Università degli Studi 'Gabriele d'Annunzio' Chieti - Pescara
Scuola di Medicina e Scienze della Salute
Dipartimento di Tecnologie Innovative in Medicina e Odontoiatria
Scuola di Specializzazione in Ortognatodonzia
Direttore: Prof. Felice Festa

TERAPIA ORTODONTICA CON ALLINEATORI E LA GESTIONE DEI DISTURBI DELL'ATM

F. FESTA, M. MACRÌ

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all’interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

Ministero della Salute

Segretariato Generale
Ufficio 2

Linee guida nazionali sulla classificazione, inquadramento e misurazione della postura e delle relative disfunzioni.

29 dicembre 2017

Raccomandazione 4

L'esame clinico di un disturbo posturale deve prevedere un percorso in senso cranio-caudale.

Forza della raccomandazione: A
Grado dell'evidenza: I

Ai fini diagnostici, l'iter valutativo prevede un percorso cranio-caudale, poiché:

- l'adattamento della postura eretta umana si è realizzato, evolutivamente, a partenza dal livello craniale (vista, occlusione, ossa mascellari e apparato vestibolare), in senso discendente verso il rachide cervicale, dorsale e lombosacrale e degli arti inferiori;
- a livello del cranio sono presenti la gran parte delle strutture anatomiche che regolano la postura.

In fase diagnostica si prevedono:

- l'anamnesi con la valutazione soggettiva del dolore mediante la scala visuo-analogica (VAS);
- l'esame clinico obiettivo cranio-vertebrale e degli arti inferiori mediante la scala VAS cranio-cervico-toraco-lombare, della pelvi e degli arti inferiori (valutazione muscolo-tendinea mediante la palpazione dei muscoli coinvolti nella postura - per ogni muscolo si valuta l'area dolente e l'entità del dolore);
- la valutazione dell'asse verticale del tronco secondo i test funzionali;
- la valutazione dell'allineamento del bacino nei tre piani dello spazio, del complesso piede-caviglia e delle ginocchia sul piano frontale e sagittale;
- la valutazione con esami radiografici, a basso dosaggio, dell'atteggiamento posturale in ortostasi.

Per un'analisi più accurata degli elementi dentari e dell'occlusione, è possibile, ai fini diagnostici, l'utilizzo di scanner intraorali.

Bibliografia

- Arlegi, M., Gómez-Olivencia, A., Albessard, L., Martínez, I., Balzeau, A., Arsuaga, J. L., Been, E. (2017). *The role of allometry and posture in the evolution of the hominin subaxial cervical spine*. Journal of Human Evolution, (3):104, 80-99.
- Feragalli, B., Rampado, O., Abate, C., Macrì, M., Festa, F., Stromei, F., Caputi S., Guglielmi, G. (2017). *Cone beam computed tomography for dental and maxillofacial imaging: technique improvement and low-dose protocols*. La radiologia medica, 122(8): 581-588.
- Festa, F., et al. (2010). *Maxillary and mandibular base size in ancient skulls and of modern humans from Opi, Abruzzi, Italy: a cross-sectional study*. World J Orthod, 11, e1-e4.
- Lacruz, R. S., de Castro, J. M. B., Martinón-Torres, M., O'Higgins, P.,Paine, M. L., Carbonell, E., Bromage, T. G. (2013). *Facial morphogenesis of the earliest Europeans*. PloS One, 8(6), e65199.
- Nevell, L., Wood, B. (2008). *Cranial base evolution within the hominin clade*. Journal of anatomy, 212(4), 455-468.
- Ribeiro, A. F. M., Bergmann, A., Lemos, T., Pacheco, A. G., Russo, M. M., de Oliveira, L. A. S., de Carvalho Rodrigues, E. (2017). *Reference values for human*

Radiol med (2017) 122:581–588
DOI 10.1007/s11547-017-0758-2

CrossMark

COMPUTED TOMOGRAPHY

Cone beam computed tomography for dental and maxillofacial imaging: technique improvement and low-dose protocols

Beatrice Feragalli[1] · Osvaldo Rampado[2] · Cecilia Abate[3] · Monica Macrì[1] · Felice Festa[1] · Francesco Stromei[4] · Sergio Caputi[1] · Giuseppe Guglielmi[3,5]

Received: 20 December 2016 / Accepted: 21 March 2017 / Published online: 1 April 2017

Abstract

Objective The aim of this study was to evaluate images quality and radiation doses of Cone Beam Computed Tomography (CBCT) for dental and maxillofacial imaging testing five different acquisition protocols.

Methods Dose measurements of different acquisition protocols were calculated for Pax Zenith three-dimensional (3D) Cone Beam (Vatech, Korea) and for conventional orthopantomography (OPT) and cephalometric skull imaging Ortophos (Sirona Dental Systems, Bernsheim, Germany). The absorbed organ doses were measured using an anthropomorphic phantom loaded with thermoluminescent dosimeters at 58 sites related to sensitive organs. Five different CBCT protocols were evaluated for image quality and radiation doses. They differed in FOV, image resolution, kVp, mA, acquisition time in seconds and radiation dose. Measurements were then carried out with the orthopantomograph. Equivalent and effective doses were calculated.

Results The reference protocol with large FOV, high resolution quality images, 95 kVp, 5 mA and acquisition time of 24 s resulted in a DAP value of 1556 mGy cm^2 instead the protocol with reduced kVp from 95 to 80 kVp translated into a value of DAP inferior to 35% (from 1556 to 1013 mGy cm^2). Going from a high resolution to a normal resolution, there was a reduction of the acquisition time to 15 s which allowed further dose reduction of approximately 40% (628 mGy cm^2); this protocol resulted in a value of effective dose of 35 microSievert (µSv). Moreover, the effect of changing FOV has been evaluated, considering two scans with a reduced FOV (160 × 140 and 120 × 90 mm, respectively).

Conclusions CBCT low-dose protocol with large FOV, normal resolution quality images, 80 kVp, 5 mA and acquisition time of 15 s resulted in a value of effective dose of 35 microSievert (µSv). This protocol allows the study of maxillofacial region with high quality of images and a very low radiation dose and, therefore, could be proposed in selected case where a complete assessment of dental and maxillofacial region is useful for treatment planning.

Keywords Cone beam computed tomography (CBCT) · Orthopantomography (OPT) · Low-dose protocol · Dental imaging · Dose area product (DAP) · In vitro phantom study

✉ Giuseppe Guglielmi
giuseppe.guglielmi@unifg.it

1 Department of Medical, Oral and Biotechnological Sciences, University G. D'Annunzio, Via dei Vestini, 66100 Chieti, Italy

2 Complex Structure Medical Physics, Scientific Institute Hospital "Città della Salute e della Scienza", C.so Bramante, 88, 10126 Turin, Italy

3 Department of Radiology, University of Foggia, Viale Luigi Pinto 1, 71100 Foggia, Italy

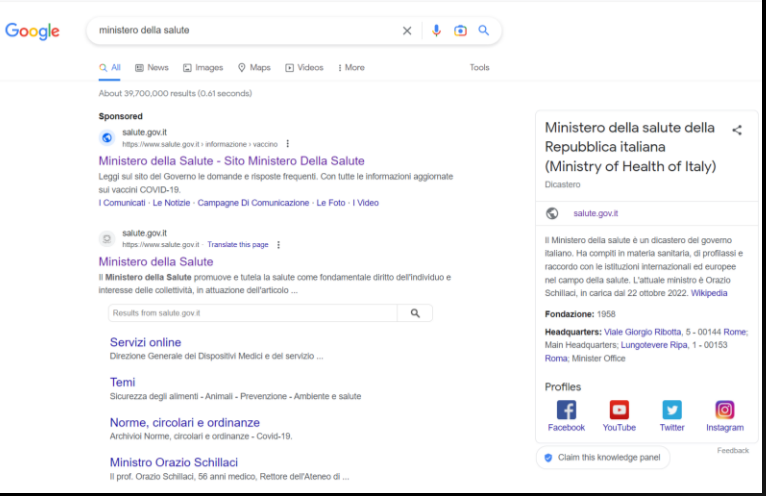
4 Department of Medical Physics, A.S.L. Lanciano-Vasto-Chieti, Chieti, Italy

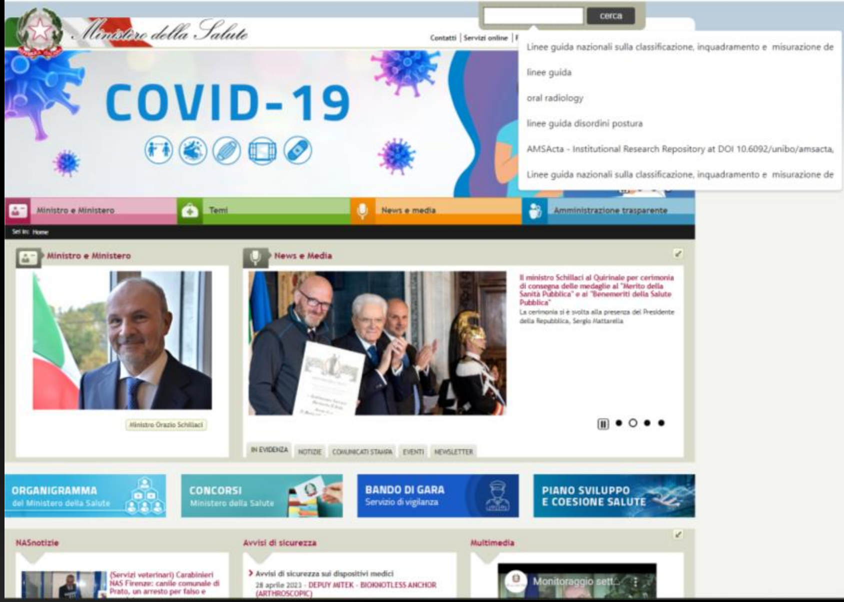
5 Department of Radiology, Scientific Institute Hospital "Casa Sollievo Della Sofferenza", Viale Cappuccini 1, 71013 San Giovanni Rotondo, FG, Italy

Introduction

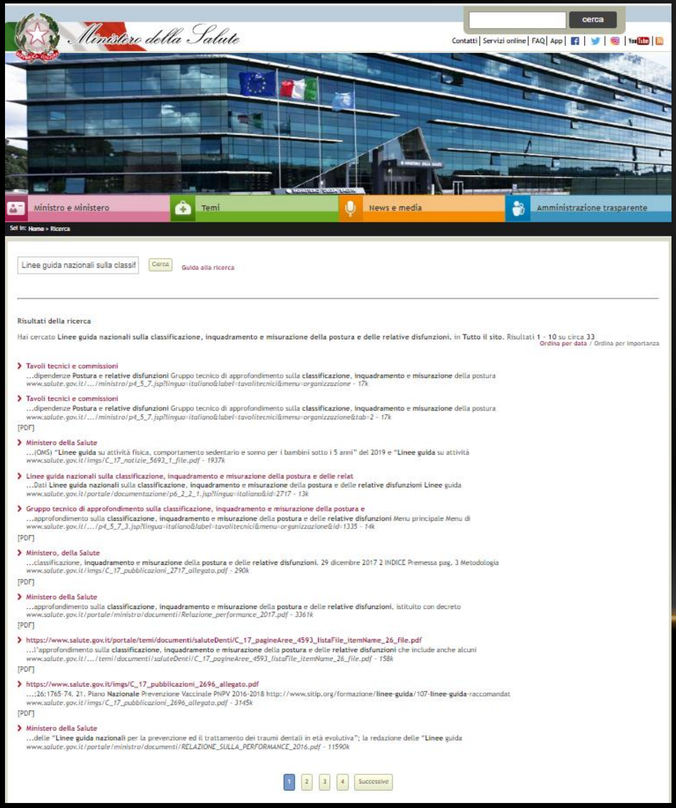
Most dental and maxillofacial procedures require the use of radiographic examinations for proper diagnostic evaluation and treatment planning. The imaging methods most commonly used in dentistry are orthopantomography (OPT) and cephalometric skull. The reason of their frequent use is

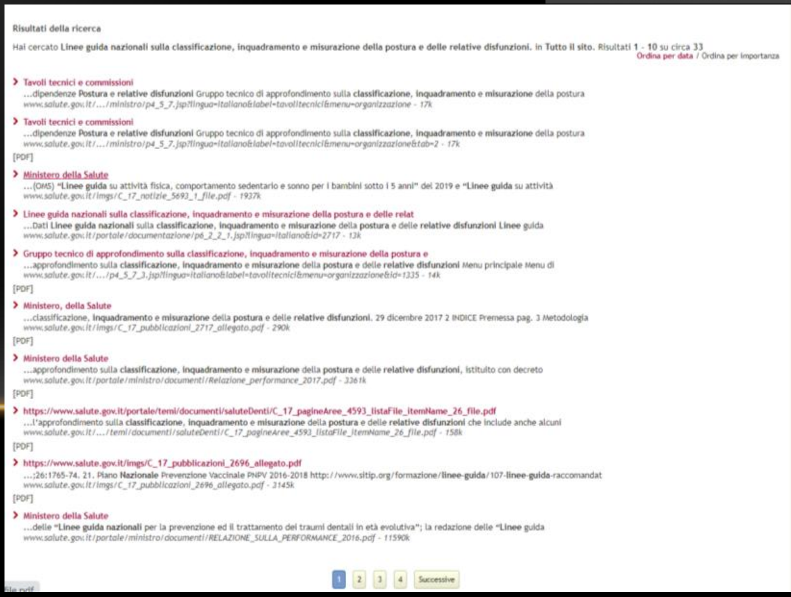
Springer

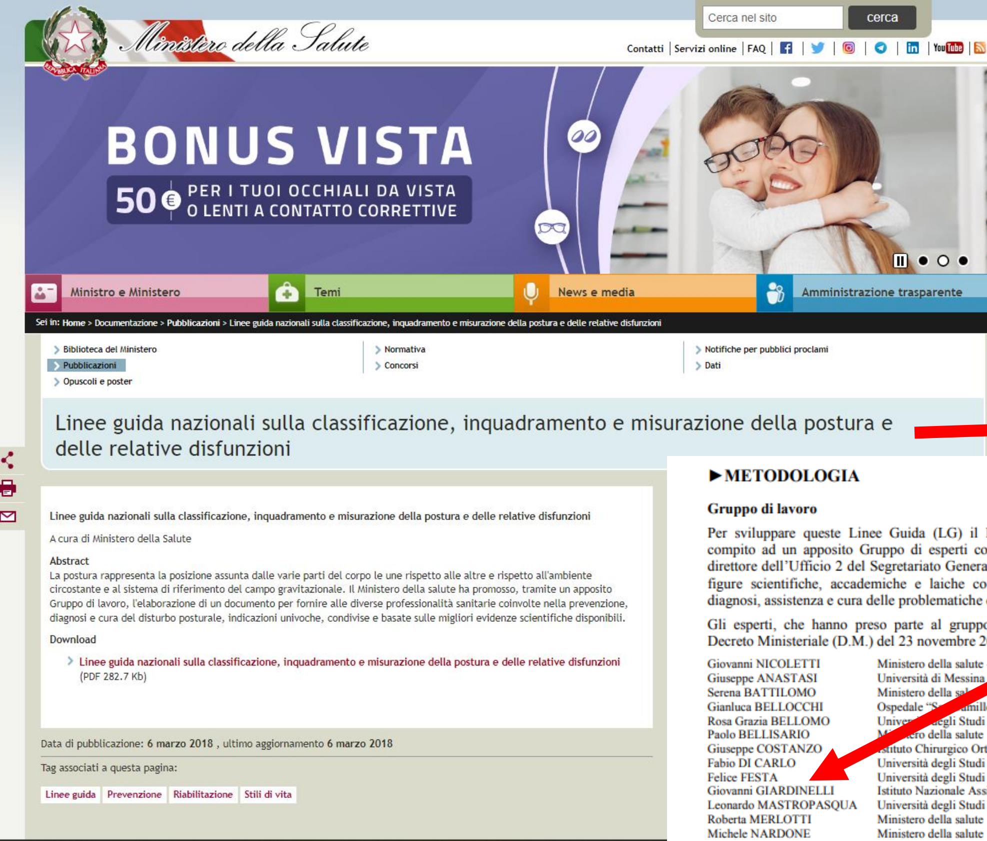

Google
ministero della salute
Ministero della Salute - Sito Ministero Della Salute
Ministero della Salute
Servizi online
Temi
Norme, circolari e ordinanze
Ministro Orazio Schillaci
Ministero della salute della Repubblica italiana (Ministry of Health of Italy)


Ministero della Salute
COVID-19
Linee guida nazionali sulla classificazione, inquadramento e misurazione de
Ministro e Ministero
Temi
News e media
Amministrazione trasparente
ORGANIGRAMMA
CONCORSI
BANDO DI GARA
PIANO SVILUPPO E COESIONE SALUTE


Orthodontics and Genetic evolution world portal
www.felicefesta.it
TMJ Posture


Ministero della Salute
Risultati della ricerca
Hai cercato Linee guida nazionali sulla classificazione, inquadramento e misurazione della postura e delle relative disfunzioni. in Tutto il sito. Risultati 1 - 10 su circa 33


Risultati della ricerca
Hai cercato Linee guida nazionali sulla classificazione, inquadramento e misurazione della postura e delle relative disfunzioni. in Tutto il sito. Risultati 1 - 10 su circa 33
Tavoli tecnici e commissioni
Ministero della Salute
Linee guida nazionali sulla classificazione, inquadramento e misurazione della postura e delle relat
Gruppo tecnico di approfondimento sulla classificazione, inquadramento e misurazione della postura e
Ministero, della Salute



Ministero della Salute

Segretariato Generale
Ufficio 2

Linee guida nazionali sulla classificazione, inquadramento e misurazione della postura e delle relative disfunzioni.

29 dicembre 2017

►METODOLOGIA

Gruppo di lavoro

Per sviluppare queste Linee Guida (LG) il Ministero della Salute ha affidato il compito ad un apposito Gruppo di esperti coordinati dal dott. Giovanni Nicoletti, direttore dell'Ufficio 2 del Segretariato Generale. Il Gruppo di lavoro è composto da figure scientifiche, accademiche e laiche coinvolte nei processi di prevenzione, diagnosi, assistenza e cura delle problematiche oggetto delle presenti LG.

Gli esperti, che hanno preso parte al gruppo di lavoro, sono stati nominati con Decreto Ministeriale (D.M.) del 23 novembre 2016 e D.M. del 17 gennaio 2017.

Giovanni NICOLETTI	Ministero della salute -Coordinatore -
Giuseppe ANASTASI	Università di Messina
Serena BATTILOMO	Ministero della salute
Gianluca BELLOCCHI	Ospedale "San Camillo", Roma
Rosa Grazia BELLOMO	Università degli Studi di Urbino "Carlo Bo"
Paolo BELLISARIO	Ministero della salute
Giuseppe COSTANZO	Istituto Chirurgico Ortopedico Traumatologico, Latina
Fabio DI CARLO	Università degli Studi di Roma "Sapienza"
Felice FESTA	Università degli Studi di Chieti e Pescara "G. d'Annunzio"
Giovanni GIARDINELLI	Istituto Nazionale Assicurazione Infortuni sul Lavoro
Leonardo MASTROPASQUA	Università degli Studi di Chieti e Pescara "G. d'Annunzio"
Roberta MERLOTTI	Ministero della salute
Michele NARDONE	Ministero della salute
Augusto ORSINI	PST Technoscienze-San Raffaele, Università "San Raffaele", Roma
Mario PASTORELLI	Università degli Studi di Siena
Raffaello PELLEGRINO	Società Italiana Medicina Fisica e Riabilitazione
Bianca Maria POLIZZI	Ministero della salute
Sandro ROSSETTI	Ospedale "San Camillo", Roma
Raoul SAGGINI	Università degli Studi di Chieti e Pescara "G. d'Annunzio"
Alberto VILLANI	Società Italiana di Pediatria
Ciro VILLANI	Università degli Studi di Roma "Sapienza"
Sabrina ZILIARDI	Ministero della salute

Su delega del Presidente della Società Italiana di Pediatria, prof. Alberto Villani, ha partecipato ai lavori il prof. Francesco MACRÌ.

Conflitto di interessi

I componenti del Gruppo di lavoro hanno dichiarato l'assenza di conflitto di interessi.

Ricerca bibliografica

È stata eseguita un'analisi sistematica della letteratura esistente utilizzando le seguenti banche dati: *PubMed, Embase e Scopus.*

La ricerca bibliografica è stata condotta utilizzando le seguenti parole chiave:
-erect posture;
-cervical lordosis angle;
-forward head posture;
-neck posture;
-orafacial pain;
-postural balance (PB);
-postural clinical evaluation;
-postural dysfunction (PD);
-posture control;
-vestibulo-ocular reflexes.

L'analisi delle pubblicazioni si è incentrata su studi condotti sull'uomo in età evolutiva, adulta e senile e redatti in lingua italiana e inglese. Sono state selezionate

Raccomandazione 4

L'esame clinico di un disturbo posturale deve prevedere un percorso in senso cranio-caudale.

Forza della raccomandazione: A
Grado dell'evidenza: I

Ai fini diagnostici, l'iter valutativo prevede un percorso cranio-caudale, poiché:

- l'adattamento della postura eretta umana si è realizzato, evolutivamente, a partenza dal livello craniale (vista, occlusione, ossa mascellari e apparato vestibolare), in senso discendente verso il rachide cervicale, dorsale e lombosacrale e degli arti inferiori;
- a livello del cranio sono presenti la gran parte delle strutture anatomiche che regolano la postura.

In fase diagnostica si prevedono:

- l'anamnesi con la valutazione soggettiva del dolore mediante la scala visuo-analogica (VAS);
- l'esame clinico obiettivo cranio-vertebrale e degli arti inferiori mediante la scala VAS cranio-cervico-toraco-lombare, della pelvi e degli arti inferiori (valutazione muscolo-tendinea mediante la palpazione dei muscoli coinvolti nella postura - per ogni muscolo si valuta l'area dolente e l'entità del dolore);
- la valutazione dell'asse verticale del tronco secondo i test funzionali;
- la valutazione dell'allineamento del bacino nei tre piani dello spazio, del complesso piede-caviglia e delle ginocchia sul piano frontale e sagittale;
- la valutazione con esami radiografici, a basso dosaggio, dell'atteggiamento posturale in ortostasi.

Per un'analisi più accurata degli elementi dentari e dell'occlusione, è possibile, ai fini diagnostici, l'utilizzo di scanner intraorali.

Bibliografia

- Arlegi, M., Gómez-Olivencia, A., Albessard, L., Martínez, I., Balzeau, A., Arsuaga, J. L., Been, E. (2017). *The role of allometry and posture in the evolution of the hominin subaxial cervical spine*. Journal of Human Evolution, (3):104, 80-99.
- Feragalli, B., Rampado, O., Abate, C., Macrì, M., Festa, F., Stromei, F., Caputi S., Guglielmi, G. (2017). *Cone beam computed tomography for dental and maxillofacial imaging: technique improvement and low-dose protocols*. La radiologia medica, 122(8): 581-588.
- Festa, F., et al. (2010). *Maxillary and mandibular base size in ancient skulls and of modern humans from Opi, Abruzzi, Italy: a cross-sectional study*. World J Orthod, 11, e1-e4.
- Lacruz, R. S., de Castro, J. M. B., Martinón-Torres, M., O'Higgins, P.,Paine, M. L., Carbonell, E., Bromage, T. G. (2013). *Facial morphogenesis of the earliest Europeans*. PloS One, 8(6), e65199.
- Nevell, L., Wood, B. (2008). *Cranial base evolution within the hominin clade*. Journal of anatomy, 212(4), 455-468.
- Ribeiro, A. F. M., Bergmann, A., Lemos, T., Pacheco, A. G., Russo, M. M., de Oliveira, L. A. S., de Carvalho Rodrigues, E. (2017). *Reference values for human*

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all’interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

Radiol med (2017) 122:581–588
DOI 10.1007/s11547-017-0758-2

COMPUTED TOMOGRAPHY

Cone beam computed tomography for dental and maxillofacial imaging: technique improvement and low-dose protocols

Beatrice Feragalli[1] · Osvaldo Rampado[2] · Cecilia Abate[3] · Monica Macrì[1] · Felice Festa[1] · Francesco Stromei[4] · Sergio Caputi[1] · Giuseppe Guglielmi[3,5]

Received: 20 December 2016 / Accepted: 21 March 2017 / Published online: 1 April 2017

Abstract

Objective The aim of this study was to evaluate images quality and radiation doses of Cone Beam Computed Tomography (CBCT) for dental and maxillofacial imaging testing five different acquisition protocols.

Methods Dose measurements of different acquisition protocols were calculated for Pax Zenith three-dimensional (3D) Cone Beam (Vatech, Korea) and for conventional orthopantomography (OPT) and cephalometric skull imaging Ortophos (Sirona Dental Systems, Bernsheim, Germany). The absorbed organ doses were measured using an anthropomorphic phantom loaded with thermoluminescent dosimeters at 58 sites related to sensitive organs. Five different CBCT protocols were evaluated for image quality and radiation doses. They differed in FOV, image resolution, kVp, mA, acquisition time in seconds and radiation dose. Measurements were then carried out with the orthopantomograph. Equivalent and effective doses were calculated.

Results The reference protocol with large FOV, high resolution quality images, 95 kVp, 5 mA and acquisition time of 24 s resulted in a DAP value of 1556 mGy cm^2 instead the protocol with reduced kVp from 95 to 80 kVp translated into a value of DAP inferior to 35% (from 1556 to 1013 mGy cm^2). Going from a high resolution to a normal resolution, there was a reduction of the acquisition time to 15 s which allowed further dose reduction of approximately 40% (628 mGy cm^2); this protocol resulted in a value of effective dose of 35 microSievert (μSv). Moreover, the effect of changing FOV has been evaluated, considering two scans with a reduced FOV (160 × 140 and 120 × 90 mm, respectively).

Conclusions CBCT low-dose protocol with large FOV, normal resolution quality images, 80 kVp, 5 mA and acquisition time of 15 s resulted in a value of effective dose of 35 microSievert (μSv). This protocol allows the study of maxillofacial region with high quality of images and a very low radiation dose and, therefore, could be proposed in selected case where a complete assessment of dental and maxillofacial region is useful for treatment planning.

Keywords Cone beam computed tomography (CBCT) · Orthopantomography (OPT) · Low-dose protocol · Dental imaging · Dose area product (DAP) · In vitro phantom study

Introduction

Most dental and maxillofacial procedures require the use of radiographic examinations for proper diagnostic evaluation and treatment planning. The imaging methods most commonly used in dentistry are orthopantomography (OPT) and cephalometric skull. The reason of their frequent use is

✉ Giuseppe Guglielmi
giuseppe.guglielmi@unifg.it

1 Department of Medical, Oral and Biotechnological Sciences, University G. D'Annunzio, Via dei Vestini, 66100 Chieti, Italy

2 Complex Structure Medical Physics, Scientific Institute Hospital "Città della Salute e della Scienza", C.so Bramante, 88, 10126 Turin, Italy

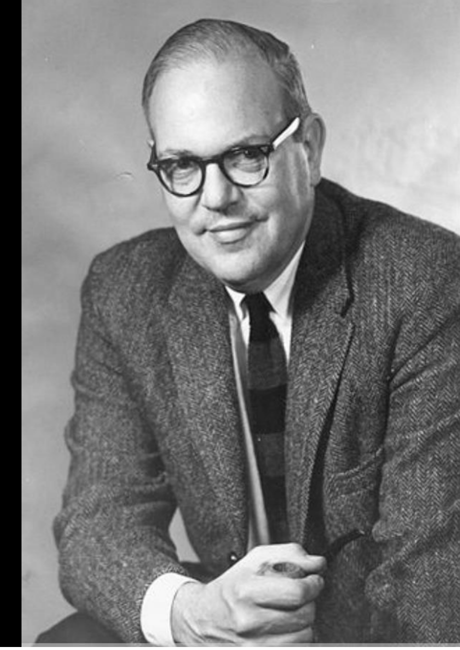
3 Department of Radiology, University of Foggia, Viale Luigi Pinto 1, 71100 Foggia, Italy

4 Department of Medical Physics, A.S.L. Lanciano-Vasto-Chieti, Chieti, Italy

5 Department of Radiology, Scientific Institute Hospital "Casa Sollievo Della Sofferenza", Viale Cappuccini 1, 71013 San Giovanni Rotondo, FG, Italy

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

MELVIN MOSS



Journal of Anatomy

J. Anat. (2014) 225, pp306–316 doi: 10.1111/joa.12212

Beyond the functional matrix hypothesis: a network null model of human skull growth for the formation of bone articulations

Borja Esteve-Altava and Diego Rasskin-Gutman

*Theoretical Biology Research Group, Cavanilles Institute for Biodiversity and Evolutionary Biology, University of Valen…
Valencia, Spain*

Abstract

Craniofacial sutures and synchondroses form the boundaries among bones in the human skull, providing functional, developmental and evolutionary information. Bone articulations in the skull arise due to interactions between genetic regulatory mechanisms and epigenetic factors such as functional matrices (soft tissues and cranial cavities), which mediate bone growth. These matrices are largely acknowledged for their influence on shaping the bones of the skull; however, it is not fully understood to what extent functional matrices mediate the formation of bone articulations. Aiming to identify whether or not functional matrices are key developmental factors guiding the formation of bone articulations, we have built a network null model of the skull that simulates unconstrained bone growth. This null model predicts bone articulations that arise due to a process of bone growth that is uniform in rate, direction and timing. By comparing predicted articulations with the actual bone articulations of the human skull, we have identified which boundaries specifically need the presence of functional matrices for their formation. We show that functional matrices are necessary to connect facial bones, whereas an unconstrained bone growth is sufficient to connect non-facial bones. This finding challenges the role of the brain in the formation of boundaries between bones in the braincase without neglecting its effect on skull shape. Ultimately, our null model suggests where to look for modified developmental mechanisms promoting changes in bone growth patterns that could affect the development and evolution of the head skeleton.

Key words: anatomical networks; epigenetics; Gabriel rule; head development; morphology.

2011a). According to this hypothesis, the position and shape of bones, as well as the formation of sutures, is fully determined by the functional needs of soft tissues and cavities that bones protect and support (Fig. 1). This hypothesis has been broadly used to explain many craniofacial disorders (Mulliken et al. 1989; Breitsprecher et al. 2002; Kikuchi, 2005) and some morphological features of the head (Festa et al. 2010; Richards & Jabbour, 2011), in particular the integration between brain growth and skull shape (Moss, 1975; Fields et al. 1978; Richtsmeier et al. 2006; Lieberman, 2011a; Richtsmeier & Flaherty, 2013). Other epigenetic factors that affect the formation of sutures include hormonal signals (Karsenty, 1999) and biomechanical mechanisms (Shwartz et al. 2012; Khonsari et al. 2013). In addition, external forces and movements related to functional matrices influence the internal complexity of sutures (Curtis et al. 2014).

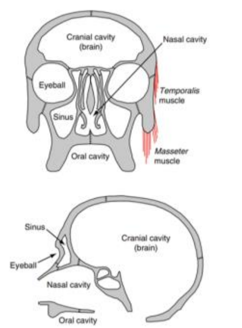


Fig. 1 Schematic representation of functional matrices proposed for the human skull. Examples of functional matrices are the cranial cavity and the brain, the nasal cavity, the eyeballs, the maxillary sinuses, the oral cavity and head muscles, such as temporalis and masseter; these cavities and soft tissues have been suggested to mediate bone growth. Modified from Lieberman (2011a).

- This hypothesis has been broadly used to explain many craniofacial disorders (Mulliken et al. 1989; Breitsprecher et al. 2002; Kikuchi, 2005) and some morphological features of the head (Festa et al. 2010; Richards & Jabbour, 2011), in particular the integration between brain growth and skull shape (Moss, 1975; Fields et al. 1978; Richtsmeier et al. 2006; Lieberman, 2011a; Richtsmeier & Flaherty, 2013).

Mulliken JB, Ferraro NF, Vento AR (1989) A retrospective analysis of growth of the constructed condyle-ramus in children with hemifacial microsomia. Cleft Palate J 26, 312–317
Breitsprecher L, Fanghanel L, Noe A, et al. (2002) The functional anatomy of the muscles of facial expression in humans with and without cleft lip and palate. A contribution to refine muscle reconstruction in primary cheilo- and rhinoplasties in patients with uni- and bilateral complete CLP. Ann Anat 184, 27–34
Kikuchi M (2005) Orthodontic treatment in children to prevent sleep-disordered breathing in adulthood. Sleep Breath 9, 146–158.
Festa F, Capasso L, D'Anastasio R, et al. (2010) Maxillary and mandibular base size in ancient skulls and of modern humans from Opi, Abruzzi, Italy: a cross-sectional study. World J Orthod 11, e1–e4
Richards GD, Jabbour RS (2011) Foramen magnum ontogeny in Homo sapiens: a functional matrix perspective. Anat Rec 294, 199–216.
Moss ML (1975) New studies of cranial growth. Birth Defects Orig Artic Ser 11, 283–295.
Fields HWJ, Metzner L, Garol JD, et al. (1978) The craniofacial skeleton in anencephalic human fetuses. I. Cranial floor. Teratology 17, 57–65
Richtsmeier JT, Aldridge K, DeLeon VB, et al. (2006) Phenotypic integration of neurocranium and brain. J Exp Zool B Mol Dev Evol 306, 360–378.
Lieberman DE (2011a) Epigenetic integration, complexity, and evolvability of the head: rethinking the functional matrix hypothesis. In: Epigenetics: Linking Genotype and Phenotype in Development and Evolution . (eds Hallgrimsson B, Hall BK), pp. 271–289, Los Angeles: California University Press
Richtsmeier JT, Flaherty K (2013) Hand in glove: brain and skull in development and dysmorphogenesis. Acta Neuropathol 125, 469–489.

- This hypothesis has been broadly used to explain many craniofacial disorders (Mulliken et al. 1989; Breitsprecher et al. 2002; Kikuchi, 2005) and some morphological features of the head (Festa et al. 2010; Richards & Jabbour, 2011), in particular the integration between brain growth and skull shape (Moss, 1975; Fields et al. 1978; Richtsmeier et al. 2006; Lieberman, 2011a; Richtsmeier & Flaherty, 2013).

Mulliken JB, Ferraro NF, Vento AR (1989) A retrospective analysis of growth of the constructed condyle-ramus in children with hemifacial microsomia. Cleft Palate J 26, 312–317

Breitsprecher L, Fanghanel L, Noe A, et al. (2002) The functional anatomy of the muscles of facial expression in humans with and without cleft lip and palate. A contribution to refine muscle reconstruction in primary cheilo- and rhinoplasties in patients with uni- and bilateral complete CLP. Ann Anat 184, 27–34

Kikuchi M (2005) Orthodontic treatment in children to prevent sleep-disordered breathing in adulthood. Sleep Breath 9, 146–158.

Festa F, Capasso L, D'Anastasio R, et al. (2010) Maxillary and mandibular base size in ancient skulls and of modern humans from Opi, Abruzzi, Italy: a cross-sectional study. World J Orthod 11, e1–e4

Richards GD, Jabbour RS (2011) Foramen magnum ontogeny in Homo sapiens: a functional matrix perspective. Anat Rec 294, 199–216.

Moss ML (1975) New studies of cranial growth. Birth Defects Orig Artic Ser 11, 283–295.

Fields HWJ, Metzner L, Garol JD, et al. (1978) The craniofacial skeleto in anencephalic human fetuses. I. Cranial floor. Teratology 17, 57–65

Richtsmeier JT, Aldridge K, DeLeon VB, et al. (2006) Phenotypic integration of neurocranium and brain. J Exp Zool B Mol Dev Evol 306, 360–378.

Lieberman DE (2011a) Epigenetic integration, complexity, and evolvability of the head: rethinking the functional matrix hypothesis. In: Epigenetics: Linking Genotype and Phenotype in Development and Evolution . (eds Hallgrimsson B, Hall BK), pp. 271–289, Los Angeles: California University Press

Richtsmeier JT, Flaherty K (2013) Hand in glove: brain and skull in development and dysmorphogenesis. Acta Neuropathol 125, 469–489.

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale

  AI (Intelligenza Artificiale)/ Robotica del Volto

  Teoria delle Matrici Funzionali

  Casi Clinici (Avanzamento mascellare, mandibolare)

  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM


TMJ Posture

applied sciences

MDPI

Article

A Digital 3D Retrospective Study Evaluating the Efficacy of Root Control during Orthodontic Treatment with Clear Aligners

Monica Macrì *, Silvia Medori, Giuseppe Varvara and Felice Festa

Department of Innovative Technologies in Medicine & Dentistry, University "G. d'Annunzio" of Chieti-Pescara, 66100 Chieti, Italy
* Correspondence: m.macri@unich.it

Abstract: This study aimed to investigate the efficacy of torque movement and the incidence of root resorption in the maxillary and mandibular teeth with clear aligner therapy using cone-beam computed tomography. The sagittal root positions, the faciolingual inclinations, and the root lengths of 672 teeth, from central incisors to first molars for each arch, were measured and compared on virtual cross sections from pre-treatment and post-treatment cone-beam computed tomography of 28 patients who received comprehensive orthodontic treatment with clear aligners. An improvement of root position was found in incisors, canines, and premolars of the upper and lower arches: over 78% of their root was centered in the alveolus at the end of orthodontic treatment. There was a statistically significant torque increase for incisors, canines, and first premolars at the end of therapy. The most considerable torque changes were achieved in incisors and canines, while the lowest was in posterior teeth. The maxillary and mandibular central incisors achieved $3.26 \pm 1.95^{\circ}$ and $2.97 \pm 2.53^{\circ}$ of mean torque increase, respectively. The root length loss was greater in the upper and lower central incisors. All teeth showed mild resorption (<10%) except for two upper lateral incisors, which showed moderate resorption (10.79% and 10.23%). Comprehensive treatment with clear aligners improved sagittal root position and increased torque, especially in the anterior teeth. Most teeth showed mild resorption after clear aligner therapy, and only two showed moderate resorption.

Keywords: 3D; artificial intelligence and health; CBCT; digital health; emerging technologies

check for updates

Citation: Macrì, M.; Medori, S.; Varvara, G.; Festa, F. A Digital 3D Retrospective Study Evaluating the Efficacy of Root Control during Orthodontic Treatment with Clear Aligners. *Appl. Sci.* **2023**, *13*, 1540. https://doi.org/10.3390/app13031540

Academic Editors: Giuseppe Minervini and Rocco Franco

Received: 9 December 2022
Revised: 21 January 2023
Accepted: 22 January 2023
Published: 25 January 2023

1. Introduction

Clear aligner therapy, consisting of customized, removable appliances, has been widely used in clinical practice as a more aesthetic and comfortable alternative to multibracket appliances.

In the beginning, the aligners were limited only to mild malocclusions, such as anterior crowding, or to periodontal patients; through the years, thanks to advances in technology and clinical trials, clear aligners have effectively performed major tooth movements, e.g. premolar derotation as well as molar distalization [1]. Despite the predictability of the treatment, its clinical potency remains debatable; opponents have remarked on the need to require mid-course correction or case refinement, especially when treating complex malocclusions, whereas advocates have remained convinced of successful outcomes at the end of the therapy [2].

Compared with our early ancestors, the modern human face reveals a characteristic spatial distribution of bone deposition and resorption. In humans, the anterior portions of the maxilla and mandible's sub-nasal region are more susceptible to surface resorption during development [3,4]. Furthermore, in the sagittal projection of X-ray examinations, clinicians commonly find that the roots of teeth, especially in the anterior region, are positioned against the labial cortical plate. Therefore, it is fundamental to manage the radicular torque and the root position relative to the orofacial cortical plates during orthodontic treatment.

In fixed orthodontic therapy, torque expression depends on several factors: bracket prescription and material (metal or ceramic brackets), inter bracket distance, the vertical

applied sciences

MDPI

Article

A Digital 3D Retrospective Study Evaluating the Efficacy of Root Control during Orthodontic Treatment with Clear Aligners

Monica Macrì *, Silvia Medori, Giuseppe Varvara and Felice Festa

Department of Innovative Technologies in Medicine & Dentistry, University "G. d'Annunzio" of Chieti-Pescara, 66100 Chieti, Italy
* Correspondence: m.macri@unich.it

Abstract: This study aimed to investigate the efficacy of torque movement and the incidence of root resorption in the maxillary and mandibular teeth with clear aligner therapy using cone-beam computed tomography. The sagittal root positions, the faciolingual inclinations, and the root lengths of 672 teeth, from central incisors to first molars for each arch, were measured and compared on virtual cross sections from pre-treatment and post-treatment cone-beam computed tomography of 28 patients who received comprehensive orthodontic treatment with clear aligners. An improvement of root position was found in incisors, canines, and premolars of the upper and lower arches: over 78% of their root was centered in the alveolus at the end of orthodontic treatment. There was a statistically significant torque increase for incisors, canines, and first premolars at the end of therapy. The most considerable torque changes were achieved in incisors and canines, while the lowest was in posterior teeth. The maxillary and mandibular central incisors achieved $3.26 \pm 1.95°$ and $2.97 \pm 2.53°$ of mean torque increase, respectively. The root length loss was greater in the upper and lower central incisors. All teeth showed mild resorption (<10%) except for two upper lateral incisors, which showed moderate resorption (10.79% and 10.23%). Comprehensive treatment with clear aligners improved sagittal root position and increased torque, especially in the anterior teeth. Most teeth showed mild resorption after clear aligner therapy, and only two showed moderate resorption.

Keywords: 3D; artificial intelligence and health; CBCT; digital health; emerging technologies

check for updates

Citation: Macrì, M.; Medori, S.; Varvara, G.; Festa, F. A Digital 3D Retrospective Study Evaluating the Efficacy of Root Control during Orthodontic Treatment with Clear Aligners. *Appl. Sci.* **2023**, *13*, 1540. https://doi.org/10.3390/app13031540

Academic Editors: Giuseppe Minervini and Rocco Franco

Received: 9 December 2022
Revised: 21 January 2023
Accepted: 22 January 2023
Published: 25 January 2023

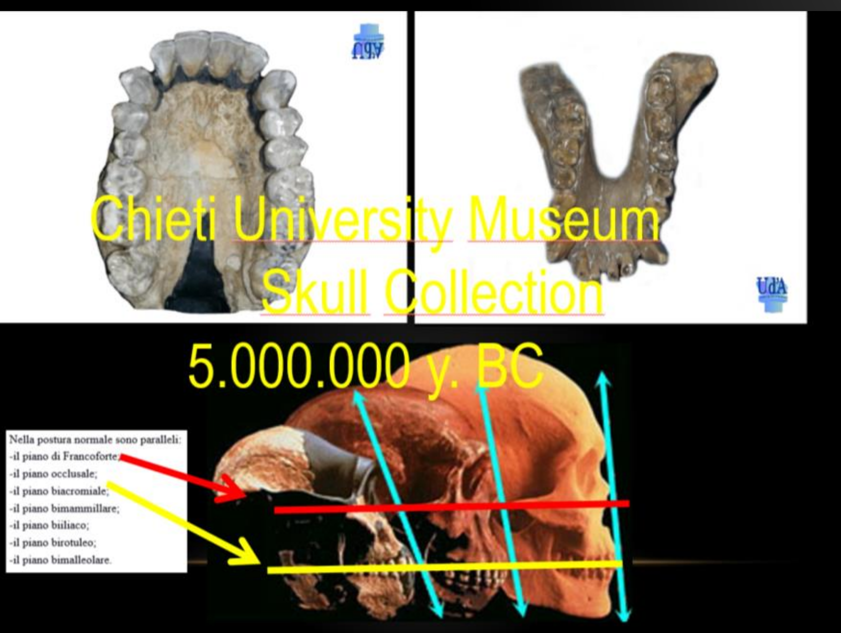
1. Introduction

Clear aligner therapy, consisting of customized, removable appliances, has been widely used in clinical practice as a more aesthetic and comfortable alternative to multibracket appliances.

In the beginning, the aligners were limited only to mild malocclusions, such as anterior crowding, or to periodontal patients; through the years, thanks to advances in technology and clinical trials, clear aligners have effectively performed major tooth movements, e.g. premolar derotation as well as molar distalization [1]. Despite the predictability of the treatment, its clinical potency remains debatable; opponents have remarked on the need to require mid-course correction or case refinement, especially when treating complex malocclusions, whereas advocates have remained convinced of successful outcomes at the end of the therapy [2].

Compared with our early ancestors, the modern human face reveals a characteristic spatial distribution of bone deposition and resorption. In humans, the anterior portions of the maxilla and mandible's sub-nasal region are more susceptible to surface resorption during development [3,4]. Furthermore, in the sagittal projection of X-ray examinations, clinicians commonly find that the roots of teeth, especially in the anterior region, are positioned against the labial cortical plate. Therefore, it is fundamental to manage the radicular torque and the root position relative to the orofacial cortical plates during orthodontic treatment.

In fixed orthodontic therapy, torque expression depends on several factors: bracket prescription and material (metal or ceramic brackets), inter bracket distance, the vertical



orthodontic treatment.

At the first visit (T0), records for each participant were collected, consisting of the following: (1) general and dental anamnesis; (2) extraoral and intraoral orthodontic clinical examination; (3) gnathological clinical examination; and (4) visual analogue scale (VAS) and muscular palpation to estimate the pain intensity ratio on patient's face and neck [16].

Each patient underwent a CBCT scan using Planmeca Promax® 3D MID unit (Planmeca Oy, Helsinki, Finland) according to the low dose protocol with these parameters: acquisition time of 15 s, 80 kVp, 5 mA, 35 microSievert (μSv), the field of view (FOV) of 240 × 190 mm, and normal image resolution [17]. The patient's CBCT was performed

with the head oriented according to the Natural Head Position (NHP); the patient was in a sitting position with the back perpendicular to the floor as much as possible. The head was stabilized with ear rods in the external auditory meatus. The patient was instructed to look into their eyes in a mirror 1.5 m in front of them to obtain NHP. The NHP is a physiological and reproducible posture defined for the morphological analysis described in the orthodontic and anthropological literature [18]. Each subject was informed about the radiographic procedure and required to avoid movement and keep centric occlusion with the lip in light contact.

After X-ray scanning, DICOM (Digital Imaging and Communications in Medicine) image files were processed by Dolphin Imaging 3D software (Dolphin Imaging & Management Solutions, Chatsworth, CA) for storage and interpretation. Establishing a predefined patient's head orientation is necessary to obtain a predictable and repeatable three-dimensional (3D) analysis. The skull image was oriented accor[...] to NHP in the three planes of space perpendicular to each other, as show[...] studies [19]: the transverse plane coincides with the Frankfurt [...] (FH), a plane passing through two points: Orbital (Or) and Porion [...] sagittal plane coincides with the mid-sagittal plane (MSP), a plane [...]cular to the FH plane and passing through two points: Crista Galli (C[...]) [...]sion (Ba); the coronal plane coincides with the anteroposterior (PO) plane, [...]pendicular to the FH and MSP, passing through the right and left portion.

After the orientation of the head, the virtual 2D radiograms were extracted in the following sequence:

Lateral teleradiography, on which the cephalometric analysis, according to McLaughlin, is performed

- orthopantomography,
- TMJ stratigraphy,
- cross sections,
- posteroanterior teleradiography,
- superior and inferior submento-vertex
- virtual reconstruction of right and left masseter muscles.

Subsequently, extraoral photos (patient's face in frontal, in the right, and left side views) and intraoral photos (frontal, right, and left lateral photos, and upper and lower occlusal photos) were performed, and the dental arches were scanned using an intraoral scanner, which allows detecting details with an accuracy up to 7 μm.

The virtual setup for each subject was planned, and aligners were manufactured.

At the end of clear aligner therapy (T1), extraoral and intraoral photos, pain assessments (through VAS and muscular palpation), and a CBCT scan were taken for each patient, and 2D virtual radiograms were obtained, as previously described.

For each upper and lower tooth, from right to left, the first molar, the changes in root position, torque, and root length were evaluated by analyzing the cross sections at the start (T0) and the end (T1) of the treatment.

Table 1 shows the number of measurements for the type of tooth of each arch taken into consideration in this study.

Chieti University Museum Skull Collection

5.000.000 y. BC

Nella postura normale sono paralleli:

-il piano di Francoforte;

-il piano occlusale;

-il piano biacromiale;

-il piano bimammillare;

-il piano biiliaco;

-il piano birotuleo;

-il piano bimalleolare.

Abstract: This study aimed to investigate the efficacy of torque movement and the incidence of root resorption in the maxillary and mandibular teeth with clear aligner therapy using cone-beam computed tomography. The sagittal root positions, the faciolingual inclinations, and the root lengths of 672 teeth, from central incisors to first molars for each arch, were measured and compared on virtual cross sections from pre-treatment and post-treatment cone-beam computed tomography of 28 patients who received comprehensive orthodontic treatment with clear aligners. An improvement of root position was found in incisors, canines, and premolars of the upper and lower arches: over 78% of their root was centered in the alveolus at the end of orthodontic treatment. There was a statistically significant torque increase for incisors, canines, and first premolars at the end of therapy. The most considerable torque changes were achieved in incisors and canines, while the lowest was in posterior teeth. The maxillary and mandibular central incisors achieved $3.26 \pm 1.95°$ and $2.97 \pm 2.53°$ of mean torque increase, respectively. The root length loss was greater in the upper and lower central incisors. All teeth showed mild resorption (<10%) except for two upper lateral incisors, which showed moderate resorption (10.79% and 10.23%). Comprehensive treatment with clear aligners improved sagittal root position and increased torque, especially in the anterior teeth. Most teeth showed mild resorption after clear aligner therapy, and only two showed moderate resorption.

The sagittal root positions, the faciolingual inclinations, and the root lengths of 672 teeth, from central incisors to first molars for each arch, were measured and compared on virtual cross sections from pre-treatment and post-treatment cone-beam computed tomography of 28 patients who received comprehensive orthodontic treatment with clear aligners.

RESULTS

- An improvement of root position was found in incisors, canines, and premolars of the upper and lower arches: over 78% of their root was centered in the alveolus at the end of orthodontic treatment. There was a statistically significant torque increase for incisors, canines, and first premolars at the end of therapy. The most considerable torque changes were achieved in incisors and canines, while the lowest was in posterior teeth. The maxillary and mandibular central incisors achieved $3.26 \pm 1.95^\circ$ and $2.97 \pm 2.53^\circ$ of mean torque increase, respectively.

Orthodontics and Genetic evolution world portal
www.felicefesta.it
TMJ Posture

- Compared with our early ancestors, the modern human face reveals a characteristic spatial distribution of bone deposition and resorption. In humans, the anterior portions of the maxilla and mandible's sub-nasal region are more susceptible to surface resorption during development [3,4]. Furthermore, in the sagittal projection of X-ray examinations, clinicians commonly find that the roots of teeth, especially in the anterior region, are positioned against the labial cortical plate. Therefore, it is fundamental to manage the radicular torque and the root position relative to the orofacial cortical plates during orthodontic treatment.

OPEN ACCESS Freely available online PLOS | ONE

Facial Morphogenesis of the Earliest Europeans

Rodrigo S. Lacruz[1]*, José María Bermúdez de Castro[2], María Martinón-Torres[2], Paul O'Higgins[3], Michael L. Paine[1], Eudald Carbonell[4], Juan Luis Arsuaga[5], Timothy G. Bromage[6]

1 Center for Craniofacial Molecular Biology, Ostrow School of Dentistry, and Department of Anthropology, University of Southern California, Los Angeles, California, United States of America, **2** Centro Nacional de Investigación sobre la Evolución Humana, Burgos, Spain, **3** Centre for Anatomical and Human Sciences, Hull York Medical School, University of York, York, United Kingdom, **4** Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain, **5** Universidad Complutense de Madrid-Instituto Carlos III (UCM-ISCIII), Centro de Investigación de la Evolución y Comportamiento Humanos, Madrid, Spain, **6** Departments of Biomaterials and Biomimetics and Basic Science and Craniofacial Biology, New York University College of Dentistry, New York, New York, United States of America

Abstract

The modern human face differs from that of our early ancestors in that the facial profile is relatively retracted (orthognathic). This change in facial profile is associated with a characteristic spatial distribution of bone deposition and resorption: growth remodeling. For humans, surface resorption commonly dominates on anteriorly-facing areas of the subnasal region of the maxilla and mandible during development. We mapped the distribution of facial growth remodeling activities on the 900–800 ky maxilla ATD6-69 assigned to *H. antecessor*, and on the 1.5 My cranium KNM-WT 15000, part of an associated skeleton assigned to African *H. erectus*. We show that, as in *H. sapiens*, *H. antecessor* shows bone resorption over most of the subnasal region. This pattern contrasts with that seen in KNM-WT 15000 where evidence of bone deposition, not resorption, was identified. KNM-WT 15000 is similar to *Australopithecus* and the extant African apes in this localized area of bone deposition. These new data point to diversity of patterns of facial growth in fossil *Homo*. The similarities in facial growth in *H. antecessor* and *H. sapiens* suggest that one key developmental change responsible for the characteristic facial morphology of modern humans can be traced back at least to *H. antecessor*.

Citation: Lacruz RS, de Castro JMB, Martinón-Torres M, O'Higgins P, Paine ML, et al. (2013) Facial Morphogenesis of the Earliest Europeans. PLoS ONE 8(6): e65199. doi:10.1371/journal.pone.0065199

Editor: John Hawks, University of Wisconsin, United States of America

Received January 28, 2013; **Accepted** April 22, 2013; **Published** June 6, 2013

Funding: RSL thanks the Leakey Foundation for financial support and the National Institutes of Health (K99/R00 grant DE # 022799). Research was also funded by Spanish "Ministerio de Ciencia e Innovación (Project N°CGL2009-12703-C03) and from Junta de Castilla y León (JCyL) (Project GR249). Additional support provided to TGB and RSL by the 2010 Max Planck Research Award, administered by the Max Planck Society and the Alexander von Humboldt Foundation in respect of the Hard Tissue Research Program in Human Paleobiomics. Fieldwork supported by the Consejería de Cultura y Turismo from the JCyL; Fundación Atapuerca. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

* E-mail: rodrigo@usc.edu

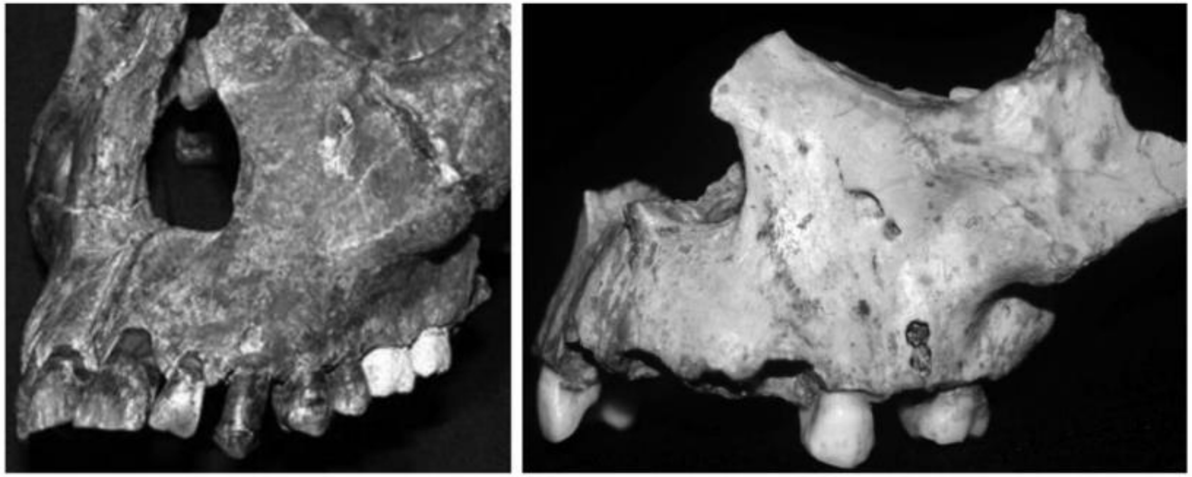


Figure 1. Lateral views of KNM-WT 15000 (left) and ATD6-69 (right). Note the differences in facial projection and in the topography of the maxilla.
doi:10.1371/journal.pone.0065199.g001

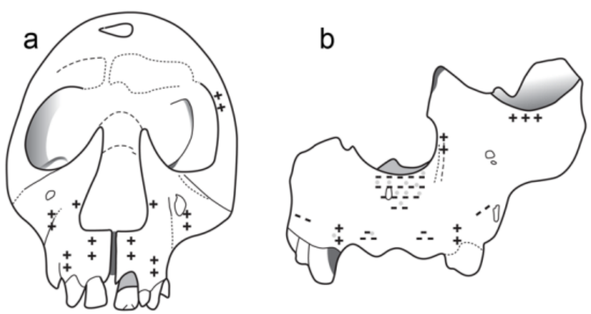


Figure 2. Facial growth remodelling maps. (**A**) Facial growth remodelling of the *H. erectus* specimen KNM-WT 15000 from Kenya, dating from ~1.5 my showing depository fields (+) over most aspects of the anteriorly facing maxilla. Taphonomic alterations prevented a more complete analysis of the periosteal surface of this specimen which was only studied by SEM. (**B**) Facial growth remodelling of the specimen ATD6-69 representing *H. antecessor*, the oldest known European hominin species dating to 900–800 ky. SEM and confocal microscopy data showed resorptive fields (−) throughout the naso-alveolar clivus of this hominin, a characteristic shared with *H. sapiens*. Gray circles indicate the areas spot-mapped using the portable confocal microscope (PCSOM).
doi:10.1371/journal.pone.0065199.g002

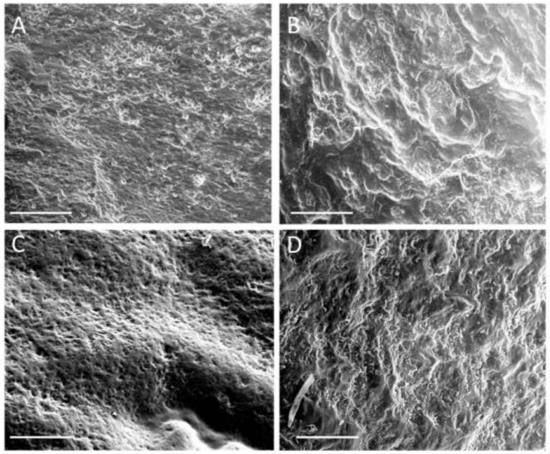


Figure 3. Scanning Electron Micrographs of facial growth remodeling in KNM-WT 15000 and ATD6-69. Images "**A**" and "**B**" are representative of growth remodeling fields in KNM-WT 15000 (*H. erectus*). Image "**A**" shows depository fields in the clivus area of this specimen. For comparison, "**B**" shows resorptive fields in the anterior aspect of the mandibular ramus of this specimen. Scale bars (A, B) = 50 µm. Images "**C**" and "**D**" represent growth remodeling fields of the specimen ATD6-69 (*H. antecessor*). Image "**C**" shows depository fields near the zygomatic region whereas "**D**" is a representative resorptive field in the clivus of ATD6-69. Scale bars (C,D) = 100 µm. All images shown here are taken from high resolution replicas examined in the scanning electron microscope.
doi:10.1371/journal.pone.0065199.g003

frontiers | Frontiers in Public Health

TYPE Case Report
PUBLISHED 01 November 202
DOI 10.3389/fpubh.2022.921

OPEN ACCESS

EDITED BY
Riccardo Nucera,
University of Messina, Italy

REVIEWED BY
Ayman Raouf Khalifa,
October 6 University, Egypt
Antonino Lo Giudice,
University of Catania, Italy

*CORRESPONDENCE
Monica Macrì
m.macri@unich.it

SPECIALTY SECTION
This article was submitted to Digital Public Health, a section of the journal Frontiers in Public Health

RECEIVED 15 April 2022
ACCEPTED 07 October 2022
PUBLISHED 01 November 2022

CITATION
Macrì M and Festa F (2022) Three-dimensional evaluation using CBCT of the mandibular asymmetry and the compensation mechanism in a growing patient: A case report. *Front. Public Health* 10:921413. doi: 10.3389/fpubh.2022.921413

Three-dimensional evaluation using CBCT of the mandibular asymmetry and the compensation mechanism in a growing patient: A case report

Monica Macrì* and Felice Festa

Department of Innovative Technologies in Medicine and Dentistry, University "G. D'Annunzio" of Chieti-Pescara, Chieti, Italy

Background: This case report aims to evaluate the development and the compensation mechanisms of the mandibular asymmetry in a growing male patient using cone beam computed tomography (CBCT). In this case, the menton deviated on the right, a sporadic condition, which may be the consequence of a disorder in the mandibular growth.

Case presentation: The young male patient was treated with rapid palatal expander (RPE) and Fränkel functional regulator III (FR-3). The initial CBCT was acquired at the beginning of therapy when the patient was 8 years old, and the final CBCT was developed at the end of the treatment when the patient was 12 years old. The patient's CBCT was performed with the head oriented according to the Natural Head Position (NHP); the NHP is a physiological and reproducible posture defined for morphological analysis. The 3D image of the cranium was oriented in the Dolphin software according to NHP posture, and cephalometric measurements were taken in the software's frontal, laterolateral right and left, posteroanterior, and submentovertex views. The therapy lasted 3.8 years and ended with significant regression of the mandibular asymmetry from moderate grade (4.2 mm) to slight grade (1.3 mm).

Conclusion: The literature shows that the left hemi-mandible has grown more than the right side, which affirms that in case of deviation of the menton >4 mm, the bone volume increases on the non-deviated side.

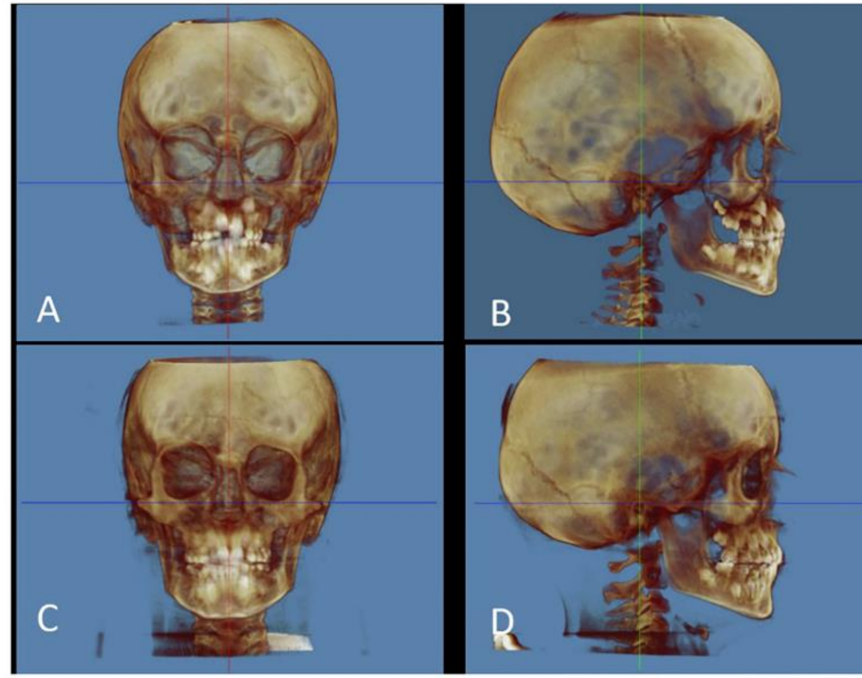


FIGURE 1
Natural head position. **(A)** Pre-treatment frontal view; **(B)** Pre-treatment lateral view (right); **(C)** Post-treatment frontal view; **(D)** Post-treatment lateral view (right). The red line corresponds to the sagittal plane. The green line corresponds to the coronal plane. The blue line corresponds to the transverse plane. The reference landmarks used for cephalometric measurements are shown in Table 1.

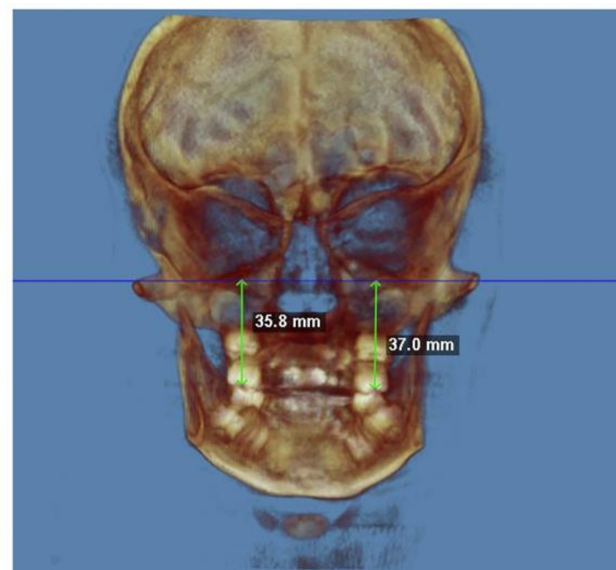


FIGURE 2
The right–left difference in maxillary height at the end of the treatment (PA view). The maxillary height was calculated from FH to the occlusal fossa of the maxillary first molar.

Am J Orthod Dentofacial Orthop. 2018 Jun;153(6):842-851. doi: 10.1016/j.ajodo.2017.10.026.

Apical root resorption during orthodontic treatment with clear aligners: A retrospective study using cone-beam computed tomography

Courtney Aman [1], Bruno Azevedo [2], Eric Bednar [3], Sunita Chandiramami [4], Daniel German [5], Eric Nicholson [6], Keith Nicholson [3], William C Scarfe [2]

Affiliations + expand

PMID: 29853242 DOI: 10.1016/j.ajodo.2017.10.026

Abstract

Introduction: We aimed to investigate the incidence and severity of orthodontically induced inflammatory root resorption (OIIRR) on maxillary incisors with clear aligner therapy using cone-beam computed tomography and to identify possible risk factors.

Methods: The root lengths of maxillary incisors were measured on orthogonal images from pretreatment and posttreatment cone-beam computed tomography examinations of 160 patients who received comprehensive orthodontic treatment with clear aligners.

Results: Mean absolute reductions in root length varied between 0.47 ± 0.61 mm and 0.55 ± 0.70 mm and were not significantly different between maxillary central and lateral incisors. The prevalence of severe OIIRR, defined as both maxillary central incisors experiencing greater than a 25% reduction in root length, was found to be 1.25%. Potential risk factors included sex, malocclusion, crowding, and posttreatment approximation of apices to the cortical plates. Race, interproximal reduction, previous trauma to the teeth, elastics, age, treatment duration, and pretreatment approximation of apices to the cortical plates did not significantly affect the amount of OIIRR.

Conclusions: Comprehensive treatment with clear aligners resulted in minimal root resorption. Sex, malocclusion, crowding, and posttreatment approximation to the cortical plates significantly affected the percentage of change in root length. Posttreatment approximation of root apices to the palatal cortical plate showed the strongest association for increased OIIRR.

The effectiveness of movement, that is, the evaluation of the sagittal root position in the alveolar bone, was performed by comparing pre-treatment and post-treatment root positions relative to the orofacial cortical plates in the cross sections at T0 and T1 stages.

The sagittal root position was qualitatively evaluated in the midsagittal view according to the rating scale reported by Kan et al. [20] and modified by Aman et al. [21] (Figure 1): In class I, the root is positioned against the labial cortical plate (A); in Class II, the root is centred in the middle of the alveolar housing without engaging either the labial or the palatal cortical plates at the apical third of the root (B); Class III, the root is positioned against the palatal cortical plate (C); Class IV, at least two-thirds of the root is engaging both the labial and palatal cortical plates (D); and Class V, the root is positioned outside the labial cortical plate (E).

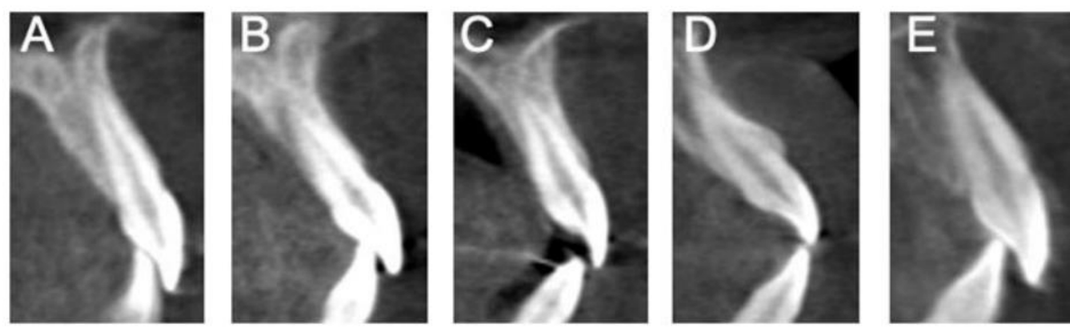


Figure 1. Classification of root position relative to cortical plates according to Aman: (**A**), Class I: the root is positioned against the labial cortical plate. (**B**), Class II: the root is centered in the alveolar housing without engaging the labial or palatal cortical plate at the apical third of the root. (**C**), Class III: the root is positioned against the palatal cortical plate. (**D**), Class IV: at least two-thirds of the root engages the labial and palatal cortical plates. (**E**), Class V: the root is positioned outside the labial cortical plate.

AJO-DO

A new method to measure mesiodistal angulation and faciolingual inclination of each whole tooth with volumetric cone-beam computed tomography images

Hongsheng Tong,[a] Reyes Enciso,[b] Dana Van Elslande,[c] Paul W. Major,[d] and Glenn T. Sameshima[e]
Los Angeles, Calif, and Calgary and Edmonton, Alberta, Canada

Introduction: The purpose of this study was to develop a methodology to measure the mesiodistal angulation and the faciolingual inclination of each whole tooth (including the root) by using 3-dimensional volumetric images generated from cone-beam computed tomography scans. **Methods:** A plastic typodont with 28 teeth in ideal occlusion was fixed in position in a dry human skull. Stainless steel balls were fixed to the occlusal centers of the crowns and to the apices or bifurcation or trifurcation centers of the roots. Cone-beam computed tomography images were taken and rendered in Dolphin 3D (Dolphin, Chatsworth, Calif). The University of Southern California root vector analysis program was developed and customized to digitize the crown and root centers that define the long axis of each whole tooth. Special algorithms were used to automatically calculate the mesiodistal angulation and the faciolingual inclination of each whole tooth. Angulation measurements repeated 5 times by using this new method were compared with the true values from the coordinate measuring machine measurements. Next, the root points of 8 selected typodont teeth were modified to generate known angulation and inclination values, and 5-time repeated measurements of these teeth were compared with the known values. **Results:** Intraclass correlation coefficients for the repeated mesiodistal angulation and faciolingual inclination measurements were close to 1. Comparisons between our 5-time repeated angulation measurements and the coordinate measuring machine's true angulation values showed 5 teeth with statistically significant differences. However, only the maxillary right lateral incisor showed a mean difference that might exceed 2.5° for clinical significance. Comparisons between the 5-repeated measurements of 8 teeth with known mesiodistal angulation and faciolingual inclination values showed no statistically significant differences between the measured and the known values, and no measurement had a 95% confidence interval beyond 1°. **Conclusions:** We have developed the novel University of Southern California root vector analysis program to accurately measure each whole tooth mesiodistal angulation and faciolingual inclination, in a clinically significant level, directly from the cone-beam computed tomography volumetric images. (Am J Orthod Dentofacial Orthop 2012;142:133-43)

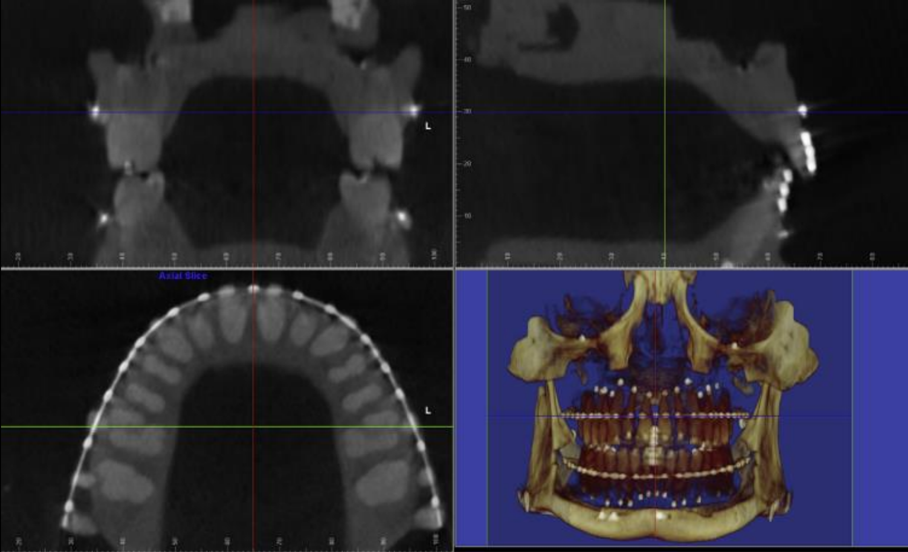


Fig 1. Setting up the global coordination system for the maxillary arch: the midsagittal plane (*red*) evenly dividing the right and left sides, the coronal plane (*green*) at the buccal groves of the maxillary right and left first molars, and the axial plane (*blue*) at the maxillary archwire level.

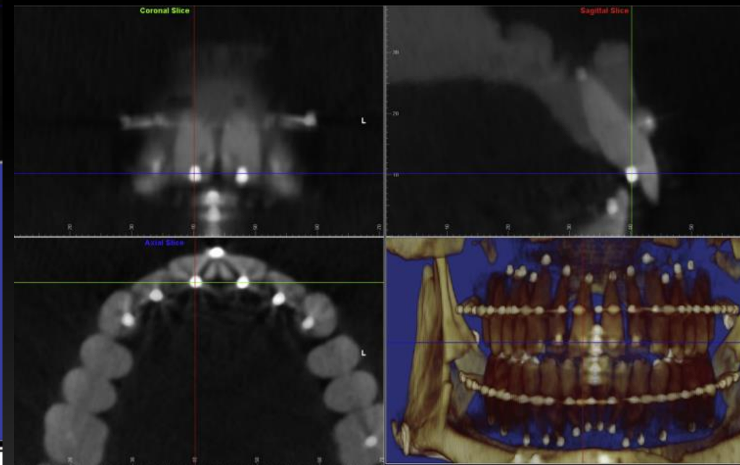


Fig 2. Locating the maxillary right central incisor crown point before digitization: parallel movements of the sagittal (*red*), coronal (*green*), and axial (*blue*) planes were made to intersect at the center of the stainless steel ball representing the tooth's crown point.

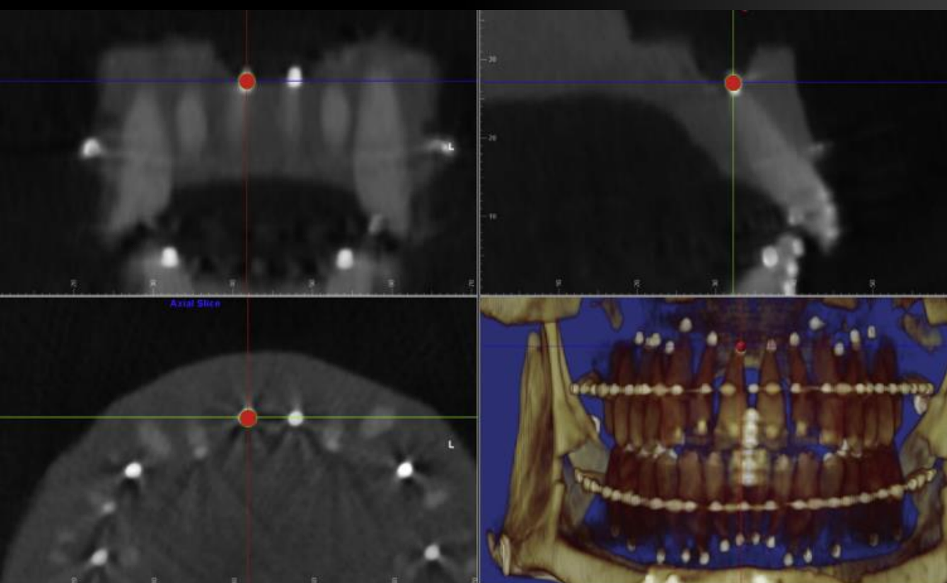


Fig 3. Digitization of the maxillary right central incisor root point: parallel movements of the sagittal (*red*), coronal (*green*), and axial (*blue*) planes were made to intersect at the center of the stainless steel ball representing the tooth's root point, and it was digitized (*red dots*).

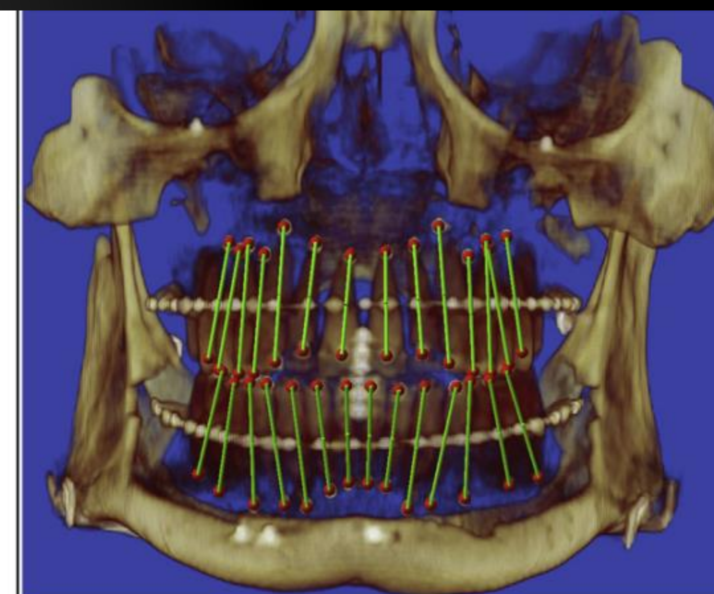
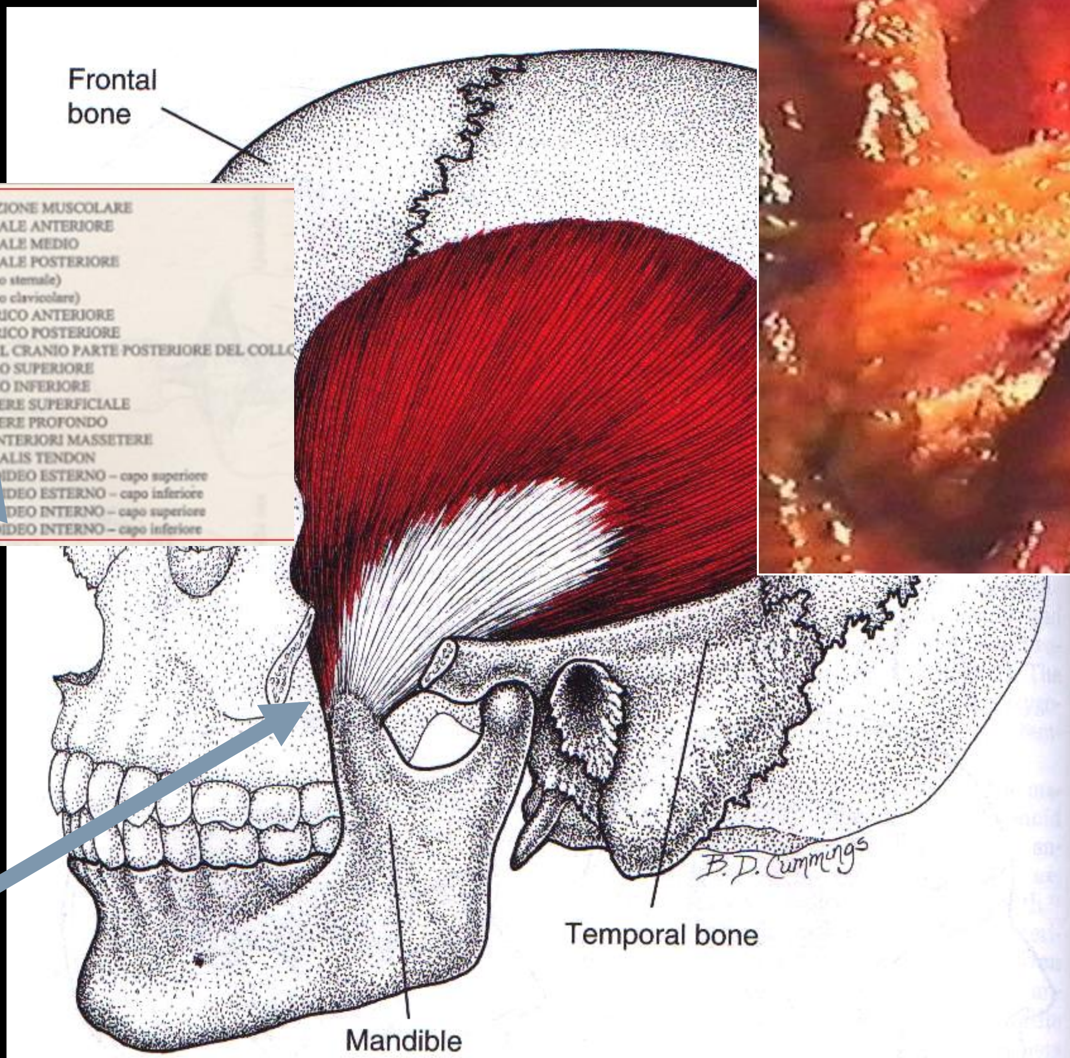


Fig 4. All crown and root points have been replaced b *red digitization dots,* and the teeth's long axes are show in *green*.

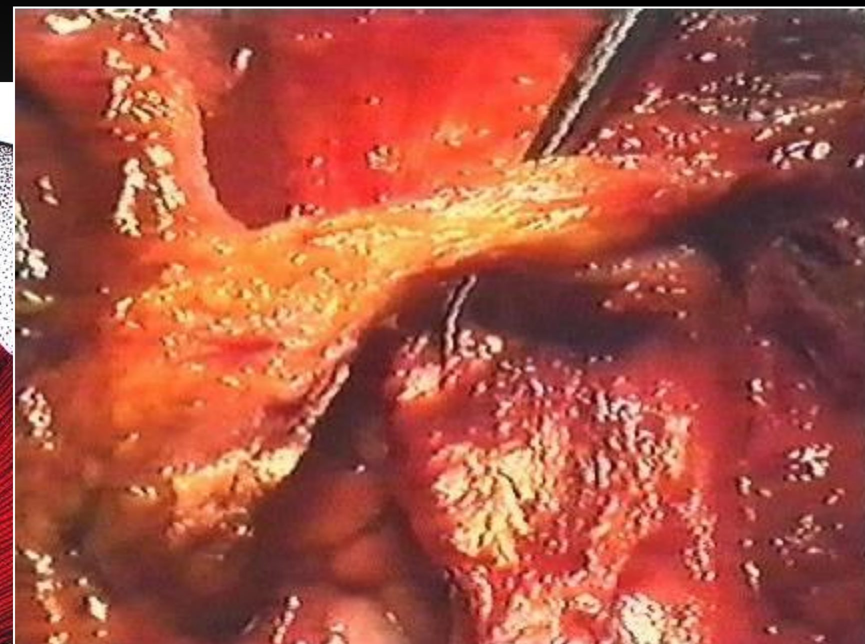
- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

TANAKA-FESTA DISSECTIONS-TEMPORALIS TENDON



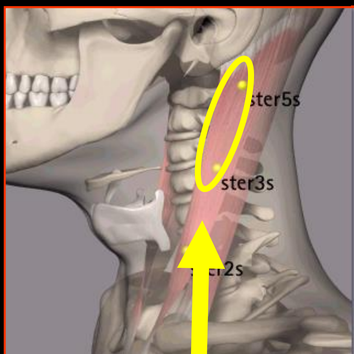
TENSIONE-DOLORE ALLA PALPAZIONE MUSCOLARE

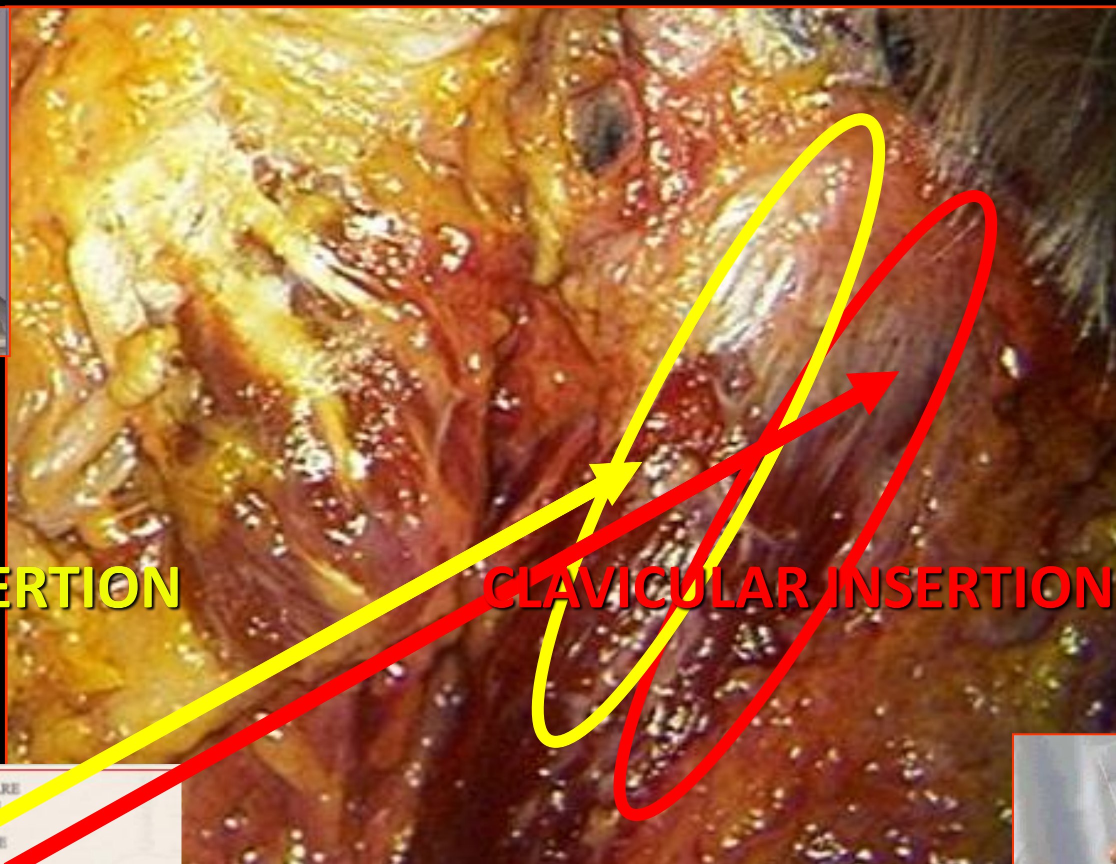
□□□D	S□□□	TEMPORALE ANTERIORE
□□□D	S□□□	TEMPORALE MEDIO
□□□D	S□□□	TEMPORALE POSTERIORE
□□□D	S□□□	SCM (capo sternale)
□□□D	S□□□	SCM (capo clavicolare)
□□□D	S□□□	DIGASTRICO ANTERIORE
□□□D	S□□□	DIGASTRICO POSTERIORE
□□□D	S□□□	BASE DEL CRANIO PARTE POSTERIORE DEL COLLO
□□□D	S□□□	TRAPEZIO SUPERIORE
□□□D	S□□□	TRAPEZIO INFERIORE
□□□D	S□□□	MASSETERE SUPERFICIALE
□□□D	S□□□	MASSETERE PROFONDO
□□□D	S□□□	FIBRE ANTERIORI MASSETERE
□□□D	S□□□	TEMPORALIS TENDON
□□□D	S□□□	PTERIG IDEO ESTERNO – capo superiore
□□□D	S□□□	PTER IDEO ESTERNO – capo inferiore
□□□D	S□□□	PTER IDEO INTERNO – capo superiore
□□□D	S□□□	PTER OIDEO INTERNO – capo inferiore

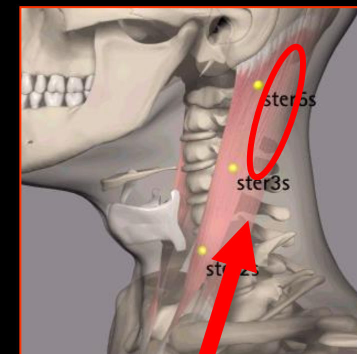


To evaluate condyle posterior displacement

STERNOCLEIDOMASTOIDEUS MUSCLE

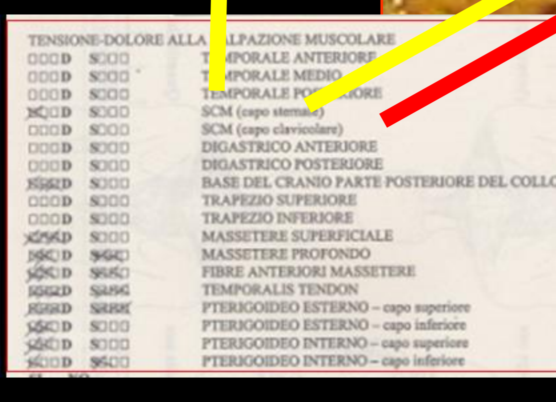






STERNAL INSERTION

CLAVICULAR INSERTION



TENSIONE-DOLORE ALLA PALPAZIONE MUSCOLARE

□□□D	S□□□	TEMPORALE ANTERIORE
□□□D	S□□□	TEMPORALE MEDIO
□□□D	S□□□	TEMPORALE POSTERIORE
☒□□D	S□□□	SCM (capo sternale)
□□□D	S□□□	SCM (capo clavicolare)
□□□D	S□□□	DIGASTRICO ANTERIORE
□□□D	S□□□	DIGASTRICO POSTERIORE
☒☒☒D	S□□□	BASE DEL CRANIO PARTE POSTERIORE DEL COLLO
□□□D	S□□□	TRAPEZIO SUPERIORE
□□□D	S□□□	TRAPEZIO INFERIORE
☒☒☒D	S□□□	MASSETERE SUPERFICIALE
☒☒□D	S☒☒□	MASSETERE PROFONDO
☒☒□D	S☒☒□	FIBRE ANTERIORI MASSETERE
☒☒☒D	S☒☒☒	TEMPORALIS TENDON
☒☒☒D	S☒☒☒	PTERIGOIDEO ESTERNO – capo superiore
☒☒□D	S□□□	PTERIGOIDEO ESTERNO – capo inferiore
☒☒□D	S□□□	PTERIGOIDEO INTERNO – capo superiore
☒□□D	S☒□□	PTERIGOIDEO INTERNO – capo inferiore

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale

AI (Intelligenza Artificiale)/ Robotica del Volto

Teoria delle Matrici Funzionali

Casi Clinici (Avanzamento mascellare, mandibolare)

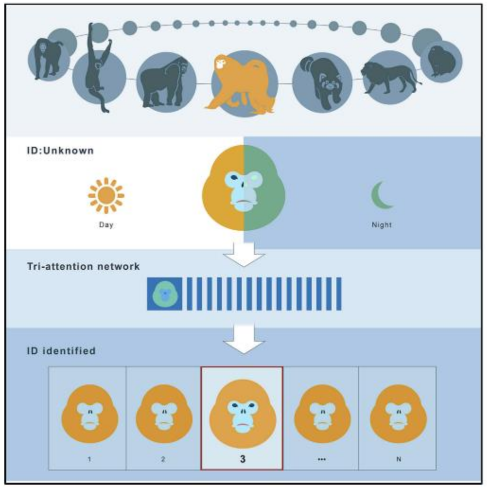
Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

iScience

CellPress OPEN ACCESS

Article

Automatic Identification of Individual Primates with Deep Learning Techniques



Songtao Guo, Pengfei Xu, Qiguang Miao, ..., Yewen Sun, Zhihui Shi, Baoguo Li

songtaoguo@nwu.edu.cn

HIGHLIGHTS

The Tri-AI system can rapidly detect and identify individuals from videos and images

Tri-AI had an ID identification accuracy of 94% for 41 primates and 4 carnivores

The system could individually recognize 31 animals/s with images taken day or night

Systems like Tri-AI make around-the-clock monitoring and behavior analysis possible

Guo et al., iScience 23, 101412
August 21, 2020 © 2020 The Authors.
https://doi.org/10.1016/j.isci.2020.101412

iScience

CellPress OPEN ACCESS

Article

Automatic Identification of Individual Primates with Deep Learning Techniques

Songtao Guo,[1,11,12,*] Pengfei Xu,[2,3,4,11] Qiguang Miao,[5,6,11] Guofan Shao,[7] Colin A. Chapman,[1,8,9] Xiaojiang Chen,[2,3,4] Gang He,[1] Dingyi Fang,[2,3,4] He Zhang,[1] Yewen Sun,[1] Zhihui Shi,[1] and Baoguo Li[1,10]

SUMMARY

The difficulty of obtaining reliable individual identification of animals has limited researcher's ability to obtain quantitative data to address important ecological, behavioral, and conservation questions. Traditional marking methods placed animals at undue risk. Machine learning approaches for identifying species through analysis of animal images has been proved to be successful. But for many questions, there needs a tool to identify not only species but also individuals. Here, we introduce a system developed specifically for automated face detection and individual identification with deep learning methods using both videos and still-framed images that can be reliably used for multiple species. The system was trained and tested with a dataset containing 102,399 images of 1,040 individuals across 41 primate species whose individual identity was known and 6,562 images of 91 individuals across four carnivore species. For primates, the system correctly identified individuals 94.1% of the time and could process 31 facial images per second.

INTRODUCTION

Answering many theoretical questions in ecology and conservation frequently requires the identification and monitoring of individual animals (Nathan, 2008). However, traditional marking methods are often costly and involve considerable risk to the animal, a risk that is typically unacceptable for endangered species (Fernandezduque et al., 2018). With the maturity of digital image acquisition and camera traps, it has become relatively easy to repeatedly capture images of animals; however, using these images to address many ecological questions requires accurate individual identification (Wang et al., 2013).

By employing image matching methods (Zeppelzauer, 2013; Zhu et al., 2013; Chu and Liu, 2013; Finch and Murray, 2003) and machine learning (Loos and Ernst, 2013; Swanson et al., 2016; Nathan, 2008), researchers have accurately identified species from images using animal body surface characteristics, like colors (Zeppelzauer, 2013; Zhu et al., 2013; Wichmann et al., 2010), shape (Chu and Liu, 2013; Tweed and Calway, 2002; Finch and Murray, 2003), and texture (Crouse et al., 2017). To identify individuals, however, the images of specific body parts are required (Norouzzadeh et al., 2018; Burghardt et al., 2004; Lahiri et al., 2011; Hiby et al., 2009; Karanth, 1995), and this has been done with penguin's abdomens (Burghardt et al., 2004), stripes of zebra (Lahiri et al., 2011) and tigers (Xu and Qi, 2008), and the unique spot and scar features on the backs of killer whales (Arzoumanian et al., 2005). Although helpful for specific studies, these methods are using species-specific traits and thus they cannot be used across species.

The objective of our study was to determine if animal facial images could be used as a universal part for individual detection and identification. Machine learning for facial recognition has been developed for animals. For example, Burghardt and Calic (2006) presented a method based on Haar-like features and AdaBoost algorithm to detect the lion's face and Ernst and Küblbeck (2011) extracted the features of the key facial points of chimpanzees for individual identification. Recently, Hou et al. (2020) used VGGNet for face recognition on 65,000 face images of 25 pandas and obtained an individual identification accuracy of 95%. Schofield et al. (2019) presented a deep convolutional neural network (CNN) approach for face detection, tracking, and recognition of wild chimpanzees from long-term video records in a 14-year dataset yielding 10 million face images from 23 individuals, and they obtained an overall accuracy of 92.5% for

[1]Shaanxi Key Laboratory for Animal Conservation, School of Life Sciences, Northwest University, Xi'an 710069, China

[2]School of Information Sciences and Technology, Northwest University, Xi'an 710127, China

[3]Shaanxi International Joint Research Centre for the Battery-free Internet of Things, Xi'an, China

[4]Institute of Internet of Things, Northwest University, Xi'an, China

[5]School of Computer Science and Technology, Xidian University, Xi'an 710071, China

[6]Xi'an Key Laboratory of Big Data and Intelligent Vision, Xi'an 710071, China

[7]Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907, USA

[8]Department of Anthropology, Center for the Advanced Study of Human Paleobiology, George Washington University, Washington, DC 20037, USA

[9]School of Life Sciences, University of KwaZulu-Natal, Scottsville, Pietermaritzburg 3209, South Africa

[10]Center for Excellence in Animal Evolution and Genetics, Chinese Academy of Sciences, Kunming 650223, China

[11]These authors contributed equally

[12]Lead Contact

*Correspondence: songtaoguo@nwu.edu.cn

https://doi.org/10.1016/j.isci.2020.101412

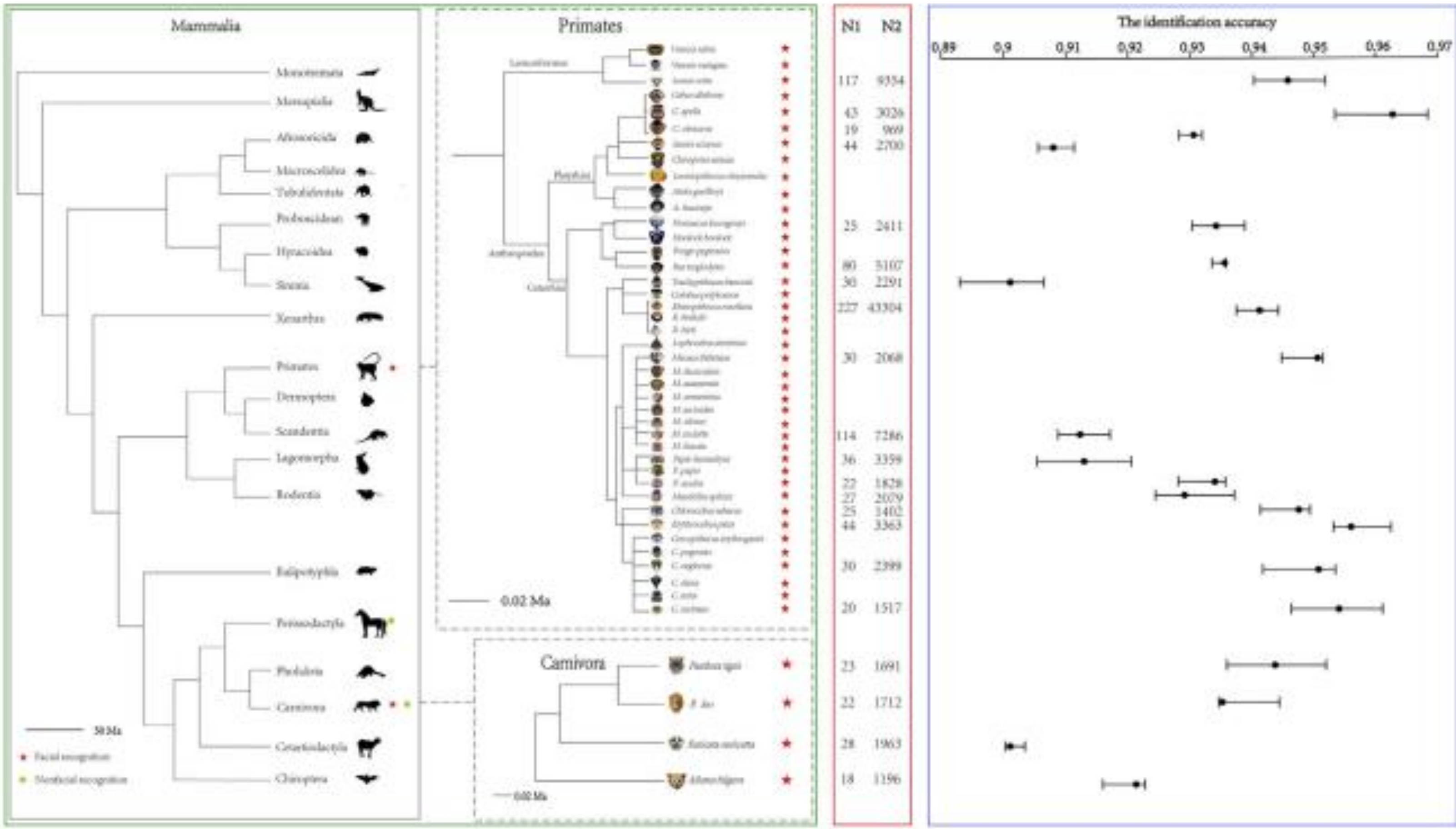


Figure 1. Application of Deep Learning in Animals and the Individual Identification Accuracy of 21 Species

Green dot, Non-facial (body) biometric character recognition; red stars, facial biometric recognition. Break line box: Tri-AI has successfully performed individual identification in the species in this study (in left green box). N1 is the number of the individuals, and N2 is the number of facial images for the corresponding species in our image dataset (in middle red box). For each species, we give the average, maximum, and minimum values of the accuracy from multiple tests (in right blue box).

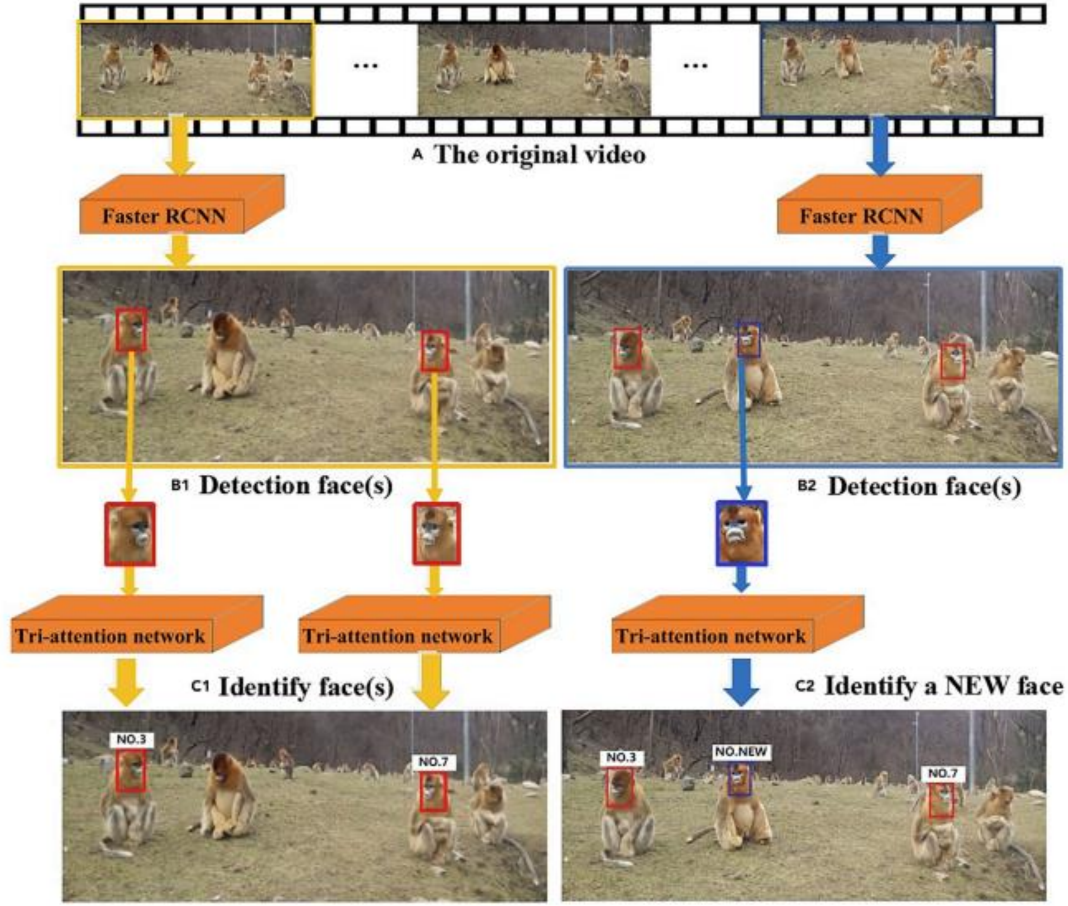


Figure 2. Face Detection and Identification of the Golden Snub-Nosed Monkeys by Using Deep Learning Methods in Tri-AI

(A) An original video has many frames, and the face areas of the monkeys must first be detected using Faster RCNN (Ren et al., 2015) from each frame.

(B1 and B2) The detected monkeys' faces are all marked in each frame by Faster RCNN and then are input to Tri-attention network for individual identification.

(C1) Tri-AI identifies and names all monkeys known in the database.

(C2) If Tri-AI finds a new monkey face, a new name is then given and automatically added to the database.

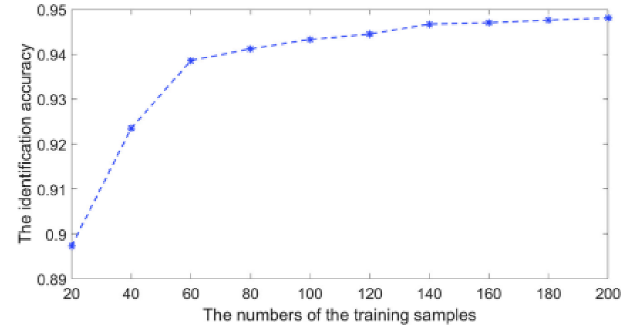


Figure 3. The Relationship between the Identification Accuracy and the Training Sample Numbers

The accuracy is improving with increasing in training samples for each individual, and the inflection point number of training images is around 60 for each individual of golden snub-nosed monkey.

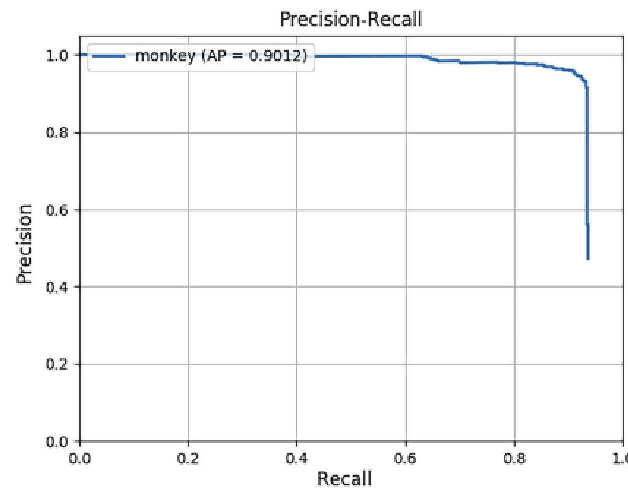
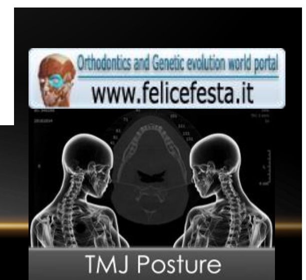


Figure 4. Precision-Recall Curves of Face Detection by Faster RCNN on Golden Snub-Nosed Monkeys



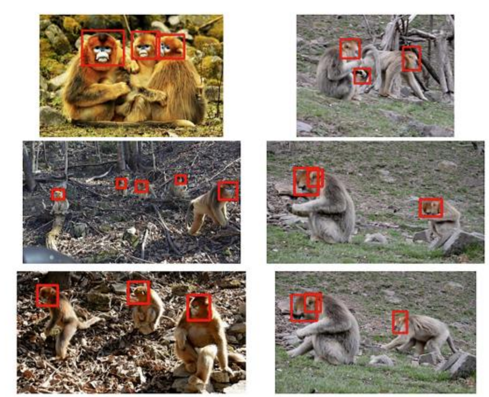
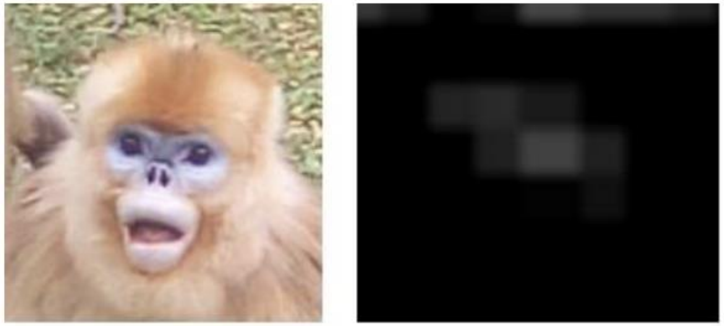
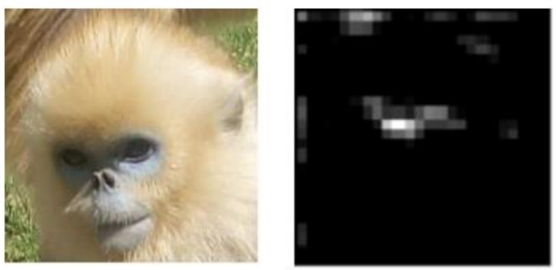


Figure 5. The Detected Results of Golden Snub-Nosed Monkeys by Faster RCNN

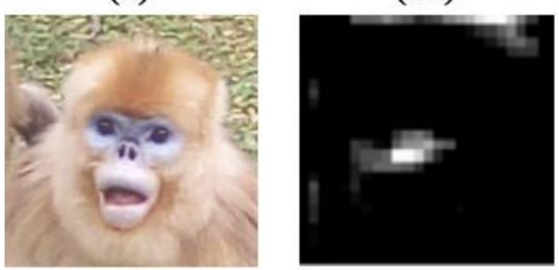


(a) (b)

Figure S5. The feature map shows the model pays attention to feature extraction from the “skin area”, related to Figure 2. (a) The facial image of golden snub-nosed monkey. (b)The feature map for the attentional facial region of the “skin area”.



(a) (a1)



(b) (b1)

Figure S6. The original facial images of golden snub-nosed monkeys and the feature maps extracted by significant partial level attention model, related to Figure 2. (a) The facial image of golden snub-nosed monkey. (a1) The feature map for the attentional facial region. (b) The facial image of golden snub-nosed monkey. (b1) The feature map for the attentional facial region.

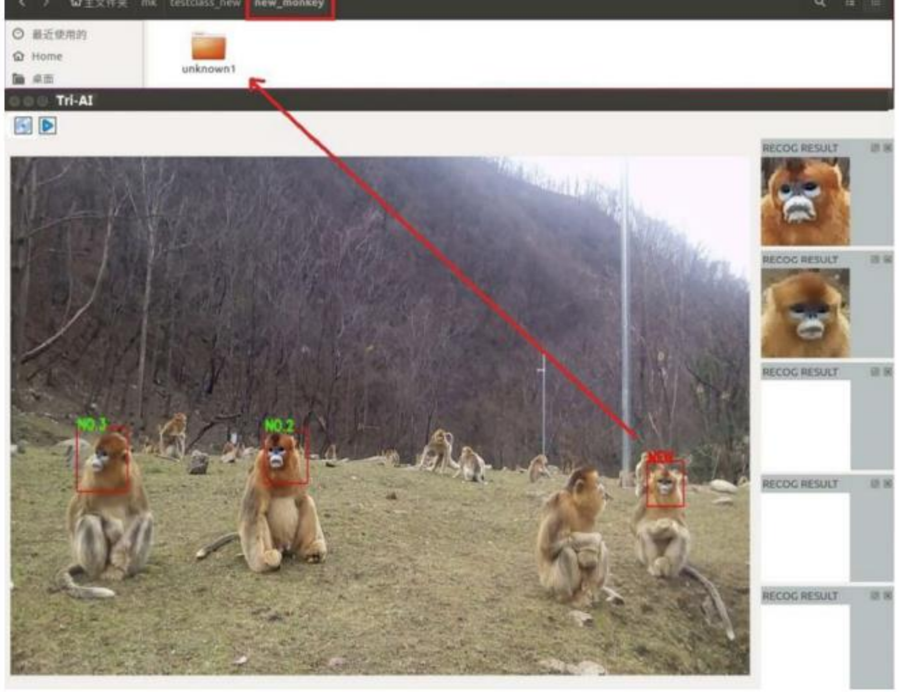


Figure S14. The recognition of a new individual. The new individual is identified, and its facial images are added to the dataset automatically, related to Figure 2.

Figure S15. Usable images of golden snub-nosed monkeys, related to Figure 1.

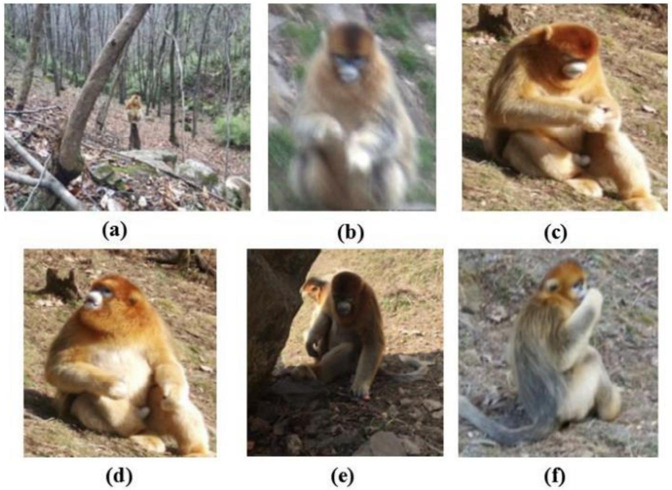


Figure S16. The unusable images under different conditions, related to Figure 1. (a) Too small face. (b) Motion blur. (c) Big angle of the face . (d) Big angle of the face. (e) Under shadow. (f) Covered by its hand.

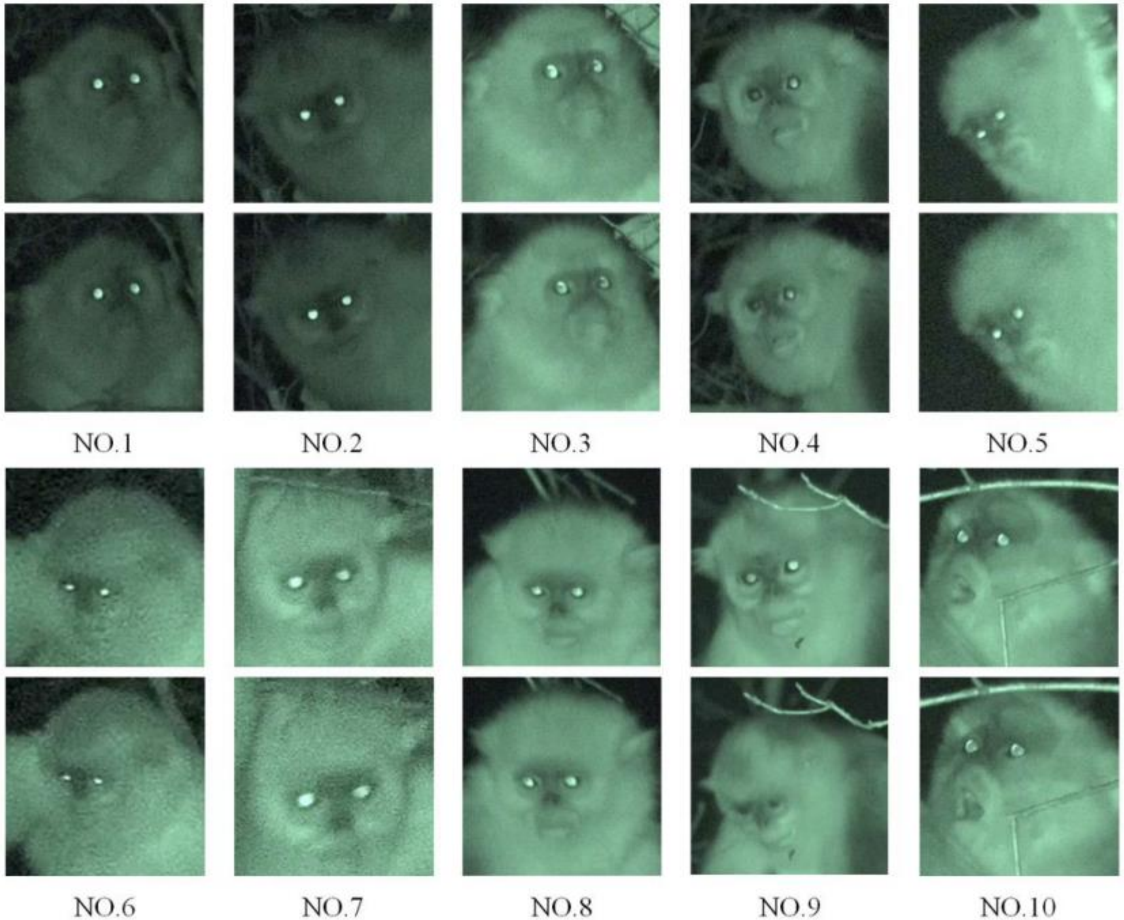
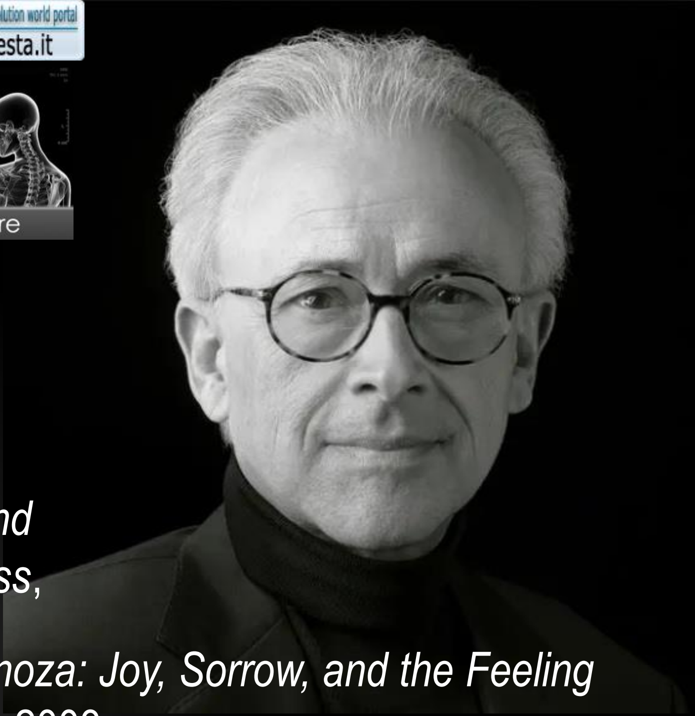


Figure S17. The night facial images of golden snub-nosed monkeys, related to Figures 2 and 3.

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

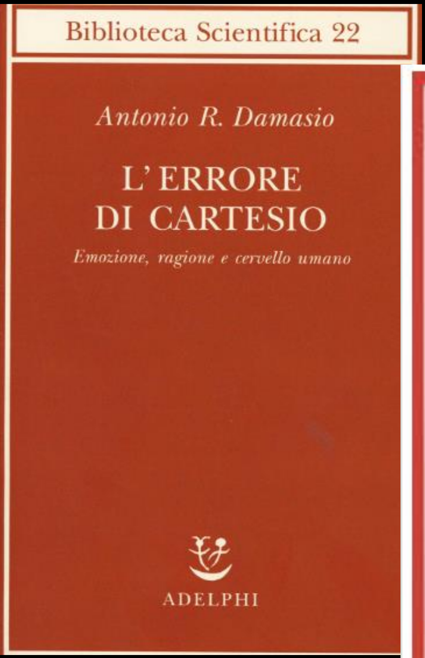
ANTONIO DAMASIO

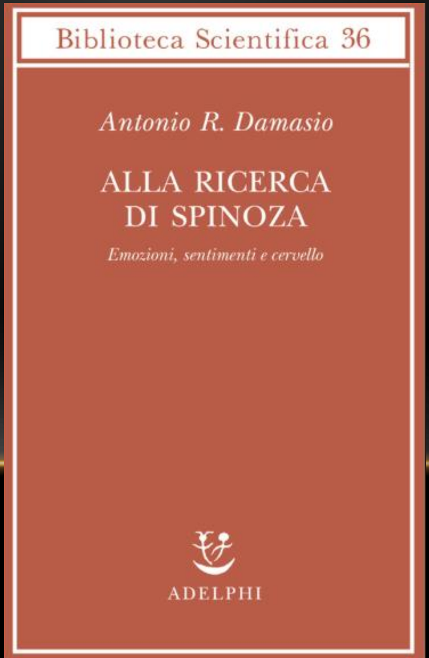


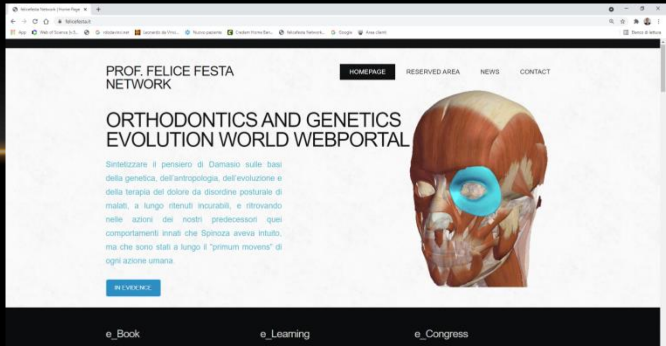
Descartes' Error: Emotion, Reason, and the Human Brain, Putnam, 1994; revised Penguin edition, 2005

The Feeling of What Happens: Body and Emotion in the Making of Consciousness, Harcourt, 1999

Looking for Spinoza: Joy, Sorrow, and the Feeling Brain, Harcourt, 2003







frontiers in Robotics and AI

ORIGINAL RESEARCH
published: 07 February 2018
doi: 10.3389/frobt.2018.00006

SEAI: Social Emotional Artificial Intelligence Based on Damasio's Theory of Mind

Lorenzo Cominelli[1]*, Daniele Mazzei[2] and Danilo Emilio De Rossi[1]

[1] E. Piaggio Research Center, Information Engineering Department, University of Pisa, Pisa, Italy, [2] Computer Science Department, University of Pisa, Pisa, Italy

A socially intelligent robot must be capable to extract meaningful information in real time from the social environment and react accordingly with coherent human-like behavior. Moreover, it should be able to internalize this information, to reason on it at a higher level, build its own opinions independently, and then automatically bias the decision-making according to its unique experience. In the last decades, neuroscience research highlighted the link between the evolution of such complex behavior and the evolution of a certain level of consciousness, which cannot leave out of a body that feels emotions as discriminants and prompters. In order to develop cognitive systems for social robotics with greater human-likeliness, we used an "understanding by building" approach to model and implement a well-known theory of mind in the form of an artificial intelligence, and we tested it on a sophisticated robotic platform. The name of the presented system is SEAI (Social Emotional Artificial Intelligence), a cognitive system specifically conceived for social and emotional robots. It is designed as a bio-inspired, highly modular, hybrid system with emotion modeling and high-level reasoning capabilities. It follows the deliberative/reactive paradigm where a knowledge-based expert system is aimed at dealing with the high-level symbolic reasoning, while a more conventional reactive paradigm is deputed to the low-level processing and control. The SEAI system is also enriched by a model that simulates the Damasio's theory of consciousness and the theory of Somatic Markers. After a review of similar bio-inspired cognitive systems, we present the scientific foundations and their computational formalization at the basis of the SEAI framework. Then, a deeper technical description of the architecture is disclosed underlining the numerous parallelisms with the human cognitive system. Finally, the influence of artificial emotions and feelings, and their link with the robot's beliefs and decisions have been tested in a physical humanoid involved in Human–Robot Interaction (HRI).

Keywords: cognitive systems, artificial intelligence, artificial consciousness, social robotics, humanoids, somatic markers, rules engine, expert systems

OPEN ACCESS

Edited by:
Antonio Chella,
Università degli Studi di Palermo, Italy

Reviewed by:
Luisa Damiano,
Università degli Studi di Messina, Italy
Tony Belpaeme,
Plymouth University, United Kingdom

***Correspondence:**
Lorenzo Cominelli
lorenzo.cominelli@for.unipi.it

Specialty section:
This article was submitted to Humanoid Robotics, a section of the journal Frontiers in Robotics and AI

Received: 21 November 2017
Accepted: 18 January 2018
Published: 07 February 2018

Citation:
Cominelli L, Mazzei D and De Rossi DE (2018) SEAI: Social Emotional Artificial Intelligence Based on Damasio's Theory of Mind. Front. Robot. AI 5:6. doi: 10.3389/frobt.2018.00006

1. INTRODUCTION

Everyone has a rough idea of what is meant by consciousness, but it is better to avoid a precise definition of consciousness because of the dangers of premature definition. Until the problem is understood much better, any attempt at a formal definition is likely to be either misleading or overly restrictive, or both. (Crick and Clark, 1994)

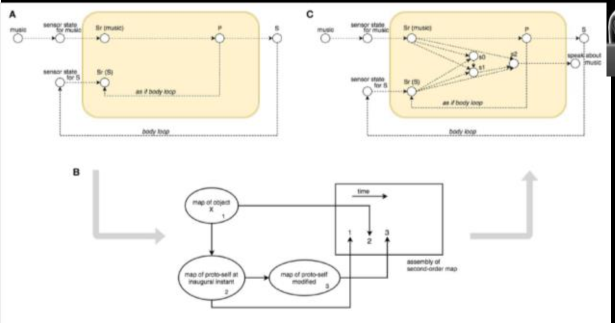


FIGURE 1 | The Bosse et al. computational model: (A) Body loop and As If Body Loop in the generation of feeling; (B) Damasio's picture for assembly of a secondary-order map; (C) overview of the overall simulation model.

as follows: "*as for the internal state of the organism in which the emotion is taking place, it has available both the emotion as neural object (the activation pattern at the induction sites) and the sensing of the consequences of the activation, a feeling, provided the resulting collection of neural patterns becomes images in mind*" (Damasio, 2000).

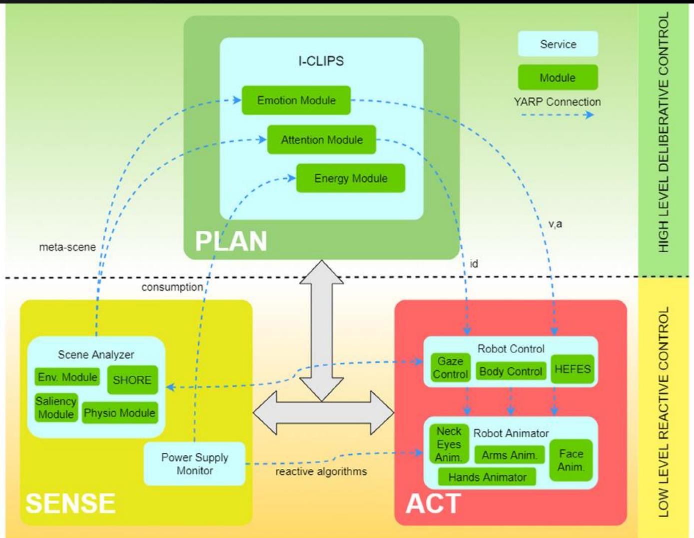


FIGURE 2 | The SEAI architecture includes a set of *services* (blue boxes), standalone applications interconnected through the network. The network communication and services deploy is based on YARP, an open-source middleware designed for the development of distributed robot control systems (Metta et al., 2006). Each service has its *modules* (green boxes) that collect and process data gathered from sensors or directly from the network and send new data over the network. The information flow is defined by XML packets, a serialized form of structured data objects. Thanks to this information management, SEAI is modular and can scale up by developing services, which can even be implemented in different programming languages and placed in different hardware devices. In the proposed architecture ACT, SENSE, and PLAN blocks are only descriptive constructs. The virtual link created by the connections between ACT and SENSE services represents the reactive subsystem. Conversely, the deliberative subsystem is represented by the connections between the I-Clips Rules Engine (PLAN) service and all the other services.

frontiers | Frontiers in Public Health

TYPE Original Research
PUBLISHED 17 November 2022
DOI 10.3389/fpubh.2022.1045815

Check for updates

Development of a new category system for the profile morphology of temporomandibular disorders patients based on cephalograms using cluster analysis

Rui Zhu[1], Yun-Hao Zheng[2], Zi-Han Zhang[2], Pei-Di Fan[2], Jun Wang[2] and Xin Xiong[2,3*]

[1]The State Key Laboratory of Oral Diseases and National Clinical Research Center for Oral Diseases, Department of Prosthodontics, West China Hospital of Stomatology, Sichuan University, Sichuan, China, [2]The State Key Laboratory of Oral Diseases and National Clinical Research Center for Oral Diseases, Department of Orthodontics, West China Hospital of Stomatology, Sichuan University, Sichuan, China, [3]Department of Temporomandibular Joint, West China Hospital of Stomatology, Sichuan University, Sichuan, China

OPEN ACCESS

EDITED BY
Yi-Ju Tseng,
National Yang Ming Chiao Tung University, Taiwan

REVIEWED BY
Jose A. Vega,
University of Oviedo, Spain
Felice Festa,
University of Studies G. d'Annunzio Chieti and Pescara, Italy

*CORRESPONDENCE
Xin Xiong
drxiongxin@scu.edu.cn

SPECIALTY SECTION
This article was submitted to Digital Public Health, a section of the journal Frontiers in Public Health

RECEIVED 16 September 2022
ACCEPTED 04 November 2022
PUBLISHED 17 November 2022

CITATION
Zhu R, Zheng Y-H, Zhang Z-H, Fan P-D, Wang J and Xiong X (2022) Development of a new category system for the profile morphology of temporomandibular disorders patients based on cephalograms using cluster analysis.
Front. Public Health 10:1045815.
doi: 10.3389/fpubh.2022.1045815

Objective: This study aims to develop a new category scheme for the profile morphology of temporomandibular disorders (TMDs) based on lateral cephalometric morphology.

Methods: Five hundred and one adult patients (91 males and 410 females) with TMD were enrolled in this study. Cluster tendency analysis, principal component analysis and cluster analysis were performed using 36 lateral cephalometric measurements. Classification and regression tree (CART) algorithm was used to construct a binary decision tree based on the clustering results.

Results: Twelve principal components were discovered in the TMD patients and were responsible for 91.2% of the variability. Cluster tendency of cephalometric data from TMD patients were confirmed and three subgroups were revealed by cluster analysis: (a) cluster 1: skeletal class I malocclusion; (b) cluster 2: skeletal class I malocclusion with increased facial height; (c) cluster 3: skeletal class II malocclusion with clockwise rotation of the mandible. Besides, CART model was built and the eight key morphological indicators from the decision tree model were convenient for clinical application, with the prediction accuracy up to 85.4%.

Conclusion: Our study proposed a novel category system for the profile morphology of TMDs with three subgroups according to the cephalometric morphology, which may supplement the morphological understanding of TMD and benefit the management of the categorical treatment of TMD.

System Integrated Digital Empowering and teleRehabilitation to promote patient Activation and well-Being in chronic disabilities: A usability and acceptability study

6.461
Impact Factor

OPEN ACCESS

EDITED BY
Yi-Ju Tseng,
National Yang Ming Chiao Tung University, Taiwan

REVIEWED BY
Jose A. Vega,
University of Oviedo, Spain
Felice Festa,
University of Studies G. d'Annunzio
Chieti and Pescara, Italy

*CORRESPONDENCE
Xin Xiong
drxiongxin@scu.edu.cn

SPECIALTY SECTION
This article was submitted to
Digital Public Health,
a section of the journal
Frontiers in Public Health

RECEIVED 16 September 2022
ACCEPTED 04 November 2022
PUBLISHED 17 November 2022

Cluster 1 | Cluster 2 | Cluster 3 | Merge

FIGURE 9
Characteristics of each cluster. The cephalometric image of the 3 subgroups as described in the results.

E' possibile inserire le emozioni nella cefalometria?

FIGURE 7 | The FACE Robot (Facial Automaton for Conveying Emotions) displaying some of its hyper-realistic facial expressions.

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

Evidence for independent brain and neurocranial reorganization during hominin evolution

José Luis Alatorre Warren[a,1], Marcia S. Ponce de León[a], William D. Hopkins[b,c], and Christoph P. E. Zollikofer[a,1]

[a]Department of Anthropology, University of Zurich, 8057 Zurich, Switzerland; [b]Neuroscience Institute, Georgia State University, Atlanta, GA 30302; and [c]Division of Developmental and Cognitive Neuroscience, Yerkes National Primate Research Center, Atlanta, GA 30322

Significance

Human brains differ substantially from those of great apes, and equally important differences exist between their braincases. However, it remains unclear to which extent evolutionary changes in brain structure are related to changes in braincase structure. To study this question, we use combined computed tomography (CT) and MRI head data of humans and chimpanzees and quantify the spatial correlations between brain sulci and cranial sutures. We show that the human brain–braincase relationships are unique compared to chimpanzees and other great apes and that structural rearrangements in the brain and in the braincase emerged independently during human evolution. These data serve as an important frame of reference to identify and quantify evolutionary changes in brain and braincase structures in fossil hominin endocasts.

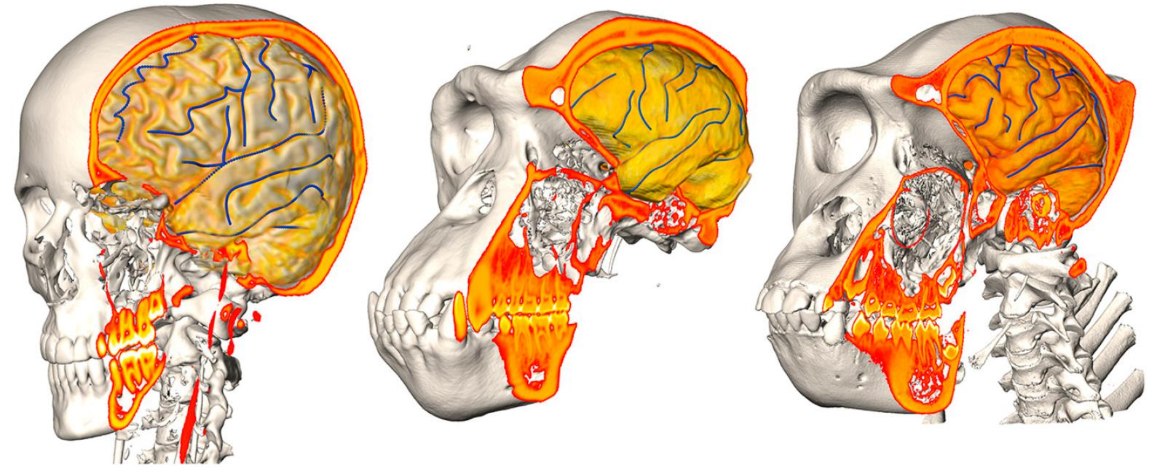
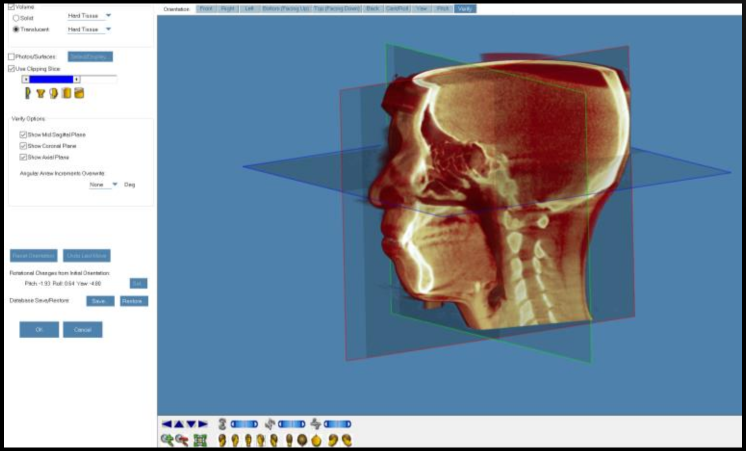


Fig. 1. Same-subject coregistered CT/MRI datasets of a human (*Left*), chimpanzee (*Center*), and gorilla (*Right*). Surface reconstructions of bony structures were derived from CT data, while volume renderings of brain segmentations were obtained from postprocessed MRI data. Delineations of some of the brain sulcal features used in the study are shown in blue.



HEAD ORIENTATION IN THE SPACE COULD BE RELATED TO DEFAULT MODE NETWORK (DMN)?

HEAD ORIENTATION IN THE SPACE IS AN EVOLUTIONARY TASK?

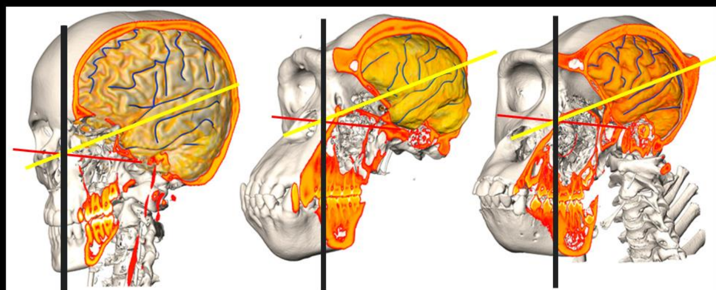
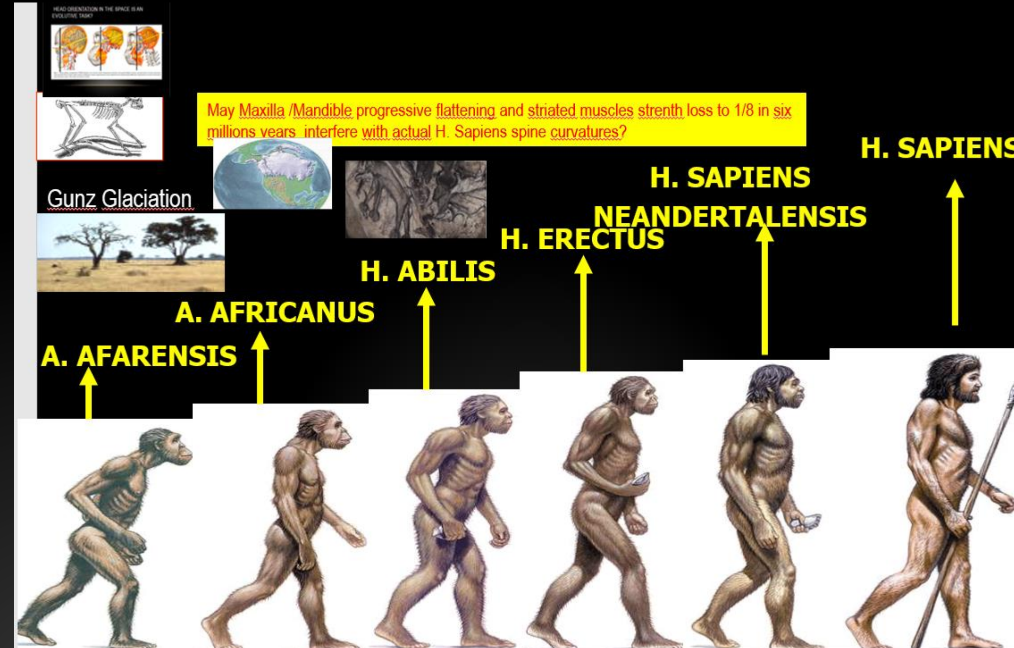
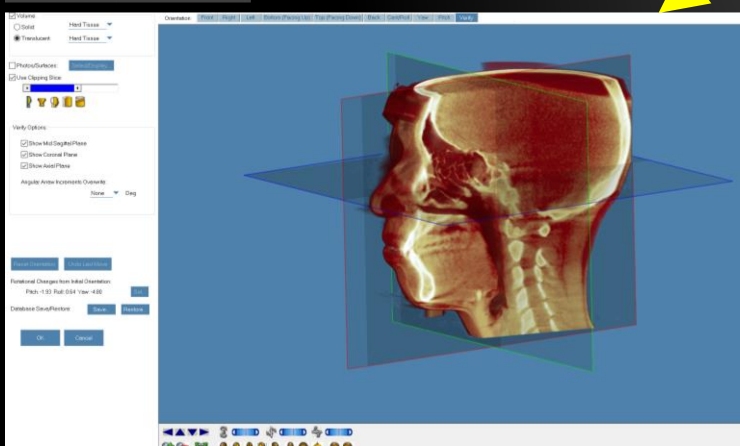


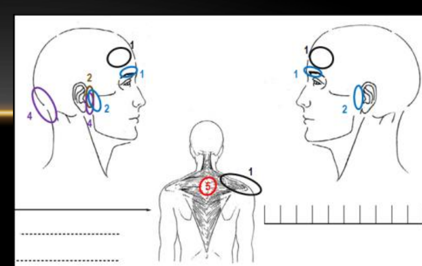
Fig. 1. Same-subject coregistered CT/MRI datasets of a human (*Left*), chimpanzee (*Center*), and gorilla (*Right*). Surface reconstructions of bony structures were derived from CT data, while volume renderings of brain segmentations were obtained from postprocessed MRI data. Delineations of some of the brain sulcal features used in the study are shown in blue.

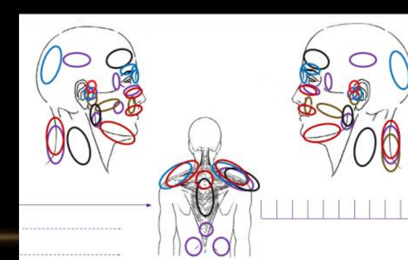
Orthodontics and Genetic evolution world portal
www.felicefesta.it

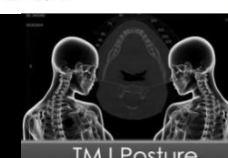




Chieti University Orthodontics and Orofacial Pain Department collection of more than 3000 head/neck bone/muscles Ortho/TMD patients before/ after treatment 3D evolutionary oriented reconstructions



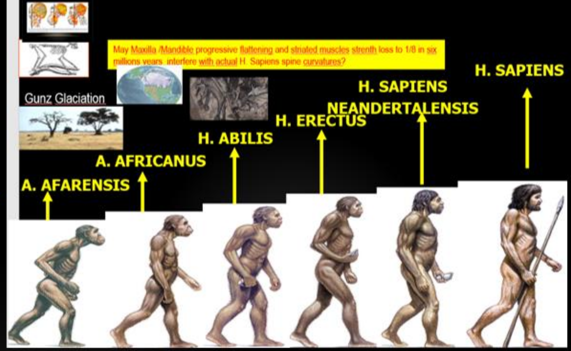


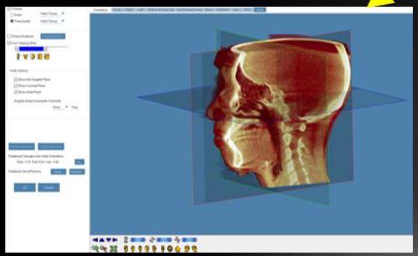


Could be useful to help autonomous AI and Androids sense of direction implementation?

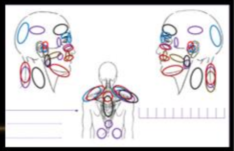
HEAD ORIENTATION IN THE SPACE IS AN EVOLUTIONARY TASK?

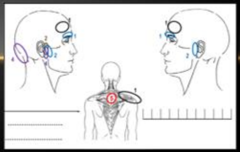
Fig. 1. Same-subject coregistered CT/MRI datasets of a human (Left), chimpanzee (Center), and gorilla (Right). Surface reconstructions of bony structures were derived from CT data, while volume renderings of brain segmentations were obtained from postprocessed MRI data. Delineations of some of the brain sulcal features used in the study are shown in blue.





In Chieti University Orthodontic Department more than 3000 head/neck bone/muscles TMD patients before after treatment 3D evolutionary oriented reconstructions





Could be useful to orientate in the space Androids?

WHY BRAIN CONNECTIVITY COULD BE USEFUL TO ROBOTICS?

This research could be useful in designing AI and Robotics to improve Healthcare?

frontiers in Neurology

ORIGINAL RESEARCH
published: 12 April 2021
doi: 10.3389/fneur.2021.629211

Functional Magnetic Resonance Connectivity in Patients With Temporomadibular Joint Disorders

Felice Festa[1], Chiara Rotelli[1], Antonio Scarano[2], Riccardo Navarra[3], Massimo Caulo[3] and Monica Macrì[1*]

[1] Department of Medical, Oral, and Biotechnological Sciences, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy, [2] Department of Medical, Oral, and Biotechnological Sciences and CeSI Met, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy, [3] Department of Clinical Sciences and Bio-Imaging, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy

Myofascial pain in the masticatory region, generally referred to as headache, is a common temporomandibular disorder (TMD) characterized by the hypersensitive regions of the contracted skeletal muscle fibers. A correct clinical treatment of myofascial pain has the potential to modify the functional activation of cerebral networks associated with pain and unconscious teeth clenching, specifically the pain network (PN) and default mode network (DMN). In this study, research is presented as a case series of five patients with myofascial pain: three were diagnosed with intra- and extra-articular disorders, and two were diagnosed with only extra-articular disorders. All five patients received gnathological therapy consisting of passive splints and biofeedback exercises for tongue–palatal vault coordination. Before and after treatment, patients underwent pain assessments (through measures of visual analog scales and muscular palpation tests), nuclear magnetic resonance of the temporomandibular joint, and functional nuclear magnetic resonance of the brain. In each patient, temporomandibular joint nuclear magnetic resonance results were similar before and after the gnathological treatment. However, the treatment resulted in a considerable reduction in pain for all patients, according to the visual analog scales and the palpation test. Furthermore, functional nuclear magnetic resonance of the brain clearly showed a homogeneous modification in cerebral networks associated with pain (i.e., PN and DMN), in all patients. In conclusion, gnathological therapy consisting of passive aligners and biofeedback exercises improved myofascial pain in all five patients. Most importantly, this study showed that all five patients had a homogeneous functional modification of pain and default mode networks. Using passive splints in combination with jaw exercises may be an effective treatment option for patients with TMD. This research could be a starting point for future investigations and for clinicians who want to approach similar situations.

Keywords: TMD, TMJ, teeth clenching, trigger points, fMRI, facial pain management, myofascial pain, headache

OPEN ACCESS

Edited by:
Teresa Lever,
University of Missouri, United States

Reviewed by:
Marco Carotenuto,
University of Campania Luigi Vanvitelli, Italy
Antonio Orlacchio,
Santa Lucia Foundation (IRCCS), Italy

*Correspondence:
Monica Macrì
m.macri@unich.it

Specialty section:
This article was submitted to Headache and Neurogenic Pain, a section of the journal Frontiers in Neurology

Received: 13 November 2020
Accepted: 01 March 2021
Published: 12 April 2021

Citation:
Festa F, Rotelli C, Scarano A, Navarra R, Caulo M and Macrì M (2021) Functional Magnetic Resonance Connectivity in Patients With Temporomadibular Joint Disorders. Front. Neurol. 12:629211. doi: 10.3389/fneur.2021.629211

Measurements

VAS

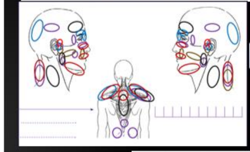
The pain intensity ratio was estimated by using a visual analog scale (VAS), which consisted of a graphic representation of the patient's face. The patient had to highlight painful areas, specifying the intensity (quantifying it with a value from 0 = No Pain to 10 = Maximum Pain) and frequency of the disturbance, and how it affected everyday life (5).

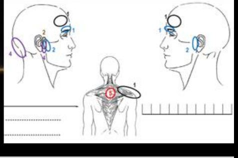
Palpation

Palpation of the temporal, masseter, sternocleidomastoid, digastric, and pterygoid muscles and TMJ was made bilaterally with constant pressure. It consisted of searching for trigger points in the masticatory muscles. Accordingly, these trigger points, once stimulated, tend to produce and provoke headaches through central excitatory effects.

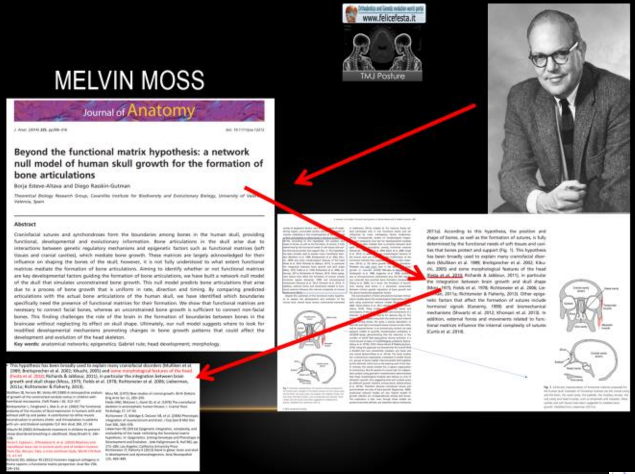
The sensations of pain were classified on a scale from 0 to 3:

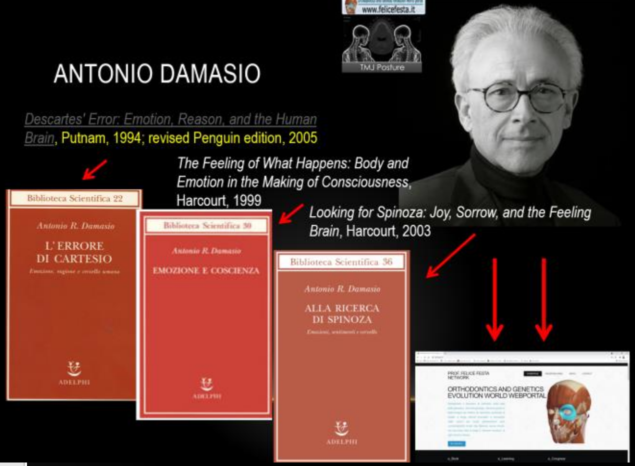
- 0: the absence of pain;
- 1: mild pain or apparent discomfort with muscle contraction;
- 2: moderate pain or discomfort with muscle contraction;
- 3: severe pain; the patient "draws back" or "drops in tears" (6).





- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM





HHS Public Access

Author manuscript

Am J Phys Anthropol. Author manuscript; available in PMC 2019 March 19.

Published in final edited form as:

Am J Phys Anthropol. 2019 January ; 168(Suppl 67): 27–46. doi:10.1002/ajpa.23766.

Craniofacial skeletal response to encephalization: How do we know what we think we know?

Kate M. Lesciotto and **Joan T. Richtsmeier**

Department of Anthropology, Pennsylvania State University, University Park, Pennsylvania

Abstract

Dramatic changes in cranial capacity have characterized human evolution. Important evolutionary hypotheses, such as the spatial packing hypothesis, assert that increases in relative brain size (encephalization) have caused alterations to the modern human skull, resulting in a suite of traits unique among extant primates, including a domed cranial vault, highly flexed cranial base, and retracted facial skeleton. Most prior studies have used fossil or comparative primate data to establish correlations between brain size and cranial form, but the mechanistic basis for how changes in brain size impact the overall shape of the skull resulting in these cranial traits remains obscure and has only rarely been investigated critically. We argue that understanding how changes in human skull morphology could have resulted from increased encephalization requires the direct testing of hypotheses relating to interaction of embryonic development of the bones of the skull and the brain. Fossil and comparative primate data have thoroughly described the patterns of association between brain size and skull morphology. Here we suggest complementing such existing datasets with experiments focused on mechanisms responsible for producing the observed patterns to more thoroughly understand the role of encephalization in shaping the modern human skull.

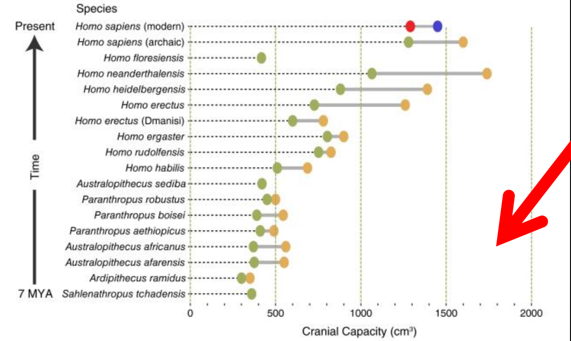


FIGURE 1.
Estimated cranial capacity across hominin species ordered by their estimated geological age. Red and blue circles: Average cranial capacity for female and male, respectively, modern *Homo sapiens*. Green and yellow circles: Minimum and maximum cranial capacity estimates for fossil hominins. Species showing only a green circle indicate that only a single cranial capacity estimate was available in the literature (de Sousa & Cunha, 2012; Elton, Bishop, & Wood, 2001; Holloway et al., 2004; Rightmire, 2004)

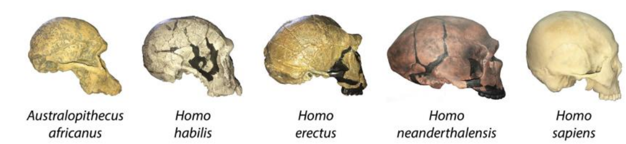


FIGURE 2.
Representative hominin fossils showing the progressive intensification of neurocranial globularity, facial retraction, and cranial base flexion with increased encephalization

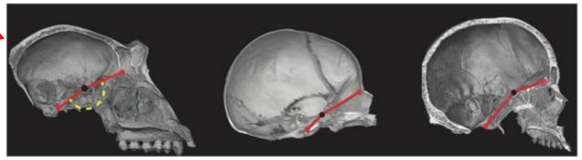
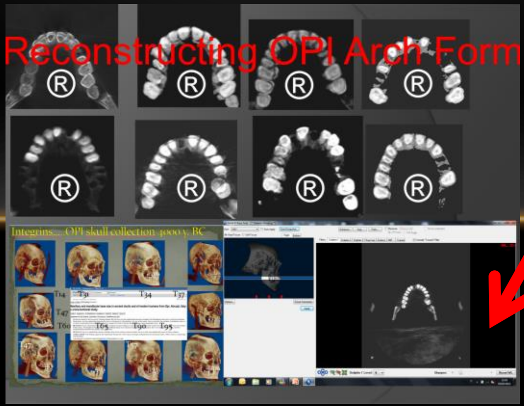


FIGURE 3.
Cranial base angle shown on a sagittal section of 3D reconstruction of adult gorilla (left), human neonate (center), and adult human (right). Though diverse measures have been proposed to estimate cranial base angle (solid red line), we show the angle constructed using the landmarks basion, sella, and foramen caecum, with sella as the vertex of the angle (black circle), with the angle measured on the ventral side (dotted yellow line)



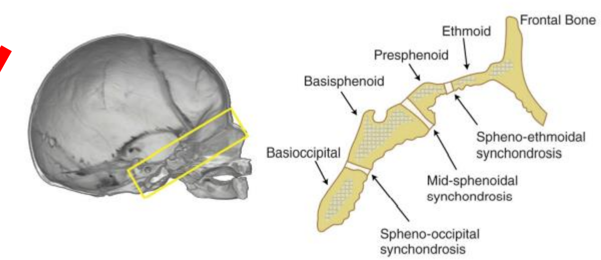
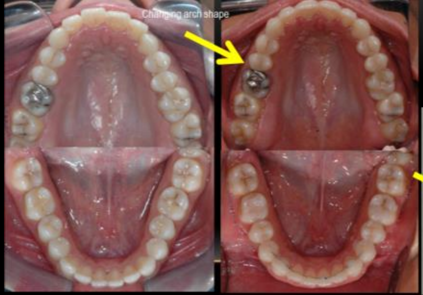
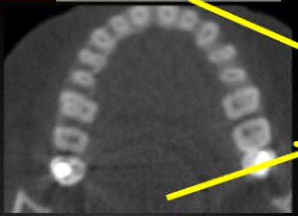


FIGURE 4.
3D reconstruction of computed tomography images of a human neonate (left) showing positioning of cranial base synchondroses (yellow box). Illustration of a sagittal section (right) of the human cranial base showing individual bones and synchondroses

An answer from human evolution

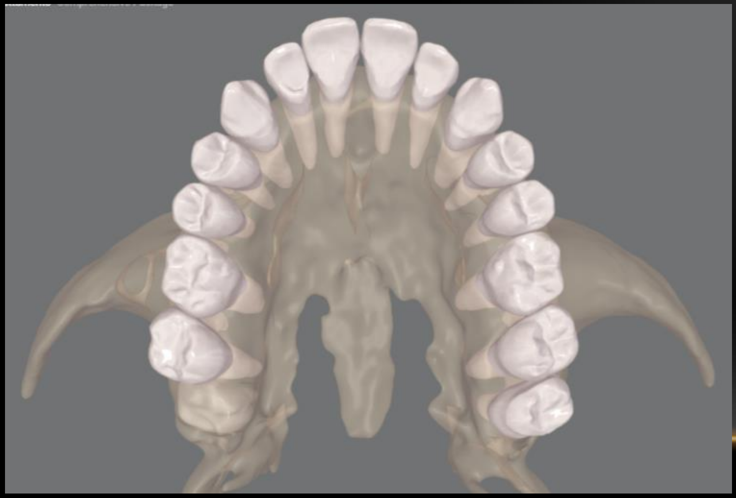


IN YELLOW POSITIVE PASSIVE MANDIBLE ADVANCEMENT

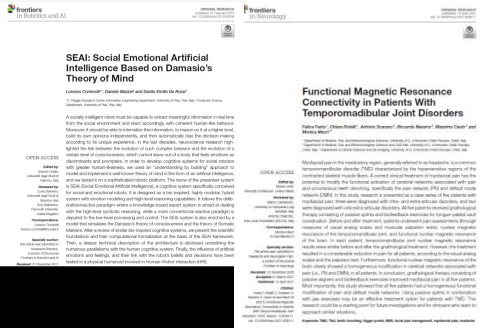


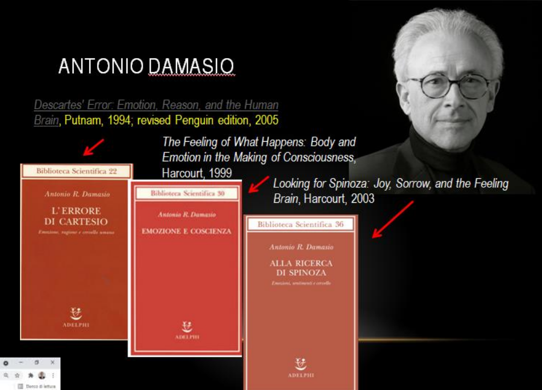
Straight-wire -- less gene adaptation

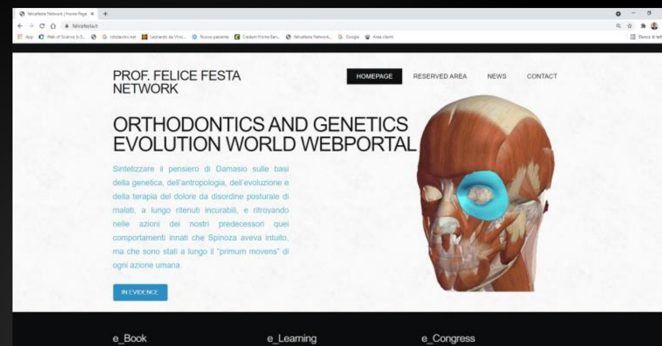
Self-ligating low friction/active aligners ++ better gene adaptation

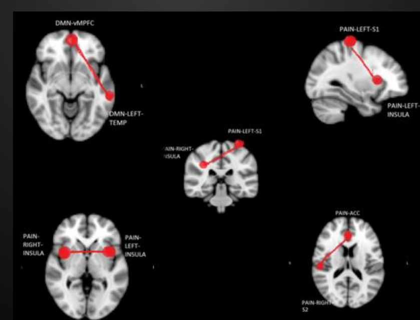


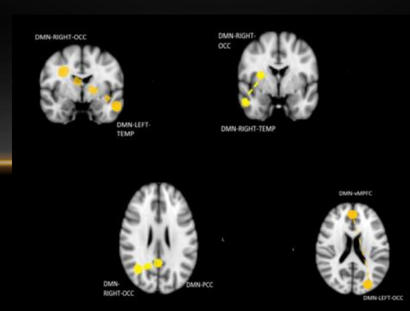
- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM











frontiers in Robotics and AI

ORIGINAL RESEARCH
published: 07 February 2018
doi: 10.3389/frobt.2018.00006

SEAI: Social Emotional Artificial Intelligence Based on Damasio's Theory of Mind

Lorenzo Cominelli[1]*, Daniele Mazzei[2] and Danilo Emilio De Rossi[1]

[1] E. Piaggio Research Center, Information Engineering Department, University of Pisa, Pisa, Italy, [2] Computer Science Department, University of Pisa, Pisa, Italy

A socially intelligent robot must be capable to extract meaningful information in real time from the social environment and react accordingly with coherent human-like behavior. Moreover, it should be able to internalize this information, to reason on it at a higher level, build its own opinions independently, and then automatically bias the decision-making according to its unique experience. In the last decades, neuroscience research highlighted the link between the evolution of such complex behavior and the evolution of a certain level of consciousness, which cannot leave out of a body that feels emotions as discriminants and prompters. In order to develop cognitive systems for social robotics with greater human-likeliness, we used an "understanding by building" approach to model and implement a well-known theory of mind in the form of an artificial intelligence, and we tested it on a sophisticated robotic platform. The name of the presented system is SEAI (Social Emotional Artificial Intelligence), a cognitive system specifically conceived for social and emotional robots. It is designed as a bio-inspired, highly modular, hybrid system with emotion modeling and high-level reasoning capabilities. It follows the deliberative/reactive paradigm where a knowledge-based expert system is aimed at dealing with the high-level symbolic reasoning, while a more conventional reactive paradigm is deputed to the low-level processing and control. The SEAI system is also enriched by a model that simulates the Damasio's theory of consciousness and the theory of Somatic Markers. After a review of similar bio-inspired cognitive systems, we present the scientific foundations and their computational formalization at the basis of the SEAI framework. Then, a deeper technical description of the architecture is disclosed underlining the numerous parallelisms with the human cognitive system. Finally, the influence of artificial emotions and feelings, and their link with the robot's beliefs and decisions have been tested in a physical humanoid involved in Human-Robot Interaction (HRI).

OPEN ACCESS

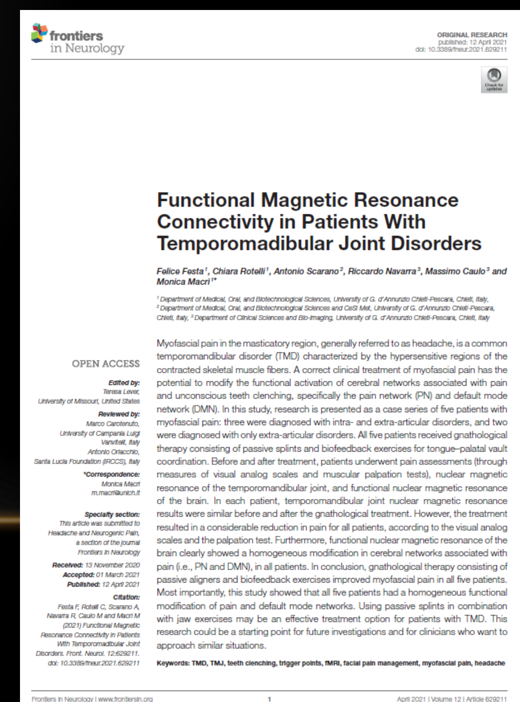
Edited by:
Antonio Chella,
Università degli Studi di Palermo, Italy

Reviewed by:
Luisa Damiano,
Università degli Studi di Messina, Italy
Tony Belpaeme,
Plymouth University, United Kingdom

***Correspondence:**
Lorenzo Cominelli
lorenzo.cominelli@for.unipi.it

Specialty section:
This article was submitted to Humanoid Robotics, a section of the journal Frontiers in Robotics and AI

Received: 21 November 2017



frontiers in Neurology

ORIGINAL RESEARCH
published: 12 April 2021
doi: 10.3389/fneur.2021.629211

Functional Magnetic Resonance Connectivity in Patients With Temporomadibular Joint Disorders

Felice Festa[1], Chiara Rotelli[1], Antonio Scarano[1], Riccardo Navarra[2], Massimo Caulo[2] and Monica Macrì[1]*

[1] Department of Medical, Oral, and Biotechnological Sciences, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy, [2] Department of Medical, Oral, and Biotechnological Sciences and CeSI Met, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy, [3] Department of Clinical Sciences and Bio-Imaging, University of G. d'Annunzio Chieti-Pescara, Chieti, Italy

Myofascial pain in the masticatory region, generally referred to as headache, is a common temporomandibular disorder (TMD) characterized by the hypersensitive regions of the contracted skeletal muscle fibers. A correct clinical treatment of myofascial pain has the potential to modify the functional activation of cerebral networks associated with pain and unconscious teeth clenching, specifically the pain network (PN) and default mode network (DMN). In this study, research is presented as a case series of five patients with myofascial pain: three were diagnosed with intra- and extra-articular disorders, and two were diagnosed with only extra-articular disorders. All five patients received gnathological therapy consisting of passive splints and biofeedback exercises for tongue-palatal vault coordination. Before and after treatment, patients underwent pain assessments (through measures of visual analog scales and muscular palpation tests), nuclear magnetic resonance of the temporomandibular joint, and functional nuclear magnetic resonance of the brain. In each patient, temporomandibular joint nuclear magnetic resonance results were similar before and after the gnathological treatment. However, the treatment resulted in a considerable reduction in pain for all patients, according to the visual analog scales and the palpation test. Furthermore, functional nuclear magnetic resonance of the brain clearly showed a homogeneous modification in cerebral networks associated with pain (i.e., PN and DMN), in all patients. In conclusion, gnathological therapy consisting of passive aligners and biofeedback exercises improved myofascial pain in all five patients. Most importantly, this study showed that all five patients had a homogeneous functional modification of pain and default mode networks. Using passive splints in combination with jaw exercises may be an effective treatment option for patients with TMD. This research could be a starting point for future investigations and for clinicians who want to approach similar situations.

Keywords: TMD, TMJ, teeth clenching, trigger points, fMRI, facial pain management, myofascial pain, headache

OPEN ACCESS

Edited by:
Teresa Lever,
University of Missouri, United States

Reviewed by:
Marco Carotenuto,
University of Campania Luigi Vanvitelli, Italy
Antonio Orlacchio,
Santa Lucia Foundation (IRCCS), Italy

***Correspondence:**
Monica Macrì
m.macri@unich.it

Specialty section:
This article was submitted to Headache and Neurogenic Pain, a section of the journal Frontiers in Neurology

Received: 13 November 2020
Accepted: 01 March 2021
Published: 12 April 2021

Citation:
Festa F, Rotelli C, Scarano A, Navarra R, Caulo M and Macrì M (2021) Functional Magnetic Resonance Connectivity in Patients With Temporomadibular Joint Disorders. Front. Neurol. 12:629211. doi: 10.3389/fneur.2021.629211

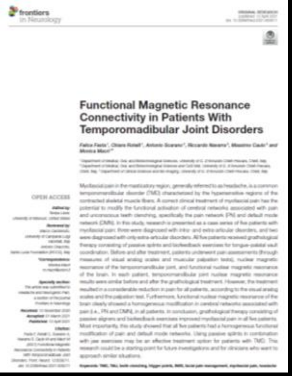
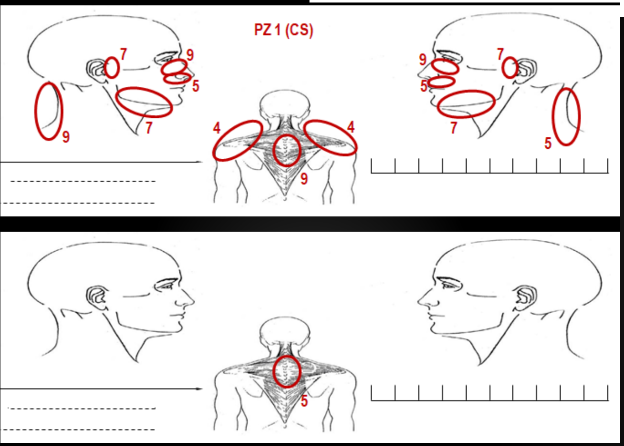
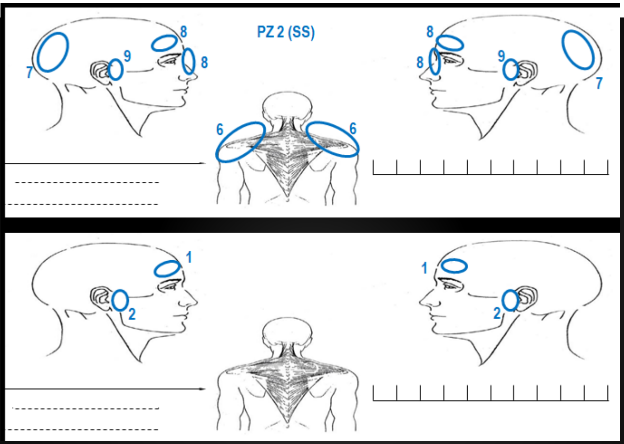
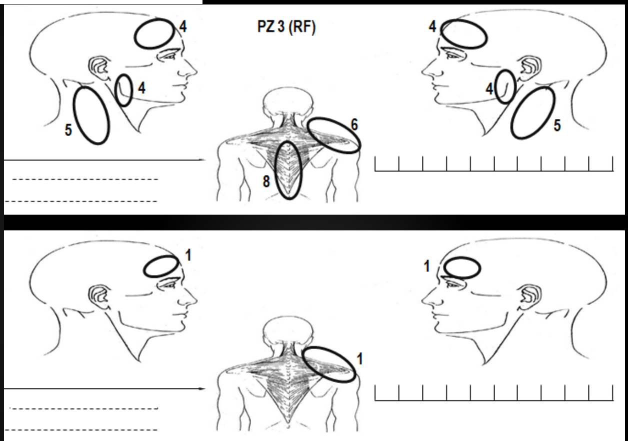


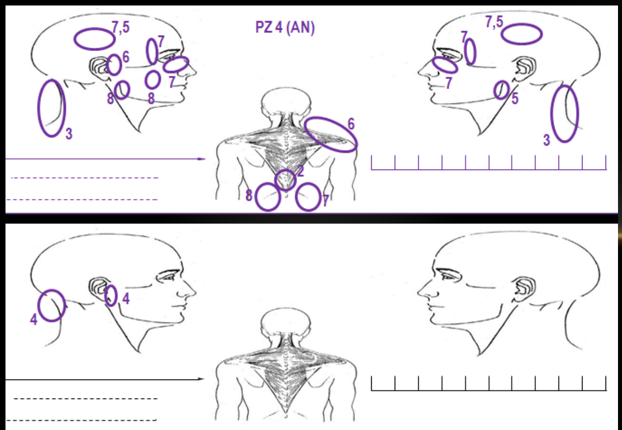
TABLE 1 | Clinical and demographical characteristics of the patients and the impact of the gnathological treatment.

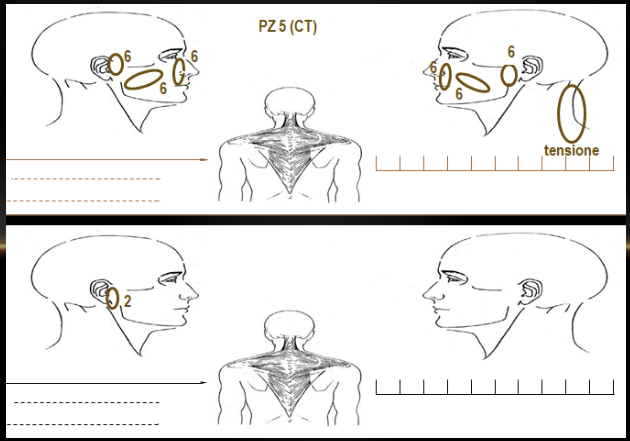
	Age	Gender	Kind of TMD	VAS at T1	VAS at T2	Painful areas at T1	Painful areas at T2	Duration of symptoms	Evolution of symptoms
PT1 (CS)	41	Female	Intra-articular	8	4	Neck, under eyes, shoulders, TMJ, mandible	Neck, shoulders	About 2 years	The symptoms worsened during this period
PT 2 (SS)	22	Female	Intra-articular	8	1	TMJ, around eyes, trapezoids	TMJ	About 1 year	The symptoms worsened during this period
PT 3 (RF)	26	Male	Extra-articular	5	1	Mandible, neck, lumbar area, head	Neck	About 2–3 years	Symptomatology remained constant during this period
PT 4 (AN)	41	Female	Intra-articular	7–8	4	Sinusitis-like symptoms, TMJ, neck, shoulders, pelvis	TMJ	About 15 years	The symptoms worsened during this period
PT 5 (CT)	55	Female	Extra-articular	6	0	Masseter, mandible, maxilla		About 5 years	The symptoms worsened during this period











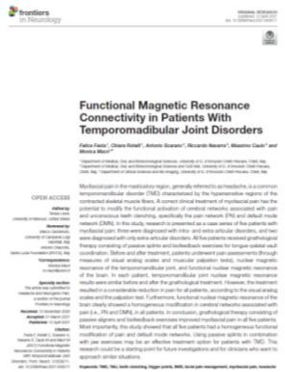


TABLE 2.1 | Masseter, temporal, and sternocleidomastoid palpation test after treatment compared with baseline.

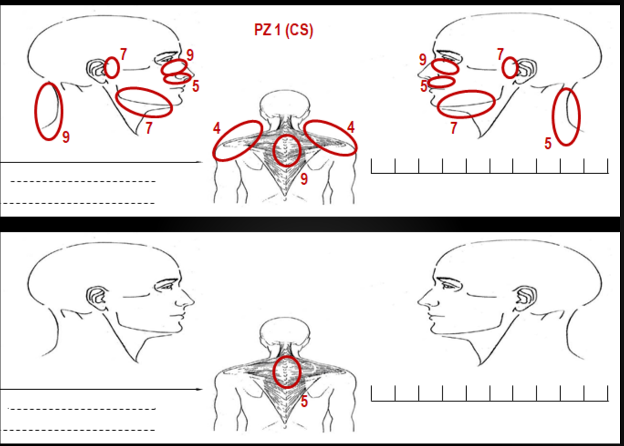
	Masseter palpation at T1	Masseter palpation at T2	Temporal palpation at T1	Temporal palpation at T2	Sternocleidomastoid palpation at T1	Sternocleidomastoid palpation at T2
PT 1 (CS)	3	1	2	1	3	1
PT 2 (SS)	3	1	3	1	3	0
PT 3 (RF)	2	0	2	0	3	1
PT 4 (AN)	3	2	2	0	3	1
PT 5 (CT)	2	0	2	1	2	0

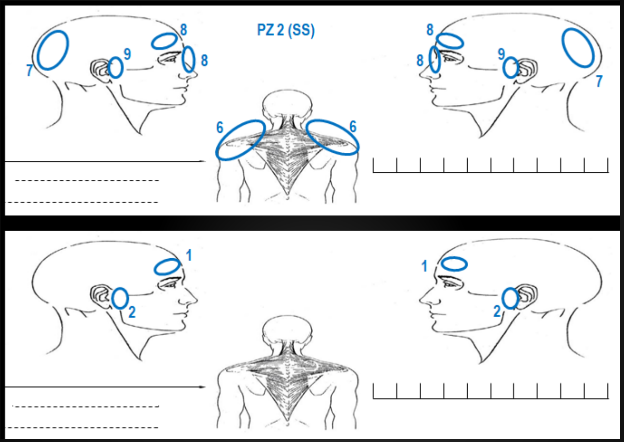
TABLE 2.2 | Digastric and pterygoid palpation test after treatment compared with baseline.

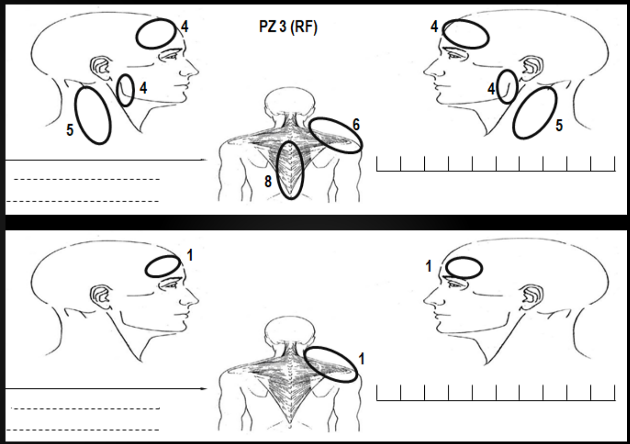
	Digastric palpation at T1	Digastric palpation at T2	Pterygoid palpation at T1	Pterygoid palpation at T2
PT 1 (CS)	1	0	3	1
PT 2 (SS)	2	0	3	0
PT 3 (RF)	2	0	3	1
PT 4 (AN)	0	0	3	2
PT 5 (CT)	1	0	2	0

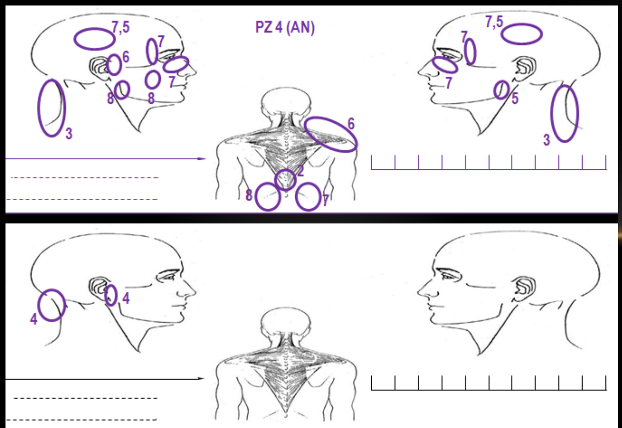
TABLE 3 | Average connectivity of the DMN and PN.

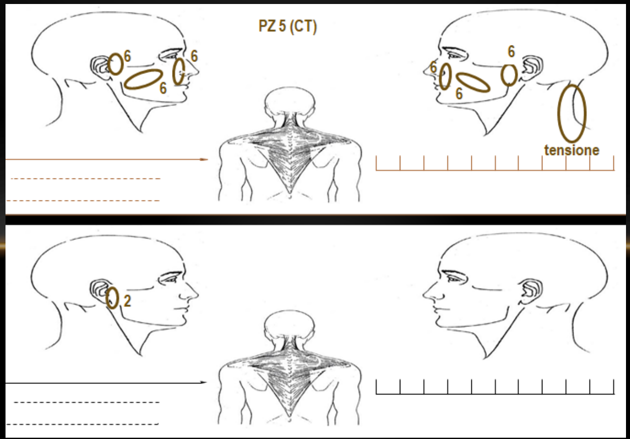
	DMN average connectivity: T2–T1	PN average connectivity: T2–T1
PT 1 (CS)	15.83	1.14
PT 2 (SS)	6.86	2.03
PT 3 (RF)	7.34	20.24
PT 4 (AN)	6.76	13.41
PT 5 (CT)	8.93	0.20

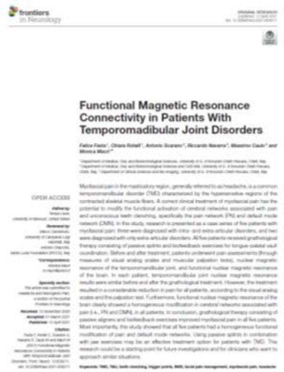












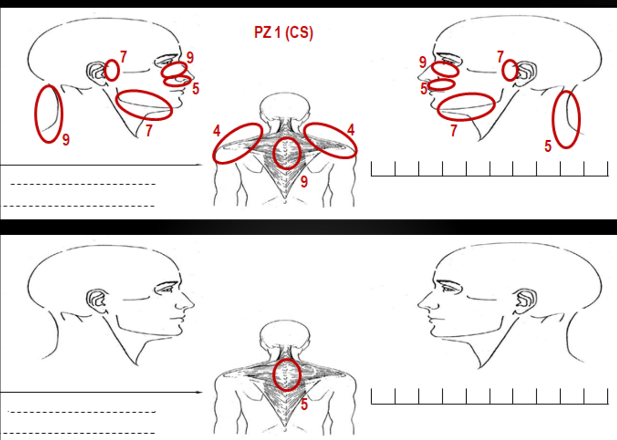
Functional Magnetic Resonance Connectivity in Patients With Temporomandibular Joint Disorders

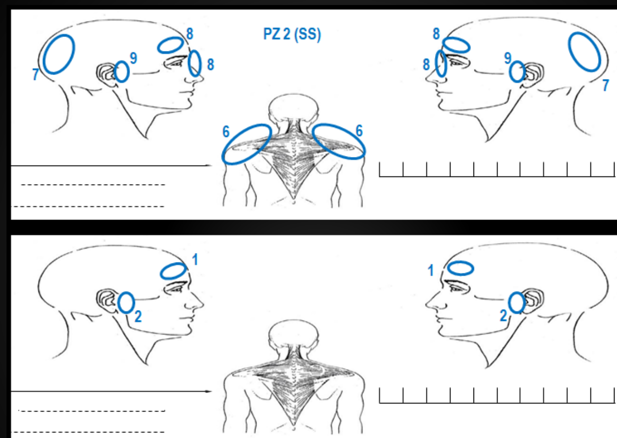
TABLE 2.2 | Digastric and pterygoid palpation test after treatment compared with baseline.

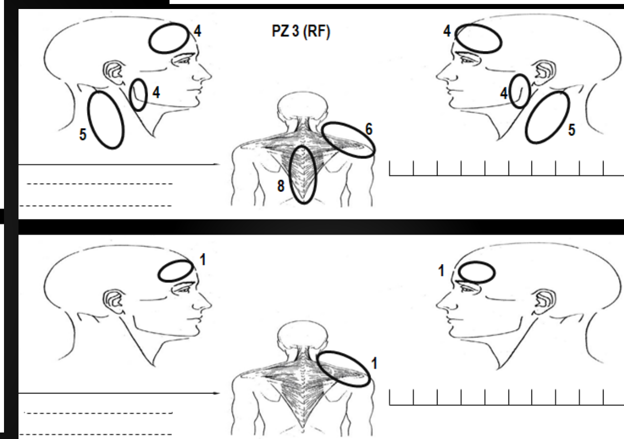
	Digastric palpation at T1	Digastric palpation at T2	Pterygoid palpation at T1	Pterygoid palpation at T2
PT 1 (CS)	1	0	3	1
PT 2 (SS)	2	0	3	0
PT 3 (RF)	2	0	3	1
PT 4 (AN)	0	0	3	2
PT 5 (CT)	1	0	2	0

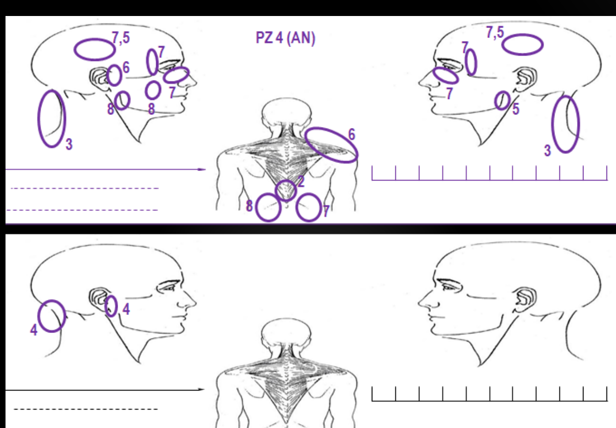
TABLE 3 | Average connectivity of the DMN and PN.

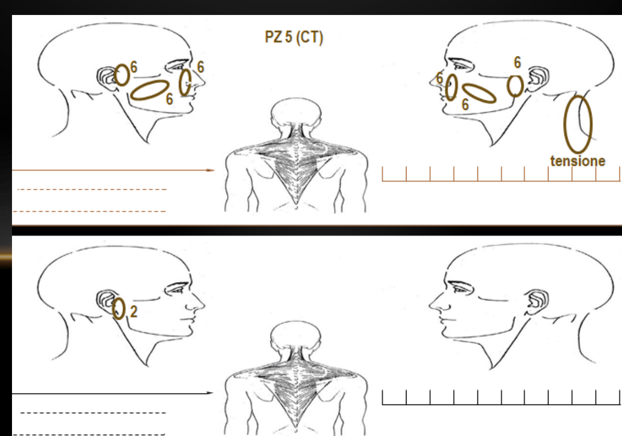
	DMN average connectivity: T2–T1	PN average connectivity: T2–T1
PT 1 (CS)	15.83	1.14
PT 2 (SS)	6.86	2.03
PT 3 (RF)	7.34	20.24
PT 4 (AN)	6.76	13.41
PT 5 (CT)	8.93	0.20

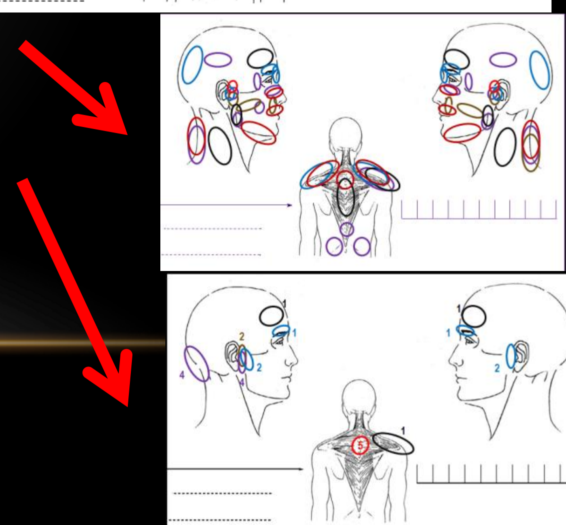




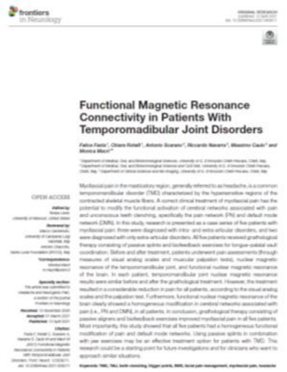




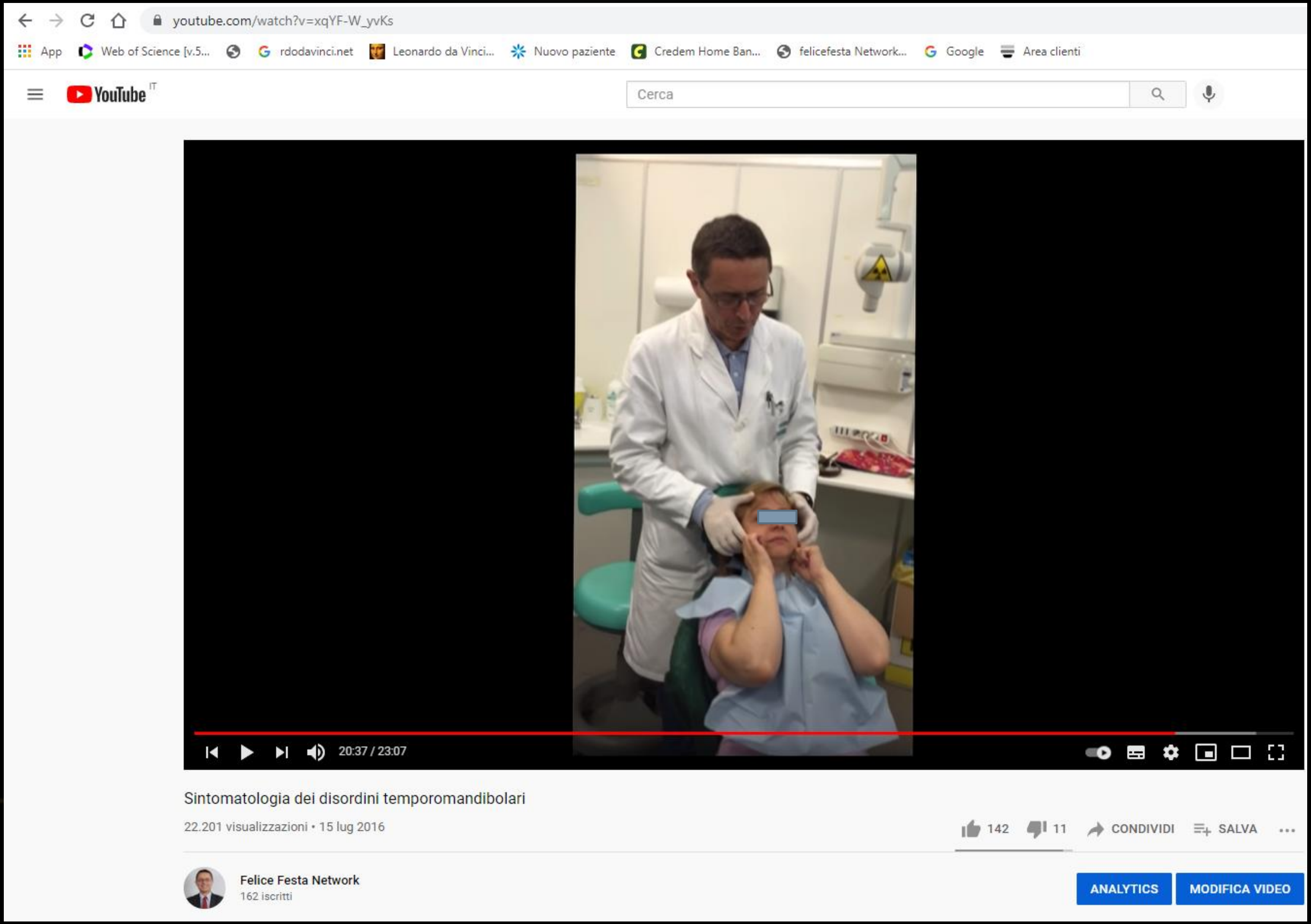




HTTPS://WWW.YOUTUBE.COM/WATCH?V=XQYF-W_YVKS&LIST=TLPQMJQWODIWMJEVSR1JTENRZQ&INDEX=1


frontiers in Neurology

Functional Magnetic Resonance Connectivity in Patients With Temporomandibular Joint Disorders



Treatment Protocol

Each patient received two passive splints made of hard polycarbonate that covers all the teeth without pre-established mandibular positions (13) (Figure 1). There was a lower passive aligner splint (LPAS) and an upper passive aligner splint (UPAS). The PAS was made of polycarbonate and was adjusted intraorally, as described by Sears, to avoid the impact of soft tissues. The LPAS was used during the daytime and the UPAS during the night.

FIGURE 1

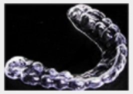


Figure 1. Passive splints made of hard polycarbonate with thickness not exceeding 0.7 mm.

While wearing the LPAS, patients performed a biofeedback exercise for 2 min, three times a day (prior to breakfast, lunch, and dinner), with a minimum of 3 h between each exercise, 7 days a week. Biofeedback exercises of the tongue serve to enhance patient awareness of the palatal arches' spatial positioning associated with jaw clenching so that patients can learn to stop or refrain from doing this maladaptive behavior.

During the exercise, patients assumed an upright position or reclined on a hard, flat surface, and were required to follow the accorded three steps:

1. In the first phase, the patient clenched their teeth to fully contract the masseter bilaterally. A light touch with the forefinger on the contracted masseter was applied during maximum contraction. The patient visualized the muscle's volume in a mirror as a swollen tennis ball for 5 s.
2. In the second phase, the patient clenched their teeth to partially contract (~50%) the masseter bilaterally; a light touch with the forefinger was applied during the contraction force, which is about halfway. The patient visualized the muscle's volume in a mirror as a semi-deflated tennis ball for 5 s.
3. In the third phase, the patient was instructed to fully relax their jaw by opening it ~1 mm and applying a light touch with the forefinger on the utterly relaxed masseter. The patient visualized the muscle's volume in a mirror as a completely deflated tennis ball for 5 s.
4. In the fourth phase, the patient touched the tip of the tongue on the top of the palatine vault, approximately between the palatine wrinkles and the flat palate for 5 s.

Then, the patient removed the LPAS for breakfast.

The same exercise was repeated before lunch and before dinner with the LPAS inserted. Biofeedback was timed to occur immediately prior to meals because masseter activation during meals typically causes pain levels to worsen.

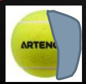
The treatment lasted ~3 months. In the 6 months follow-up, a new assessment was made using the VAS and palpation test of temporal, masseter, sternocleidomastoid, digastric, pterygoid muscles, and TMJ MRI, and fMRI of the brain was repeated to evaluate the treatment effect.

Throughout the entire study duration, every patient continued to record in their diaries the extent and intensity of their pain during headaches and treatment sessions/compliance.

3

1

2

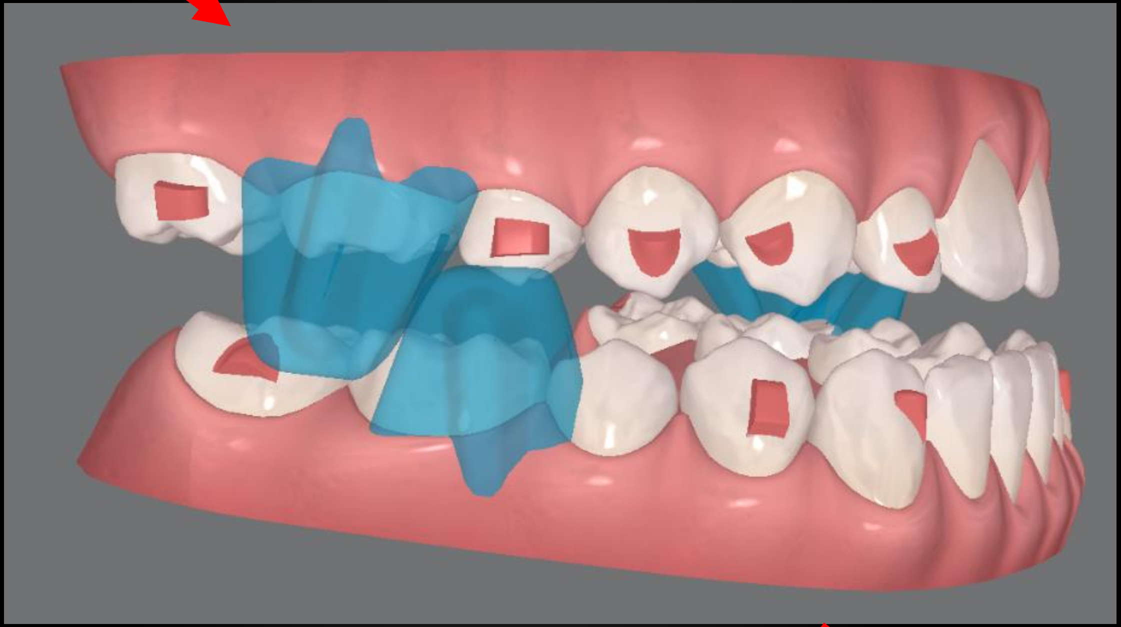


4

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

Orthodontics and Genetic evolution world portal
www.felicefesta.it
TMJ Posture

- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all'interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM



- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all’interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM

http://www.editorialmanager.com/scs/default.a | (1) journal craniofacial surgery ... | Information for Authors : Jour... | Editorial Manager®

Cerca | Facebook | Ascolta musica | YouTube | 20° Rome, Italy | Corriere della Sera | La Gazzetta dello Sport | Giochi | Opzioni

THE JOURNAL OF CRANIOFACIAL SURGERY

Editorial Manager®

HOME • LOG OUT • HELP • REGISTER • UPDATE MY INFORMATION • JOURNAL OVERVIEW
MAIN MENU • CONTACT US • SUBMIT A MANUSCRIPT • INSTRUCTIONS FOR AUTHORS

Role: Author Username: ffesta

Submissions with an Editorial Office Decision for Author Felice Festa, Ph.D., M.D.

Page: 1 of 1 (2 total completed submissions) Display 10 results per page.

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status	Date Final Disposition Set	Final Disposition
Action Links	SCS-10-312	Upper airway volume after Le Fort III advancement in craniofacial malformated subjects.	Apr 28, 2010	Aug 17, 2010	Completed	Aug 17, 2010	Accept
Action Links	SCS-11-45	Orbital volume and surface after Le Fort III advancement in syndromic craniosynostosis Short Title: Orbital volume volume and Le Fort III	Dec 17, 2010	Jan 31, 2012	Completed	Jan 31, 2012	Accept

Page: 1 of 1 (2 total completed submissions) Display 10 results per page.

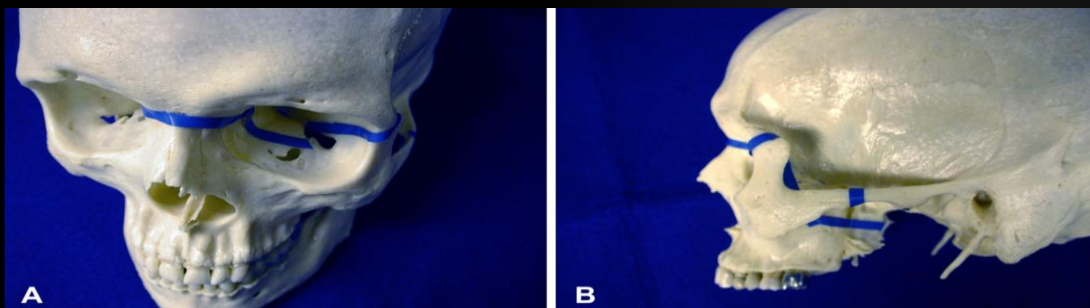
Journal of Craniofacial Surgery

Orbital volume and surface after Le Fort III advancement in syndromic craniosynostosis Short Title: Orbital volume volume and Le Fort III

--Manuscript Draft--

Manuscript Number:	SCS-11-45R3
Full Title:	Orbital volume and surface after Le Fort III advancement in syndromic craniosynostosis Short Title: Orbital volume volume and Le Fort III
Short Title:	Orbital volume and le Fort III
Article Type:	Original Article
Keywords:	syndromic synostosis, orbital volume, midface advancement, distraction osteogenesis, Le Fort III osteotomy
Corresponding Author:	Felice Festa, Ph.D., M.D. Chieti-Pescara "G. d'Annunzio" University Chieti Scalo, Chieti ITALY
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	Chieti-Pescara "G. d'Annunzio" University
Corresponding Author's Secondary Institution:	
First Author:	Felice Festa, Ph.D., M.D.

UPPER THIRD FACE SURGICAL ADVANCEMENT LE FORT III



- Subperiosteal undermining allows exposure of the fronto-nasal and fronto-malar sutures
- The osteotomy line is then performed between these sutures, along the lateral wall of the orbit, reaching the inferior orbital fissure.
- The osteotomy line continues along the medial orbital wall behind the naso-lacrymal canal .
- The zygomatic body and arch are also interrupted medially or laterally, depending upon the preoperative planning .
- The osteotomy is then completed with the pterigo-maxillary disjunction.
- The mobilization of the maxillo-facial skeleton is achieved with the use of the Rowe disimpaction forceps.

Thanks to prof. G. Iannetti for the surgical part of the study

Crouzon and Apert cases Surgery performed from Prof. G. Iannetti, Director Department of Maxillofacial Surgery “La Sapienza” University Rome ITALY

The original technique was characterized by a one-stage acute midface advancement, but it presented a limiting factor determined by the muscular and soft-tissue resistance. In order to overcome these limits, recently, a midface advancement with distraction osteogenesis has been proposed.

Thanks to prof. G. Iannetti for the surgical part of the study

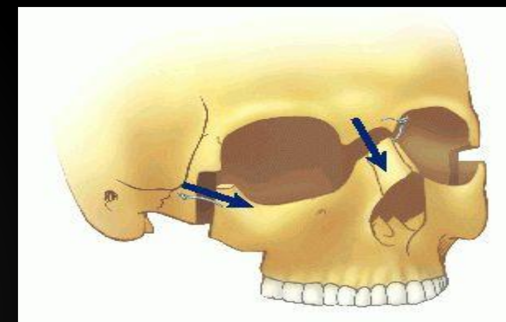
The Rigid External Distractor (RED) is applied. The halo-type external fixation device of the RED is secured to the calvaria and connected, through anchored-bars, with plates at the inferior orbital rim and at the pyramidal apophysis of the upper maxilla, bilaterally.

Traction is initiated at a rate of 0.5 mm twice a day to achieve the desired advancement in the sagittal and vertical plane. After the distraction process is completed, a 2-3 months consolidation phase is required. After advancing the midface for at least 20 mm the occlusion was corrected from class III in class II with overcorrection in all patients

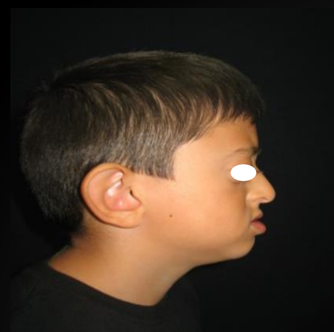
Thanks to prof. G. Iannetti for the surgical part of the study

EXPERIMENTAL PROTOCOL

- The subjects were limited to those treated only with Le Fort III midface advancement, and all operations were performed by the same operator (Prof. G. Iannetti).
- The pre-operative (T0) and post-operative (T1: 6 months after surgery) 3D craniofacial CT scans of the subjects were collected and retrospectively analyzed.
- The airway space volume and orbital volume before and after treatment were analyzed and compared; also the airway surfaces and orbital surfaces on the axial, coronal, and sagittal CT scans were calculated and compared.
- Informed consent had been obtained from all subjects.



Patient affected by Crouzon syndrome pre-treatment photo


Patient affected by Crouzon syndrome post-treatment photo



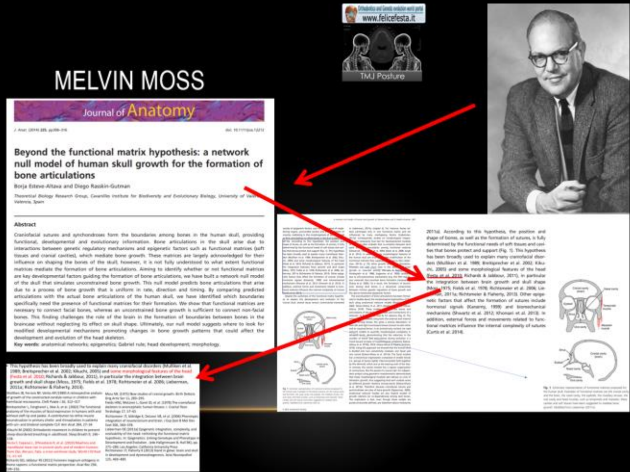
Patient affected by Apert syndrome pre-treatment photo

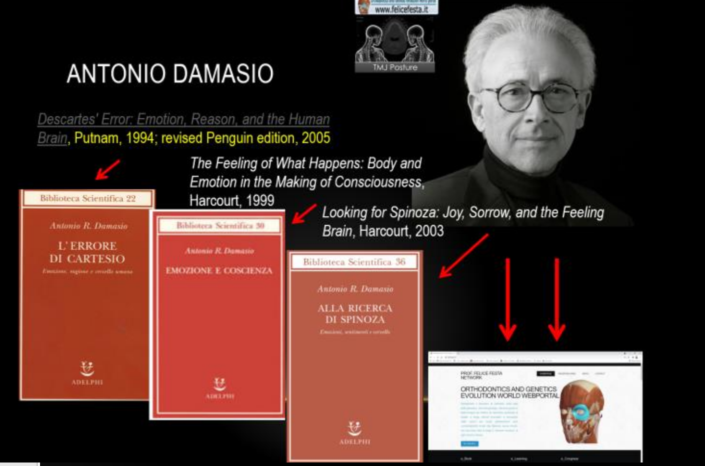


Patient affected by Apert syndrome post-treatment photo



- Linee Guida Misurazione e Disfunzioni Postura
- Protocollo CBCT low-dose
- Posizione radici all’interno delle corticali su base evolutiva/Correlazione cranio-colonna vertebrale
  AI (Intelligenza Artificiale)/ Robotica del Volto
  Teoria delle Matrici Funzionali
  Casi Clinici (Avanzamento mascellare, mandibolare)
  Interrelazioni tra Evoluzione Craniofacciale, Ortodonzia e DTM





HHS Public Access

Author manuscript

Am J Phys Anthropol. Author manuscript; available in PMC 2019 March 19.

Published in final edited form as:

Am J Phys Anthropol. 2019 January ; 168(Suppl 67): 27–46. doi:10.1002/ajpa.23766.

Craniofacial skeletal response to encephalization: How do we know what we think we know?

Kate M. Lesciotto and **Joan T. Richtsmeier**

Department of Anthropology, Pennsylvania State University, University Park, Pennsylvania

Abstract

Dramatic changes in cranial capacity have characterized human evolution. Important evolutionary hypotheses, such as the spatial packing hypothesis, assert that increases in relative brain size (encephalization) have caused alterations to the modern human skull, resulting in a suite of traits unique among extant primates, including a domed cranial vault, highly flexed cranial base, and retracted facial skeleton. Most prior studies have used fossil or comparative primate data to establish correlations between brain size and cranial form, but the mechanistic basis for how changes in brain size impact the overall shape of the skull resulting in these cranial traits remains obscure and has only rarely been investigated critically. We argue that understanding how changes in human skull morphology could have resulted from increased encephalization requires the direct testing of hypotheses relating to interaction of embryonic development of the bones of the skull and the brain. Fossil and comparative primate data have thoroughly described the patterns of association between brain size and skull morphology. Here we suggest complementing such existing datasets with experiments focused on mechanisms responsible for producing the observed patterns to more thoroughly understand the role of encephalization in shaping the modern human skull.

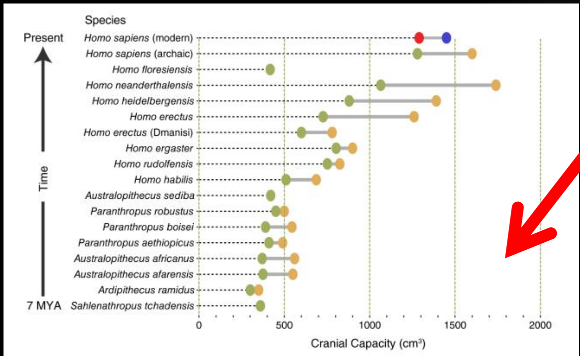


FIGURE 1.

Estimated cranial capacity across hominin species ordered by their estimated geological age. Red and blue circles: Average cranial capacity for female and male, respectively, modern *Homo sapiens*. Green and yellow circles: Minimum and maximum cranial capacity estimates for fossil hominins. Species showing only a green circle indicate that only a single cranial capacity estimate was available in the literature (de Sousa & Cunha, 2012; Elton, Bishop, & Wood, 2001; Holloway et al., 2004; Rightmire, 2004)

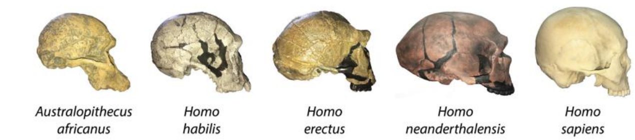


FIGURE 2.

Representative hominin fossils showing the progressive intensification of neurocranial globularity, facial retraction, and cranial base flexion with increased encephalization

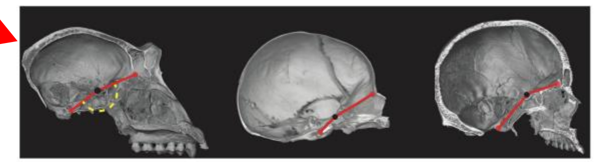
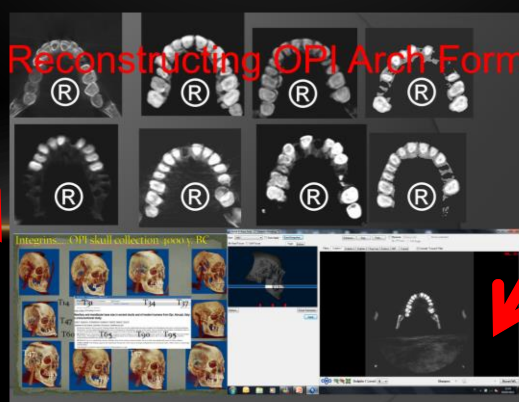


FIGURE 3.

Cranial base angle shown on a sagittal section of 3D reconstruction of adult gorilla (left), human neonate (center), and adult human (right). Though diverse measures have been proposed to estimate cranial base angle (solid red line), we show the angle constructed using the landmarks basion, sella, and foramen caecum, with sella as the vertex of the angle (black circle), with the angle measured on the ventral side (dotted yellow line)



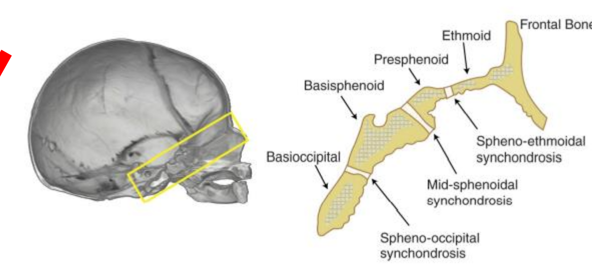
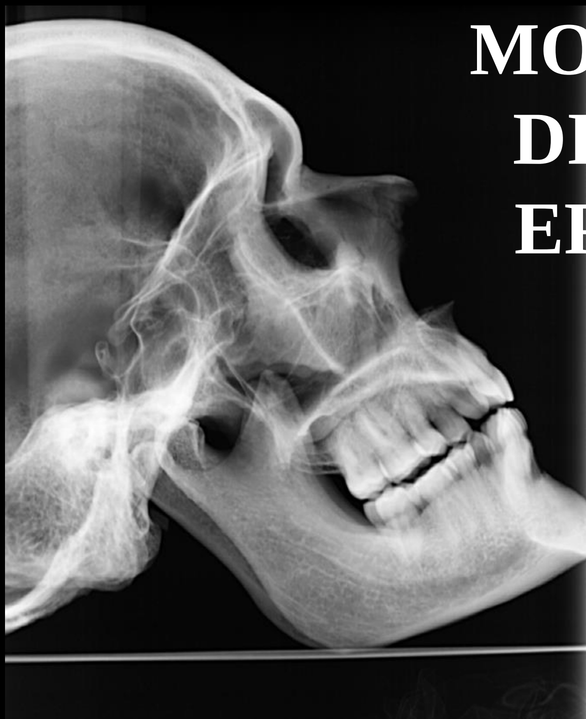


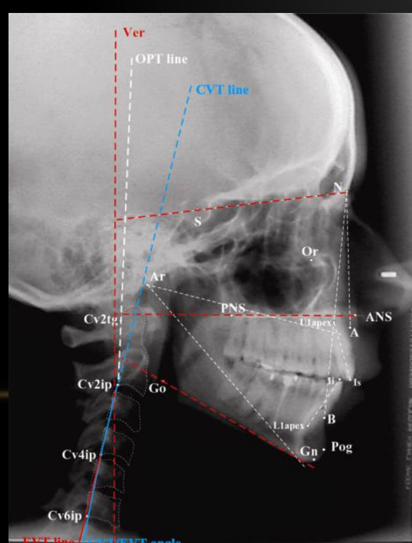
FIGURE 4.

3D reconstruction of computed tomography images of a human neonate (left) showing positioning of cranial base synchondroses (yellow box). Illustration of a sagittal section (right) of the human cranial base showing individual bones and synchondroses

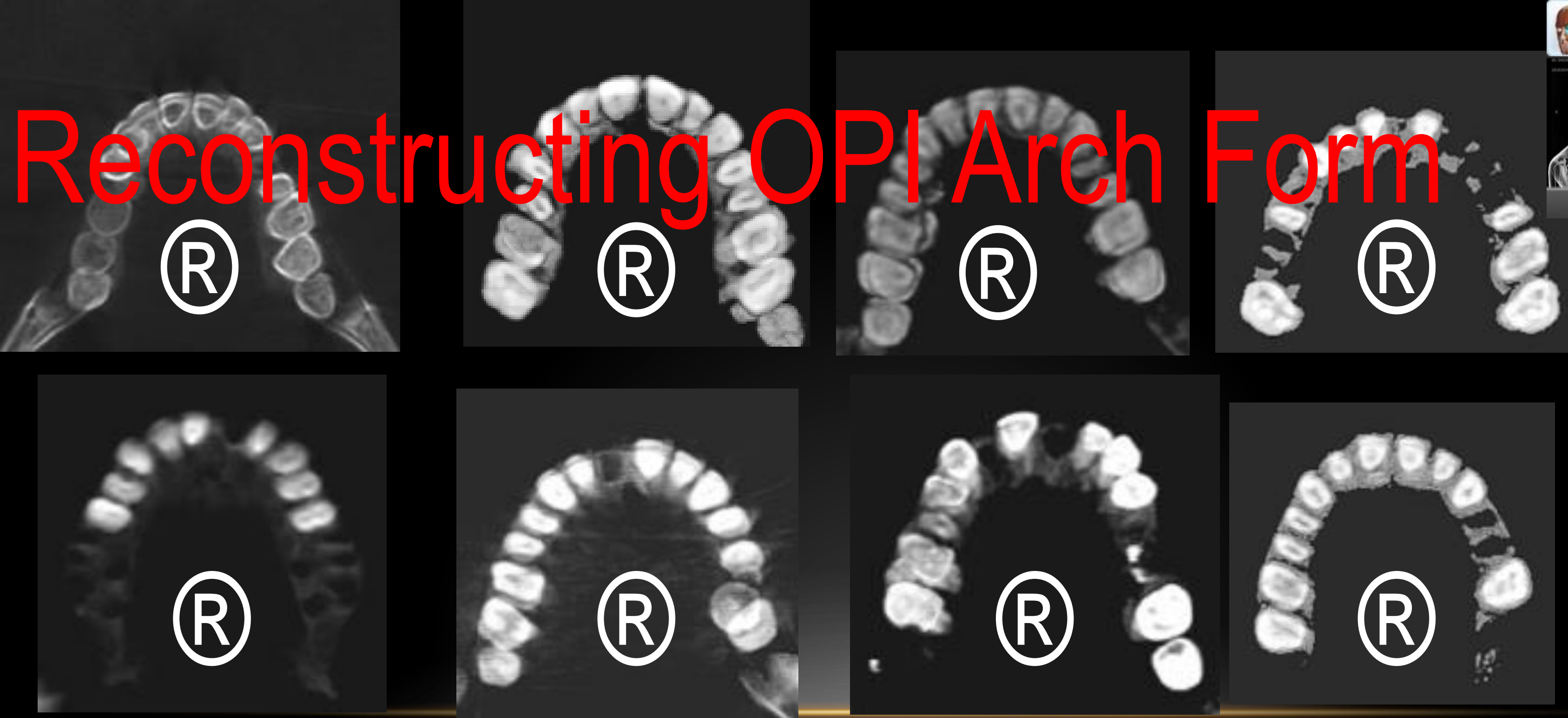
COMPARAZIONE DELLA MORFOLOGIA DELLA FACCIA DI SOGGETTI NELLE VARIE EPOCHE E UOMO ATTUALE

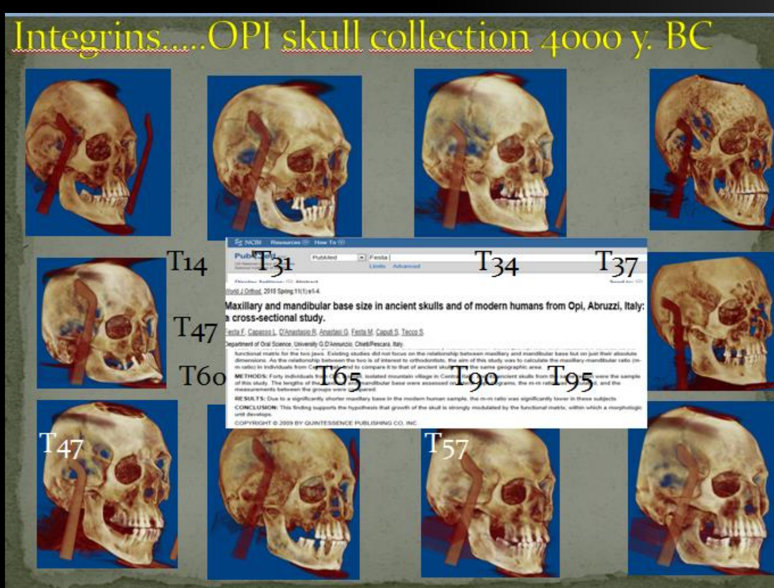


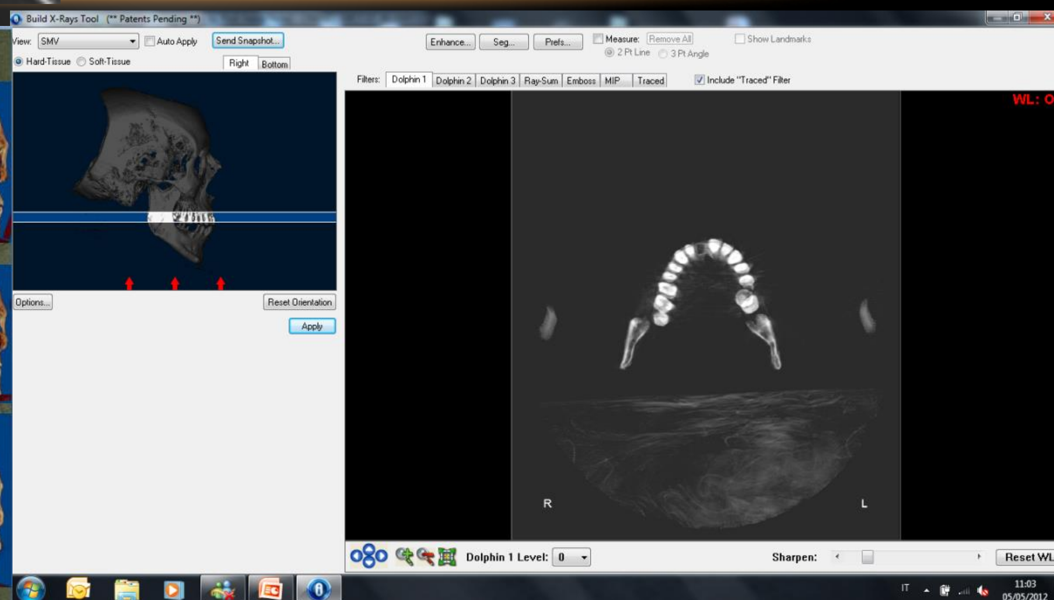
POPOLAZIONE DI OPI, 2000 a.C.

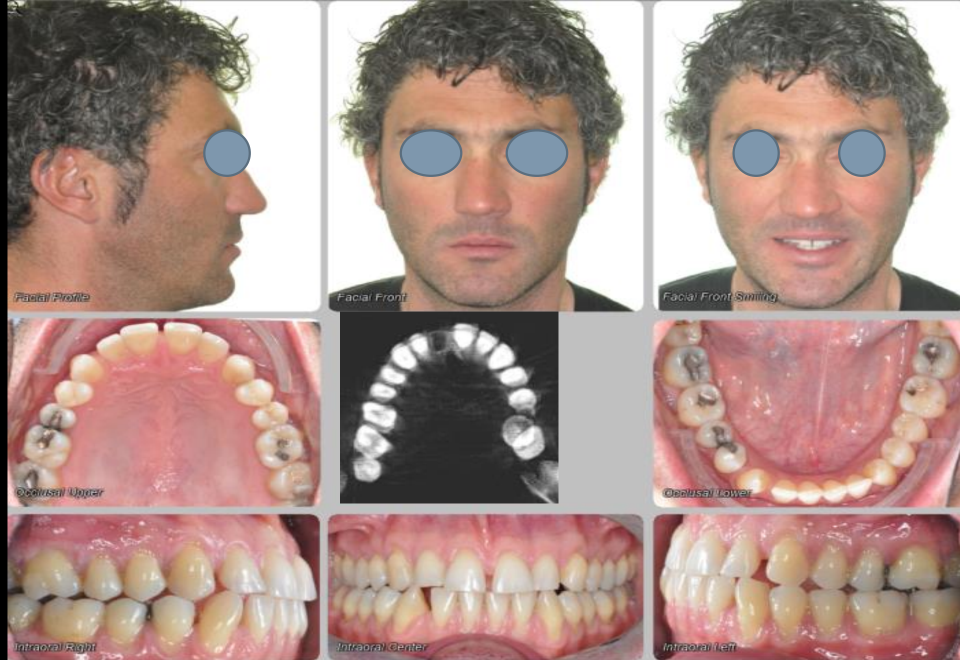


Reconstructing OPI Arch Form

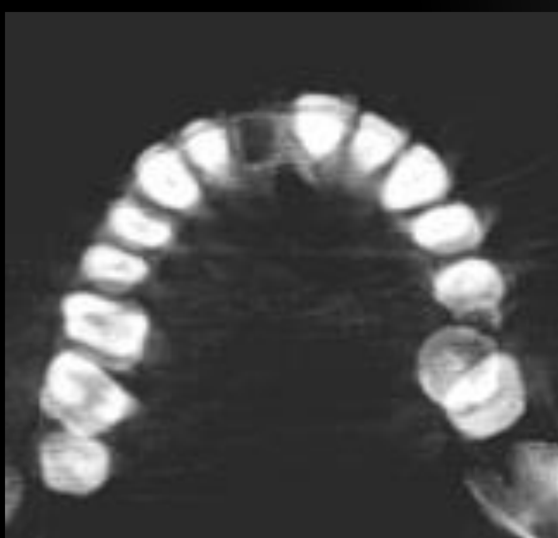


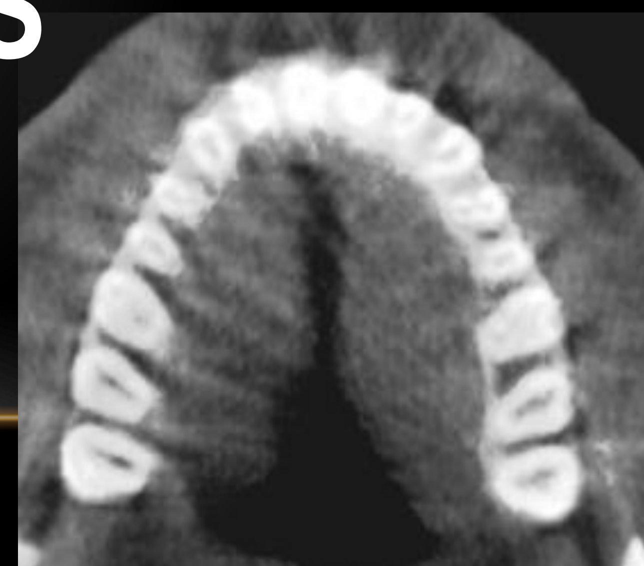





Facial Profile
Facial Front
Facial Front Smiling
Occlusal Upper
Occlusal Lower
Intraoral Right
Intraoral Center
Intraoral Left

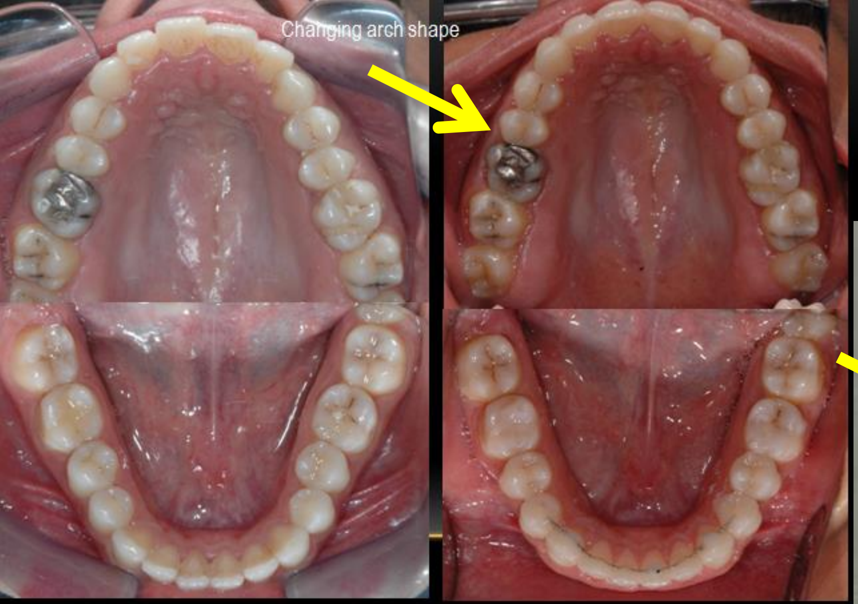
4000 YEARS

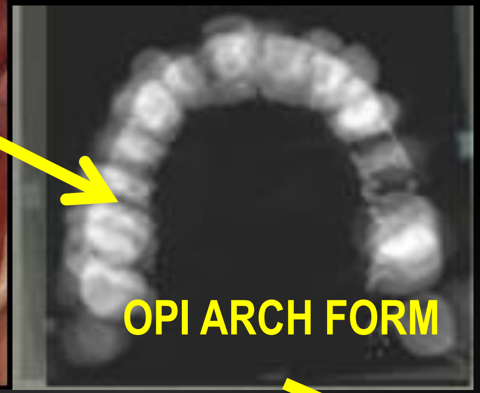




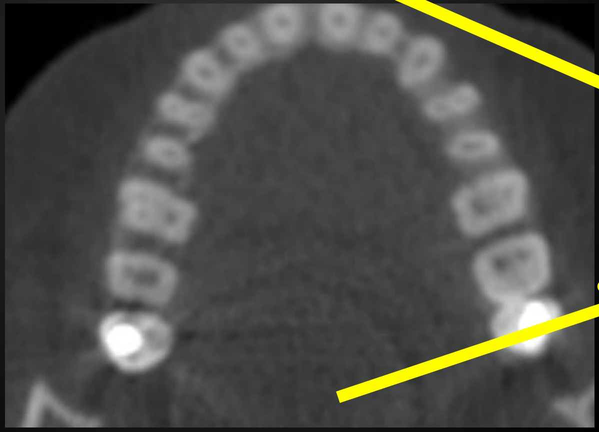
Orthodontics and Genetic evolution world portal
www.felicefesta.it
TMJ Posture

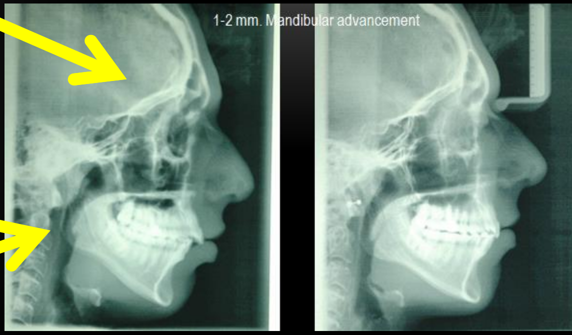
An answer from human evolution





IN YELLOW POSITIVE PASSIVE MANDIBLE ADVANCEMENT

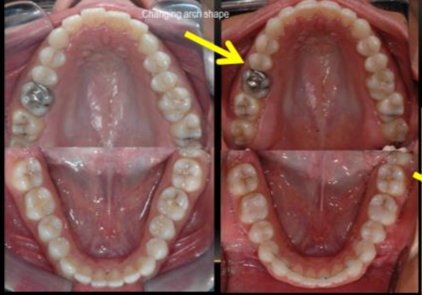




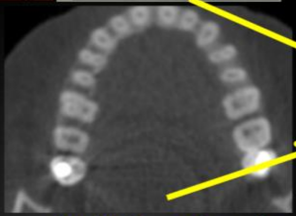
Self-ligating low friction/active aligners ++ better gene adaptation

Straight-wire -- less gene adaptation

An answer from human evolution

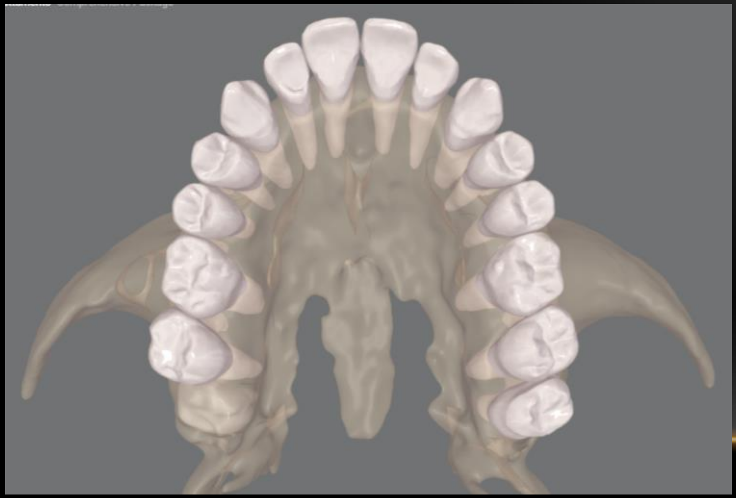


IN YELLOW POSITIVE PASSIVE MANDIBLE ADVANCEMENT



Straight-wire -- less gene adaptation

Self-ligating low friction/active aligners ++ better gene adaptation



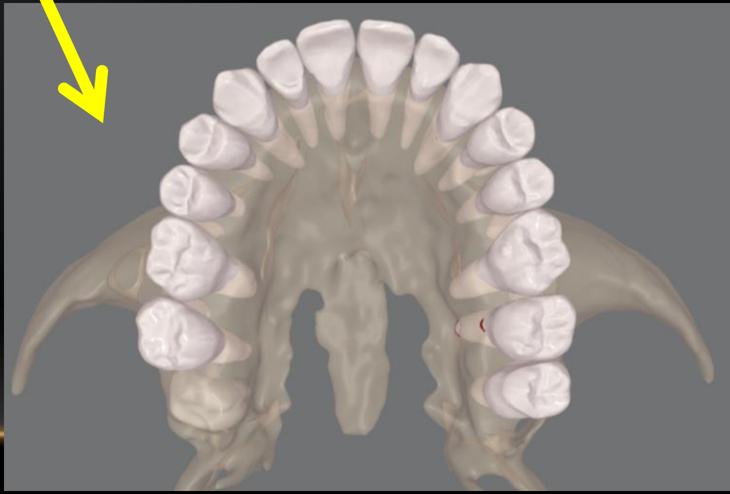


Fig. 7.
Rodent-robot interaction using the PiRat robot. Adapted from [77] with permission.