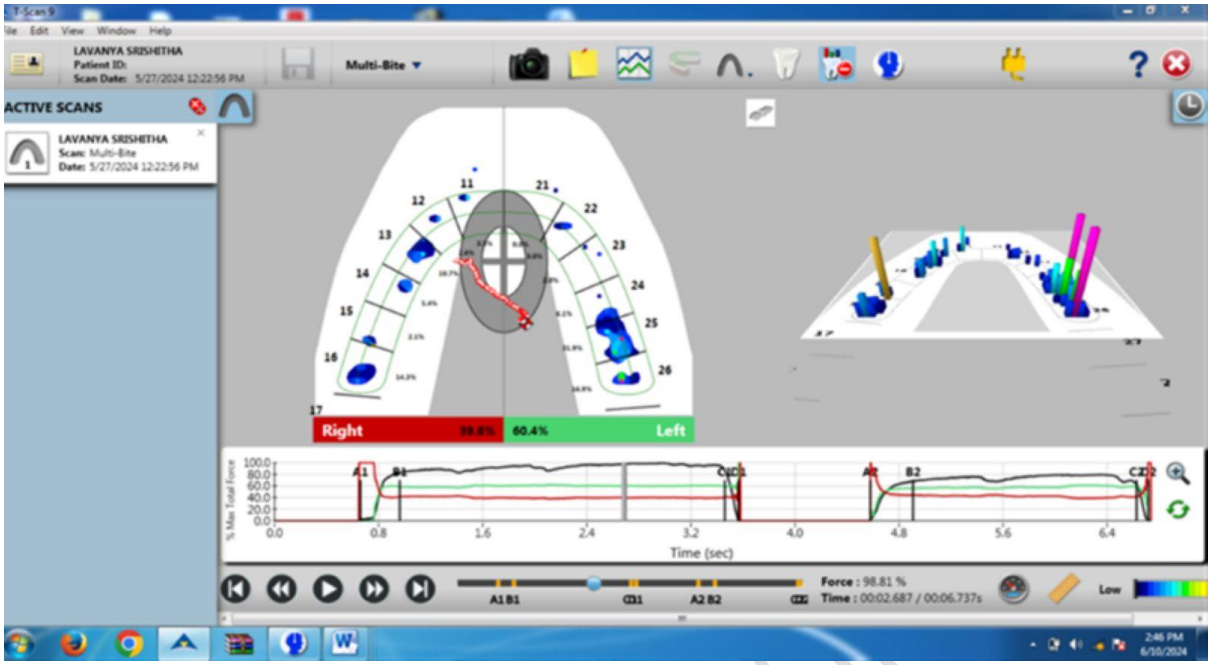


Fig 5: T – scan

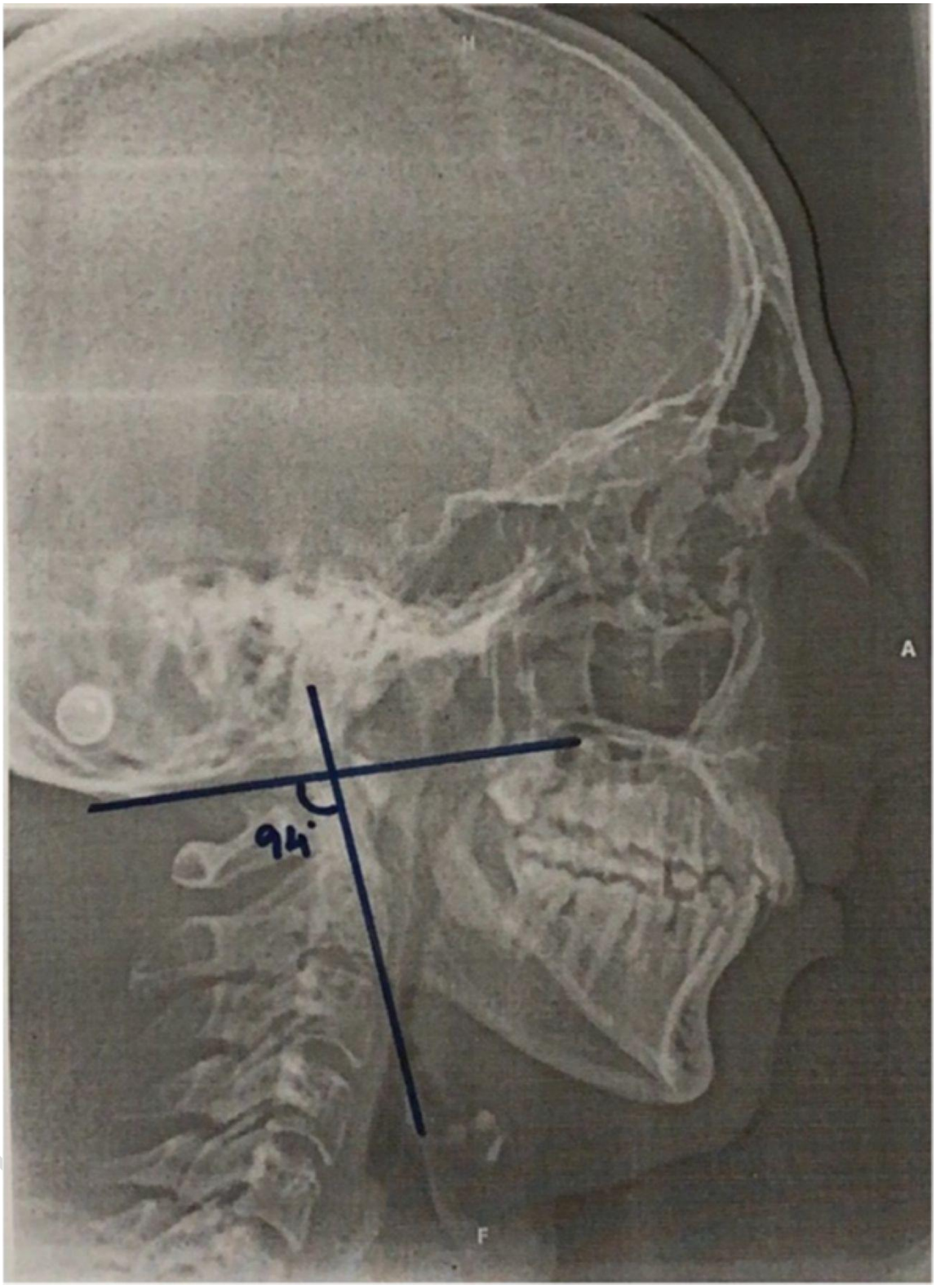


Fig 6: lateral cephalography

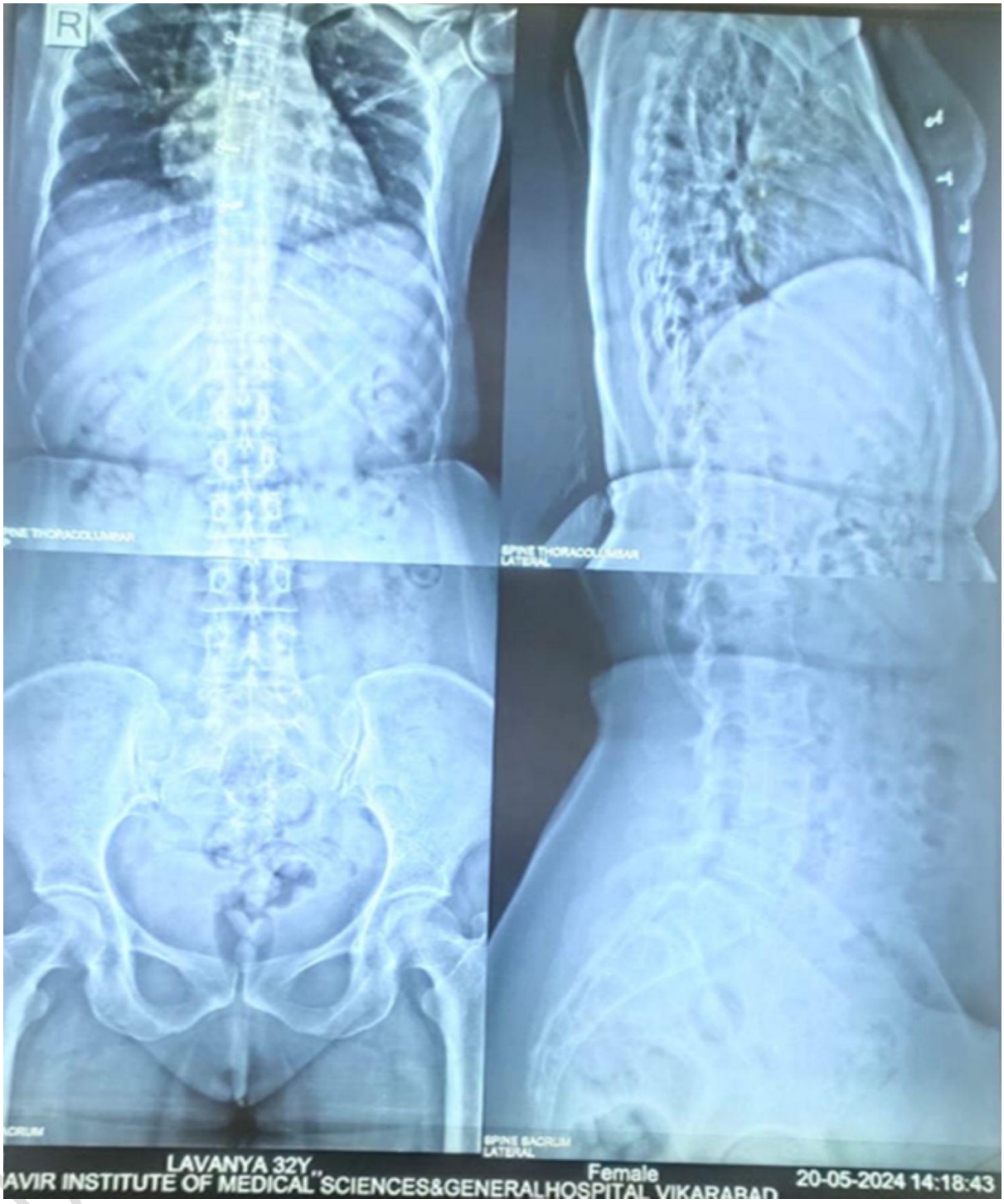


Fig 7: spine x ray

Fig 8: foot impression

Fig 9: TENS Therapy

Fig 10: ultrasound therapy

Fig 11: posture modification belt

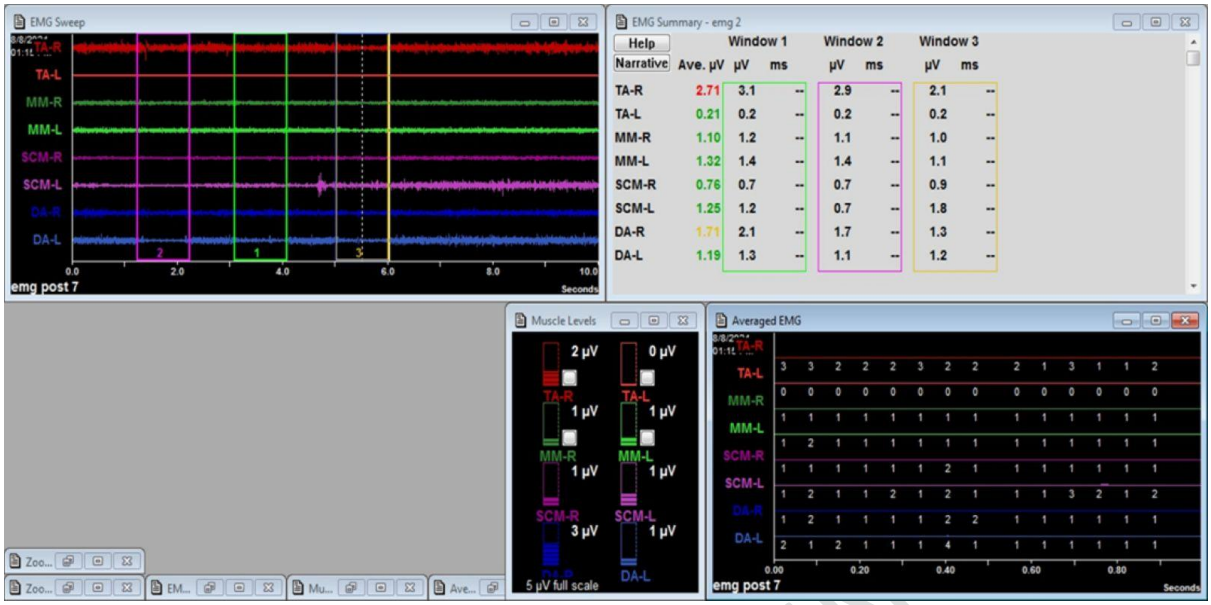


Fig 12: electromyograph

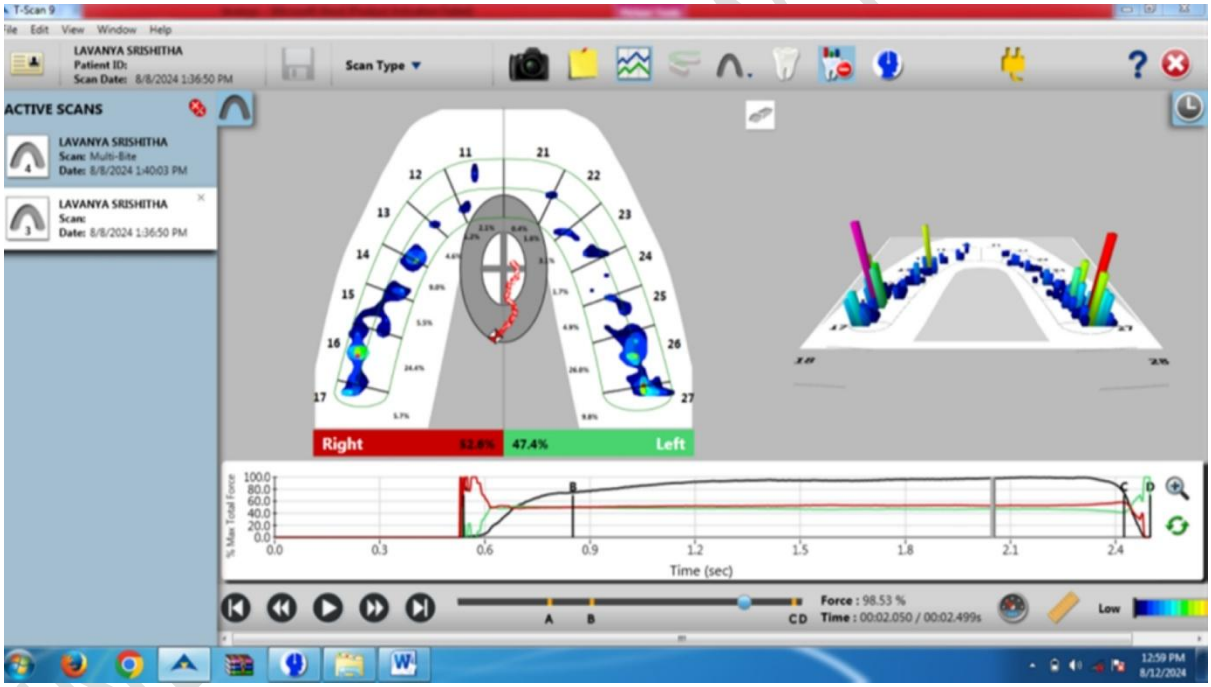


Fig 13: T – scan

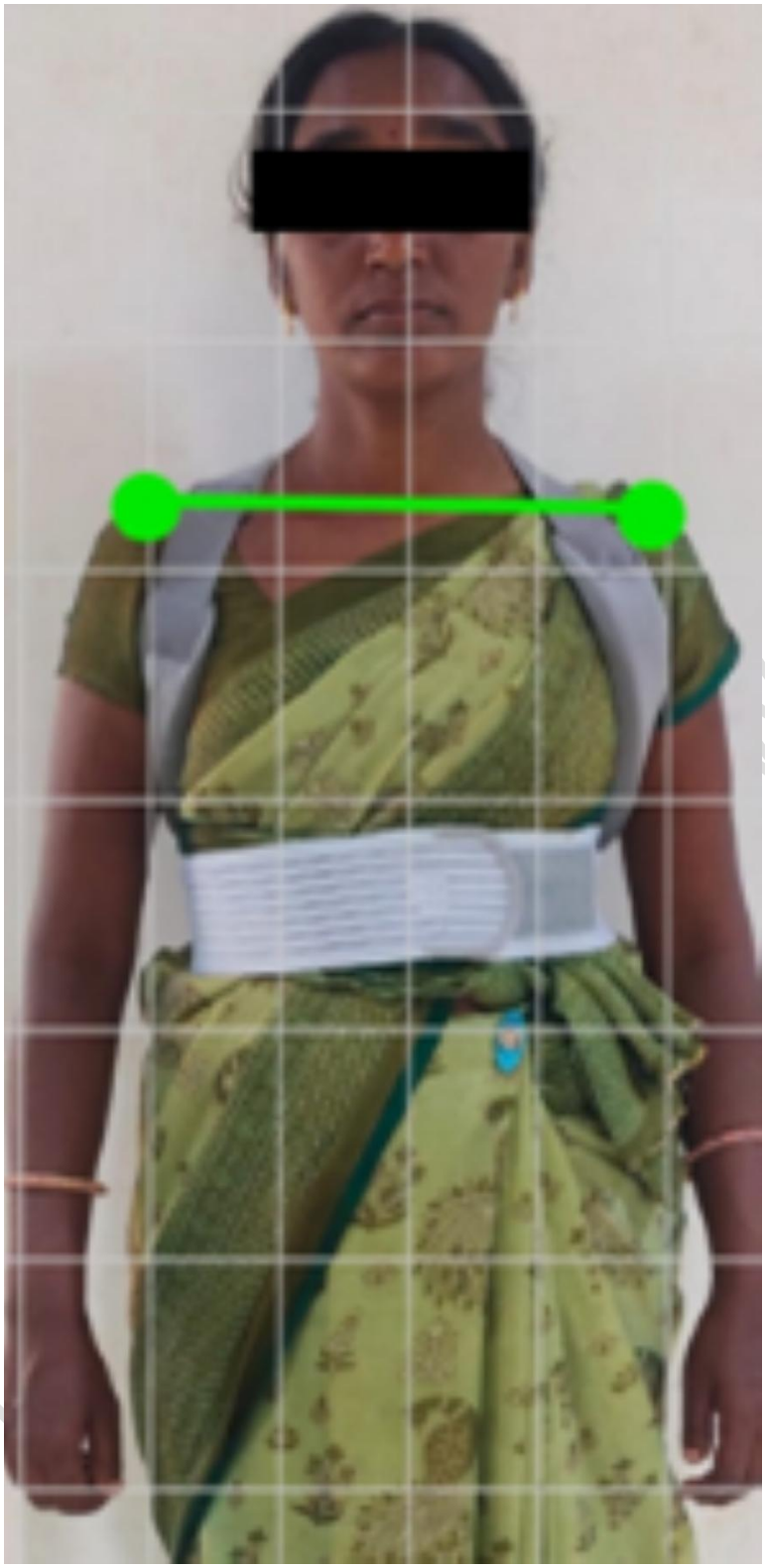


Fig 14: corrected shoulder line.

Fig 1: shoulder drooping towards left side.

Fig 2: mild attrition with mild recession in anterior teeth.

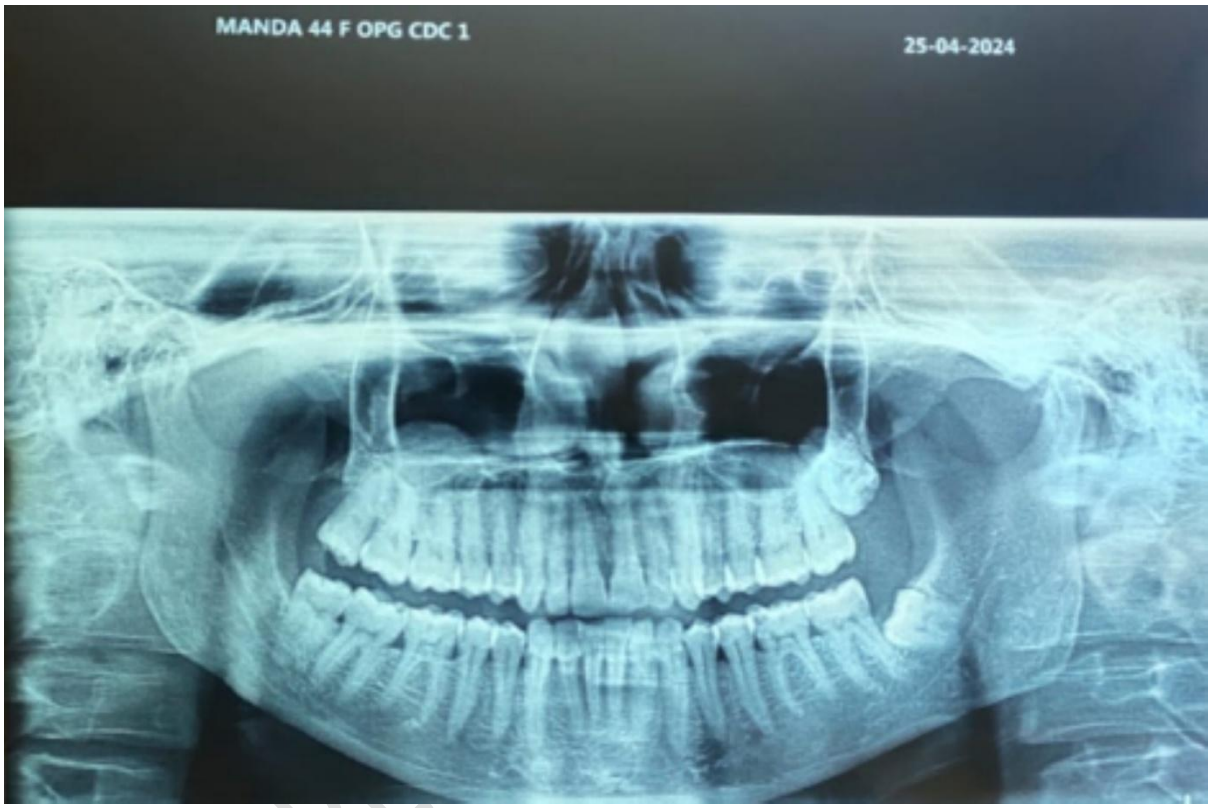


Fig 3: orthopantomography

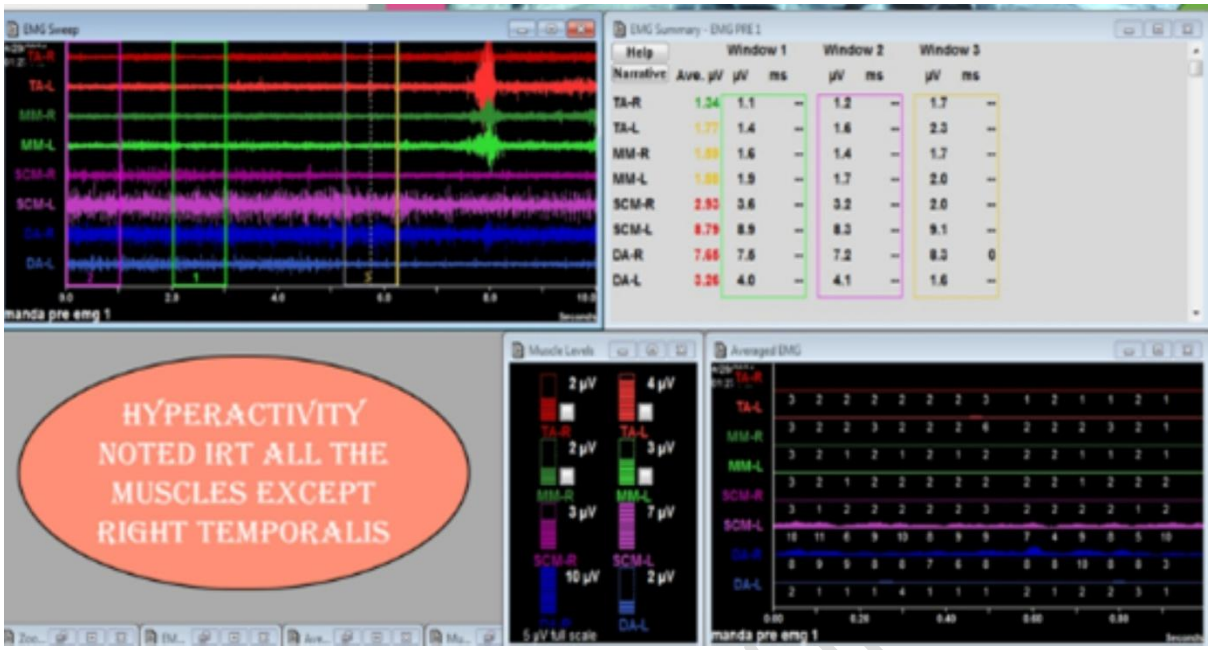


Fig 4: electromyograph

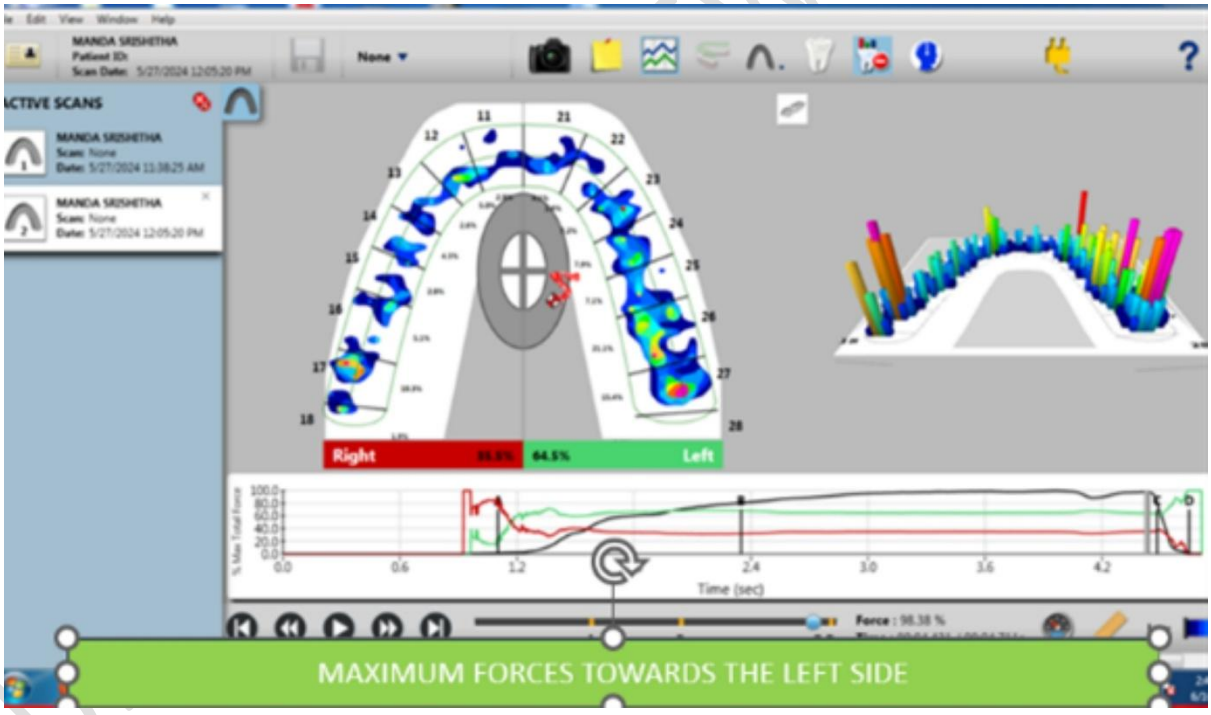


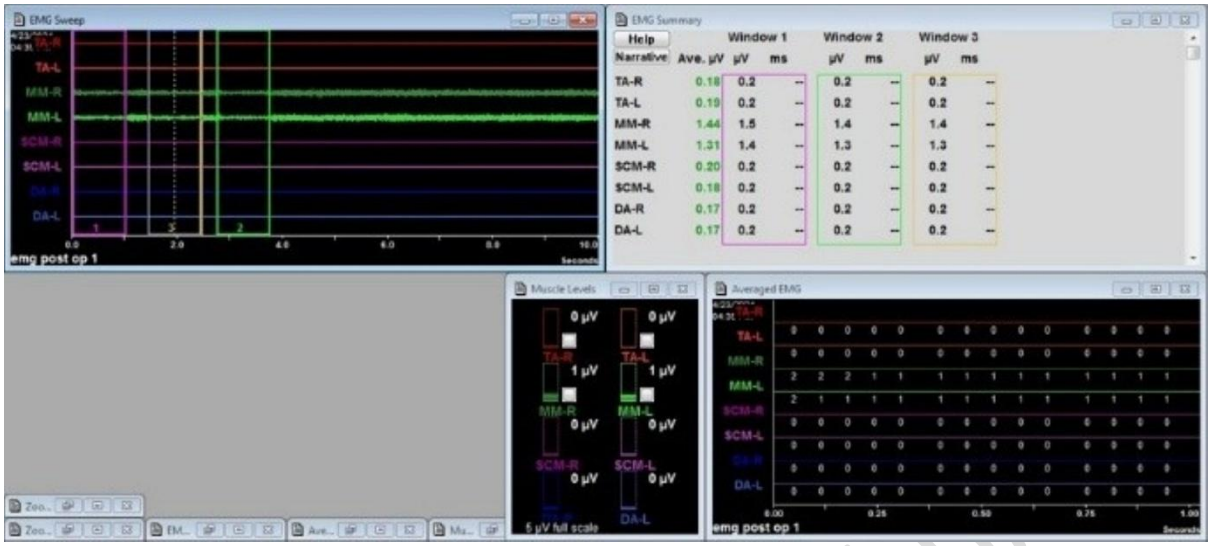
Fig 5: T scan

Fig 6: lateral cephalogram

Fig 7: spine x ray

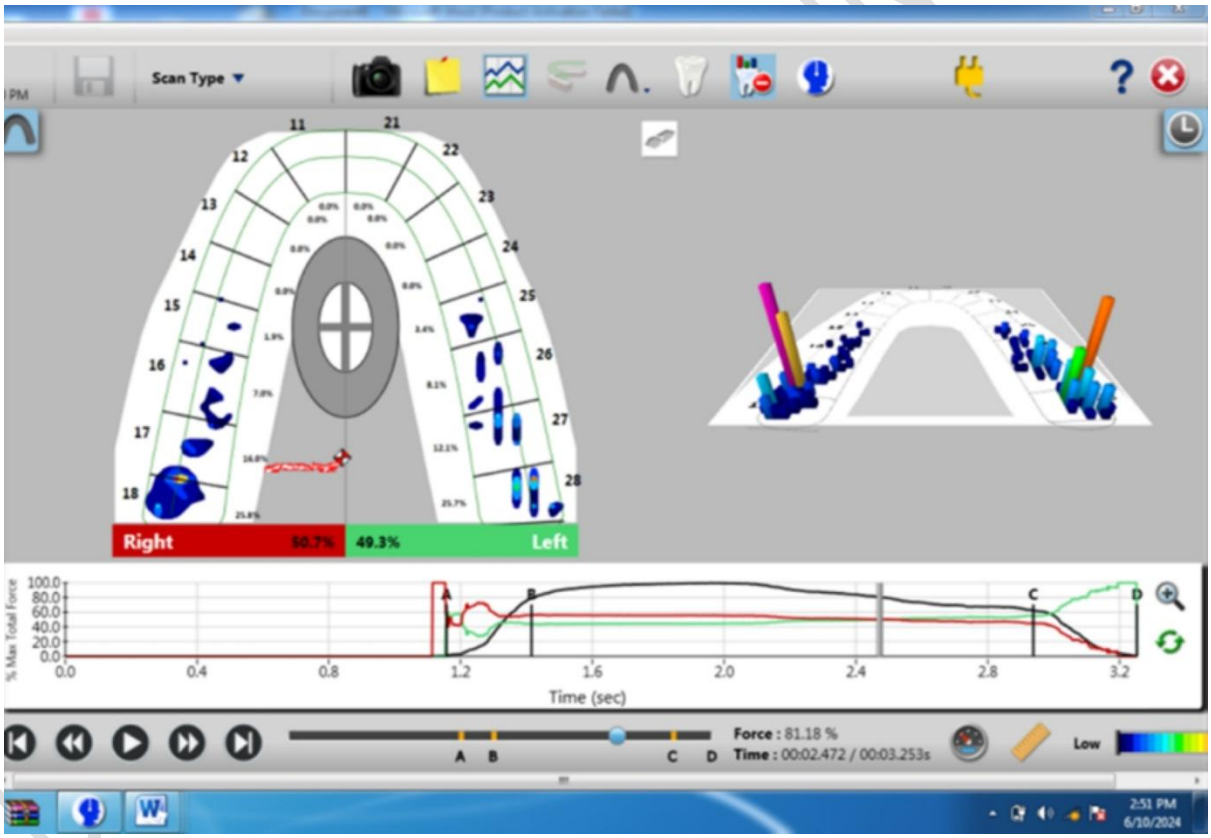
Fig 8: foot pressure analysis

Fig 9: posture belt



294

295 Fig 10: post treatment electromyography



296

297 Fig 11: T scan

Fig 12: shoulder line.