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IZVORNI ZNANSTVENI RAD
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Ponovljivost određivanja centrične relacije kod pacijenata s dislokacijom diska s redukcijom

Reproducibility of the Obtained Centric Relation Records in Patients with Disc Displacement with Reduction

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Sažetak

Uvod: Svrha ovoga istraživanja bila je procijeniti ponovljivost položaja centrične relacije kod pacijenata s dislokacijom diska s redukcijom. **Materijali i metode:** U ispitnoj skupini bilo je 30 ispitanika s utvrđenom dislokacijom diska s redukcijom u desnom i lijevom zglobu ili u oba. Kontrolna skupina sastojala se od 12 sudionika bez znakova i simptoma temporomandibularnih poremećaja. Koristeći se metodom vođenja brade s prednjim deprogramatorom, učinjena su tri registrata centrične relacije za svakog ispitanika i to tijekom jednog posjeta. Elektroničkim ultrazvučnim mjernim uređajem snimljen je položaj lijevoga i desnoga kondila kod svakog dobivenog registrata centrične relacije. Podatci su analizirani računalom. Izmjerena je udaljenost kondila dobivena kod različitih registrata centrične relacije (anteroposteriorne, vertikalne, transverzalne i linearne vrijednosti) te su podatci statistički analizirani t i F testom. **Rezultati:** Nije utvrđena statistički značajna razlika između ispitne i kontrolne skupine. Kod dvije trećine ispitanika kondilni je položaj tijekom ponavljanja određivanja centrične relacije bio unutar promjera od 0,3 milimetra. Za više od 90 posto ispitanika to je područje bilo unutar 0,4 milimetra. **Zaključak:** Ne postoji razlika u ponovljivosti centrične relacije između pacijenata s dislokacijom diska s redukcijom i onih sa zdravim temporomandibularnim zglobom ($p > 0,05$). Kada se radi registrat centrične relacije na pacijentu s dislokacijom diska s redukcijom, prije toga nije potrebna terapija udlagom, dovoljne su standardne mjere opreza. Dobiveni rezultati moraju se interpretirati unutar ispitne skupine, bez povezivanja s drugim skupinama temporomandibularnih poremećaja.

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Ključne riječi
čeljusni zglob, disk; centrična relacija; kondil donje čeljusti; vertikalna dimenzija; zubna okluzija, centrična

Uvod

Položaj centrične relacije osnovni je referentni položaj donje čeljusti pri pregledu i terapiji u stomatološkoj protetici. *The glossary of prosthodontic terms* (1) nudi sedam različitih definicija centrične relacije, što upućuje na kontroverznost tog položaja. Posljednja definicija u tom priručniku definira centričnu relaciju kao odnos donje i gornje čeljusti kada su kondili u kontaktu s najtanjim avaskularnim dijelom zglobne pločice, te je cijeli kompleks u anterosuperiornom položaju u odnosu na zglobnu kvržicu (1).

Temporomandibularni poremećaji i dalje su jedna od kontroverznih tema u stomatologiji (2). Iako se centrična relacija smatra pouzdanim i ponovljivim položajem (3), u istraživanjima je ustanovljena smanjena ponovljivost mandibularnih kretnji kod pacijenata s temporomandibularnim poremećajima u odnosu na kontrolnu skupinu (4 – 6). U

Introduction

Centric relation is a basic mandibular reference position for evaluation and treatment in prosthetic dentistry. The Glossary of Prosthodontic Terms (1) offers seven different definitions of centric relation, which points to some controversies regarding the position. The last definition of the Glossary defines centric relation as the maxillomandibular relationship in which the condyles articulate with the thinnest avascular portion of their respective discs with the complex in the anterior-superior position against the shapes of articular eminencies (1).

Temporomandibular disorders still represent one of the most controversial topics in dentistry (2). Although centric relation is considered a reliable and reproducible position (3), studies showed lower reproducibility of mandibular movements in patients with temporomandibular disorders com-

skladu s tim očekuje se da će pacijenti s temporomandibularnim poremećajima pokazati smanjenu ponovljivost određivanja centrične relacije. U nekoliko studija (7, 8) u kojima se proučavala ponovljivost centrične relacije kod pacijenata s temporomandibularnim poremećajima to se nije uspjelo potvrditi.

Dislokacija diska jedan je od najčešćih temporomandibularnih poremećaja, s prevalencijom između 18 i 35 posto u općoj populaciji (9). U slučaju dislokacije diska s redukcijom disk je smješten anteriorno ako su usta zatvorena i vraća se u normalan položaj tijekom njihova otvaranja (10). Koliko je autorima poznato, nije provedeno mnogo istraživanja o ponovljivosti određivanja centrične relacije kad je riječ o pacijentima s dislokacijom diska s redukcijom. Naime, u većini tih studija uključena je dislokacija diska s redukcijom zajedno s drugim oblicima temporomandibularnih poremećaja unutar jedne eksperimentalne skupine (5, 7, 8).

Svrha ovog istraživanja *in vivo* bila je procijeniti ponovljivost položaja centrične relacije u slučaju pacijenata s dislokacijom diska s redukcijom, usporedbom s kontrolnom skupinom ispitanika bez znakova i simptoma temporomandibularnih poremećaja.

Materijali i metode

Ispitanici

U ispitnoj skupini bilo je 30 ispitanika (24,0 ± 3,9 godina) s dislokacijom diska s redukcijom u desnom, lijevom ili u oba temporomandibularna zgloba. Dislokacija diska s redukcijom potvrđena je prema protokolu *Research Diagnostic Criteria for Temporomandibular Disorders* (11). Osim toga problema ispitanici u ispitnoj skupini nisu imali druge znakove i simptome temporomandibularnih poremećaja (TMD-a). U ispitnoj skupini je 18 sudionika imalo dislokaciju diska s redukcijom na jednoj strani (12 u lijevom, 6 u desnom zglobu), a njih 12 obostranu. Kontrolna skupina sastojala se od 12 ispitanika (26,0 ± 3,8 godina) bez znakova i simptoma TMD-a. Svaki ispitanik morao je potpisati informirani pristanak koji je odobrilo Etičko povjerenstvo Stomatološkog fakulteta Sveučilišta u Zagrebu.

Mjerenja

Za mjerenje položaja kondila korišten je ultrazvučni uređaj za snimanje kretnji donje čeljusti (ArcusDigma II, Kavo, Biberach, Njemačka). Preciznost metode potvrđena je u ranijim istraživanjima (12). Uređaji za snimanje kretnji donje čeljusti daju podatke o položaju kondila u realnom vremenu te se uobičajeno upotrebljavaju u istraživanjima anatomije i funkcije temporomandibularnog zgloba (13, 14). Obrez i Gallo (15) ustvrdili su da se tek nakon razvoja mjernih uređaja temeljenih na konceptu šest stupnjeva slobode (matematička pretvorba podataka) omogućilo razmjerno precizno određivanje kretnji kondila.

Najprije su tijekom prvog posjeta uzeti alginatni otisci (Aroma Fine Plus, GC, Tokio, Japan) svakom ispitaniku. Zatim je za svakoga izrađena paraokluzijska žlica od svjetlosnopolimerizirajućeg akrilata (Unitray, Polident, Volčja Draga,

pared to the control group (4-6). Accordingly, it is expected that patients with temporomandibular dysfunctions demonstrate lower reproducibility of the centric relation record. Yet, a small number of studies (7, 8) that investigated reproducibility of the centric relation in patients with temporomandibular disorders failed to confirm it.

Disc displacement is one of the most frequent temporomandibular disorders, with reported prevalence ranging from 18% to 35% in general population (9). In disc displacement with reduction the disc is anteriorly displaced in the closed mouth position and reverts to a normal superior position during opening (10). To the authors' knowledge there were not many studies about centric relation reproducibility in subjects with disc displacement with reduction. Most of the reported studies combined disc displacement with reduction together with other temporomandibular disorders (5, 7, 8) within one experimental group.

The aim of this study was to investigate reproducibility of centric relation position in patients with disc displacement with reduction, compared to a control group of subjects with no signs and symptoms of temporomandibular disorders.

Material and methods

Subjects

The test group included 30 participants (24.0 ± 3.9 years), with disc displacement with reduction in right, left or both temporomandibular joints. Disc displacement with reduction was confirmed according to the Research Diagnostic Criteria for Temporomandibular Disorders (11) protocol. Apart from disc displacement with reduction, the participants in test group had no other signs and symptoms of temporomandibular disorders (TMD). 18 participants in the test group had monolateral disc displacement (12 in left joint, 6 in right joint), while 12 participants had bilateral disc displacement. The control group included 12 subjects (26.0 ± 3.8 years) with no signs and symptoms of the TMD. Each subject had to give written informed consent, which was approved by the Ethics Committee of the School of Dental Medicine, University of Zagreb, Croatia.

Procedure

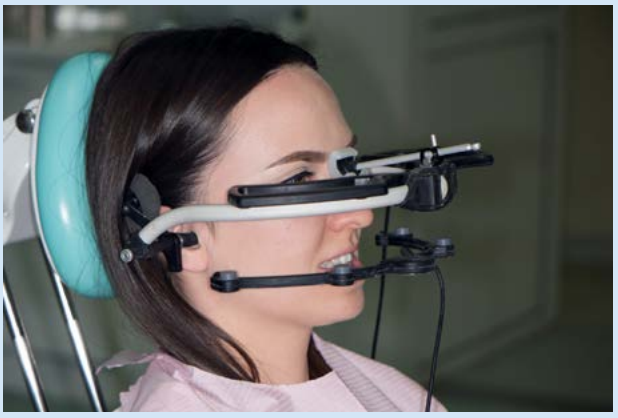
The apparatus which integrates the ultrasonic sensor and computer technology (ArcusDigma II, Kavo, Biberach, Germany) was used for recording of condylar distances. The accuracy of the method has been confirmed in previous publications (12). Mandibular movement recording instruments provide information on condylar position in real time period, and are standardly used for investigation of temporomandibular joint anatomy and function (13, 14). Obrez and Gallo (15) reported that assessment of condylar position with relative precision has been possible since the development of a three-dimensional device for mandibular recording with six degrees of freedom (mathematical transformation).

First, alginate impressions (Aroma Fine Plus, GC, Tokyo, Japan) were made for each subject at first visit. Afterwards a mandibular clutch was made from light-polymerizing acrylics

Slovenija). U drugom posjetu svakom su ispitaniku učinjena tri registrata centrične relacije metodom vođenja brade (16) koristeći se termoplastičnom kompozicijskom masom (Bite Compound, GC, Tokio, Japan) (slika 1.). Registrati centrične relacije napravljeni su s pomoću triju različitih akrilatnih nosača (s prednjim deprogramatorima). Sva tri registrata centrične relacije odredio je isti operater. Nakon određivanja centrične relacije (tri puta), korišten je elektronički ultrazvučni mjerni uređaj za mjerenje prostornog položaja lijevog i desnog kondila u položaju registrirane centrične relacije (slika 2.). Svaki ispitanik sjedio je udobno na stolcu (uspravna postura). Paraokluzijska žlica pričvršćena je na vestibularnu stranu donjega zubnog niza, a koristio se materijal za izradu privremenih nadomjestaka (Structur, Voco, Cuxhaven, Njemačka). Nije bila u kontaktu s gornjim zubima u maksimalnoj interkuspidaciji ni tijekom lateralnih kretnji donje čeljusti, te je bila čvrsto pričvršćena na donji zubni niz. Nakon pričvršćivanja paraokluzijske žlice, svaki registrat centrične relacije (slika 3.) vraćen je u usta kako bi se provjerilo je li paraokluzijska žlica bila u doticaju s registratom. Ako jest, bukalne impresije registrata centrične relacije skraćene su skalpelom. Montiran je gornji luk elektroničkoga ultrazvučnog mjernog uređaja. Usporedba kondilarnih položaja s registratima centrične relacije rađena je u modulu *Electronic Position Analysis*, prema uputama proizvođača. Taj modul računa udaljenost mjerenog položaja lijevoga i desnoga kondila prema njihovu korištenom referentnom položaju. Korišteni referentni položaj bio je položaj pri jednom od triju korištenih centričnih registrata (nasumično izabran) zbog jednostavno-

(Unitray, Polident, Volčja Draga, Slovenia) for each subject. At the second visit, a centric relation record was made three times per every participant with thermoplastic registration material (Bite Compound, GC, Tokyo, Japan) using a chin point guidance with a jig method (16) (Figure 1). Centric relation records were recorded for three times using three different jigs. All three centric relation records were done by the same operator. After the recording of centric relation position for three times, an electronic ultrasonic mandibular recording instrument was used for measuring spatial position of the left and the right condyles at recorded centric relation (Figure 2). Each subject sat comfortably in a dental chair (upright posture). The mandibular clutch was fixed on the buccal side of mandibular teeth with acrylics for provisional restoration (Structur, Voco, Cuxhaven, Germany). It was not in touch with the maxillary teeth in the maximum intercuspation or at lateral movements, and it was firmly fixed on mandibular teeth. After fixation of the mandibular clutch, every centric relation record (Figure 3) was repositioned in the mouth to check if the paraocclusal tray was in contact with centric relation record. If there was contact, buccal impressions of centric relation record registration material were shortened with a scalpel. Upper bow of the ultrasonic measuring device was mounted. A comparison of condylar position of centric relation records was made using module "Electronic Position Analysis", as recommended by the manufacturer. The module "Electronic Position Analysis" measures distance of the measured position of the left and right condyles in relation to selected reference position of the condyles. The selected refer-

Slika 1. Određivanje položaja centrične relacije pomoću akrilatnog nosača s prednjim deprogramatorom i metode vođenja brade.
Figure 1 Registration of the centric relation position using a bite plate with a jig and a chin point guidance method.



Slika 2. Ultrazvučni uređaj za snimanje kretnji donje čeljusti na temelju šest stupnjeva slobode
Figure 2 Ultrasonic mandibular recording instrument with six degrees of freedom.

Slika 3. Registrat centrične relacije
Figure 3 The obtained centric relation record.

sti i preciznosti. Nakon registriranja referentnog položaja svaki centrični registrat vraćen je u usta kako bi se snimio položaj kondila. Softverskim uređajem (Kavo Integrated Desktop, Kavo, Biberach, Njemačka) izmjerena je udaljenost između registrata centrične relacije (na kondilarnoj razini). S pomoću opcije unutar softvera *Copy points,* izmjerene udaljenosti prebačene su u Microsoft Excel® (Microsoft Corporation, Redmond, SAD). Referentni položaj bio je nulti položaj Kartezijeva koordinatnog sustava te je kondilarna udaljenost između različitih registrata centrične relacije prikazana na tri osi – anteroposteriornoj (x), vertikalnoj (y) i transverzalnoj (z). Nakon što je izmjerena kondilarna udaljenost različitih registrata centrične relacije prema referentnom položaju, izračunate su kondilarne udaljenosti između samih centričnih registrata – između prvoga i drugoga, prvoga i trećega te između drugoga i trećega registrata. Udaljenosti su izračunate na razini lijevoga i desnoga kondila u anteroposteriornom, vertikalnom i transverzalnom smjeru. Nakon što su izračunate kondilarne udaljenosti između različitih registrata centrične relacije unutar Kartezijeva koordinatnog sustava, izračunate su i linearne. To je učinjeno za lijevi i desni kondil između različitih registrata centrične relacije. Za svakog ispitanika dobivena je srednja vrijednost udaljenosti između različitih registrata centrične relacije za lijevi i desni kondil i ona je korištena za statističku analizu. Podatci su statistički analizirani testovima t i F (Statsoft, Tulsa, SAD).

Rezultati

U tablici 1. su rezultati t testa između eksperimentalne i kontrolne skupine za dobivene kondilarne udaljenosti između različitih registrata centrične relacije. Pritom je minimalna udaljenost za anteroposteriornu, vertikalnu i transverzalnu os iznosila je 0 milimetara, a maksimalna 0,47 milimetara i za eksperimentalnu i za kontrolnu skupinu. Minimalna linearna udaljenost između različitih registrata centrične relacije iznosila je 0,07 milimetara za eksperimentalnu skupinu i 0,13 milimetara za kontrolnu. Maksimalna linearna udaljenost bila je 0,70 milimetara za eksperimentalnu i 0,51 mili-

ence position was mandibular position of randomly selected centric relation record, due to simplicity and precision. After the reference position had been recorded, every centric relation record was repositioned in the mouth, and the position of the condyles was recorded. Deviations between different centric relation records were measured (at condylar level) with software of the instrument (Kavo Integrated Desktop, Kavo, Biberach, Germany). Measured positions were copied to Microsoft Excel®, (Microsoft Corporation, Redmond, USA) using the option in the software "Copy points". The reference position was representing zero point of the Cartesian coordinate system and condylar deviations of different centric relation records to the zero point were measured in three axis; anteroposterior (x), superoinferior (y), and lateral (z). After the condylar deviations of different centric relation records to the zero point had been measured, condylar distances between different centric relation records were calculated; between first and second, first and third, and second and third centric relation record. The distances were calculated for the left and the right joint in anteroposterior, superoinferior and transversal direction. After the condylar distances between different centric relation records had been calculated in the Cartesian coordinate system, linear values were also calculated. The linear values were calculated for the left and the right condyle between different centric relation records. For each participant, mean value of distances between different centric relation records was calculated for the left and the right condyle, and used for statistical evaluation. The data were analyzed statistically using the t and the F test (Statsoft, Tulsa, USA).

Results

Table 1 shows the results of the t test between the experimental and control groups for obtained condylar distances between different centric relation records. The minimal distance between different centric relation records for the anteroposterior, vertical and transversal axis was 0 mm, while maximal distance was 0.47 mm for both, the experimental and control group. The minimal linear distance between different centric relation records was 0.07 mm for the experimental group and 0.13 mm for the control group. The maximal linear distance was 0.70 mm for the experimental group

Tablica 1. Rezultati t testa između eksperimentalne (E) i kontrolne (C) skupine za utvrđene razlike između različitih registrata centrične relacije (mm); $p < 0,05$.
Table 1 Results of the t test between experimental (E) and control (C) group for obtained distances between different centric relation records (mm); $p<0.05$.

Varijabla • Variable	$\bar{X}_E$ (mm)	$\bar{X}_C$ (mm)	SD_E	SD_C	p
XL	0.10	0.11	0.10	0.07	0.86
YL	0.16	0.21	0.10	0.11	0.12
ZL	0.08	0.11	0.07	0.06	0.31
XR	0.10	0.11	0.09	0.07	0.81
YR	0.17	0.14	0.10	0.09	0.39
ZR	0.08	0.11	0.07	0.06	0.36
LL	0.24	0.29	0.13	0.09	0.20
LR	0.26	0.25	0.12	0.09	0.85

* X – anteroposteriorni smjer • anteroposterior direction; Y – vertikalni smjer • vertical direction ; Z – transverzalni smjer • transversal direction; L – lijevi kondil • left condyle; R – desni kondil • right condyle; LL – linearna udaljenost za lijevi kondil • linear distance for the left condyle; LR – linearna udaljenost za desni kondil • linear distance for the right condyle

metar za kontrolnu skupinu. T test između lijeve strane za ispitanike s dislokacijom diska s redukcijom i lijeve strane onih sa zdravim temporomandibularnim zglobom te t test između desne strane za ispitanike s dislokacijom diska s redukcijom i desne strane ispitanika sa zdravim temporomandibularnim zglobom, nije utvrdio statistički značajnu razliku dobivenih udaljenosti između različitih registrata centrične relacije. Tablica 2. prikazuje rezultate F testa između svih zglobova s dislokacijom diska s redukcijom i svih zglobova bez dislokacije diska s redukcijom. U tablici 3. vidi se razlika dobivenih vrijednosti između ispitanika.

and 0.51 mm for the control group. The T test between left side of subjects with disc displacement with reduction and left side of those with healthy temporomandibular joint, and t test between right side of subjects with disc displacement with reduction and right side of subjects with healthy temporomandibular joint showed no statistically significant difference for obtained distances between different centric relation records. Table 2 shows results of the F test between all joints with disc displacement with reduction and all joints without disc displacement with reduction. Table 3 shows size differences for obtained values between participants.

Tablica 2. Rezultati F testa između svih zglobova s dislokacijom diska s redukcijom (E, N = 42) i svih zglobova bez dislokacije diska s redukcijom (C, N = 42), za utvrđene razlike između različitih registrata centrične relacije (mm); eksperimentalna i kontrolna skupina jedan su uzorak ($p < 0,05$)
Table 2 Results of the F test between all joints with disc displacement with reduction (E, N=42) and all joints without disc displacement with reduction (C, N=42), for obtained distances between different centric relation records (mm). The experimental and control group are one sample ($p<0.05$).

Varijabla • Variable	$\bar{X}_E$ (mm)	$\bar{X}_C$ (mm)	SD_E	SD_C	p
X	0.10	0.11	0.08	0.09	0.56
Y	0.16	0.17	0.10	0.10	0.67
Z	0.08	0.10	0.07	0.06	0.16
L	0.24	0.27	0.11	0.11	0.33

* X – anteroposteriorni smjer • anteroposterior direction; Y – vertikalni smjer • vertical direction; Z – transverzalni smjer • transversal direction; L – linearna udaljenost • linear distance.

Tablica 3. Razlike u veličini pri odstupanju između različitih registrata centrične relacije; prikazane su razlike između svih zglobova s dislokacijom diska s redukcijom (E) i svih zglobova bez dislokacije diska s redukcijom (C); lijeva i desna strana jedan su uzorak ($p < 0,05$).
Table 3 Size differences for distances between different centric relation records. The differences between all joints with disc displacement with reduction (E) and all joints without disc displacement with reduction (C) are shown. Left and right side are one sample ($p<0.05$).

Smjer • Direction	TMZ s dislokacijom diska s redukcijom (N = 42) • TMJ with disc displacement with reduction (N=42)	Zdravi TMZ (N = 42) • Healthy TMJ (N=42)
≤ 0.1 mm, anteroposteriorno • anteroposterior	23 (54.8%)	23 (54.8%)
≤ 0.1 mm, vertikalno • vertical	12 (28.6%)	10 (23.8%)
≤ 0.1 mm, transverzalno • transversal	27 (64.3%)	22 (52.4%)
≤ 0.2 mm, anteroposteriorno • anteroposterior	40 (95.2%)	39 (92.9%)
≤ 0.2 mm, vertikalno • vertical	33 (78.6%)	29 (69.0%)
≤ 0.2 mm, transverzalno • transversal	41 (97.6%)	41 (97.6%)
≤ 0.3 mm, anteroposteriorno • anteroposterior	42 (100%)	41 (97.6%)
≤ 0.3 mm, vertikalno • vertical	39 (92.9%)	39 (92.9%)
≤ 0.3 mm, transverzalno • transversal	42 (100%)	42 (100%)
Linearna udaljenost • Linear distance ≤ 0.1 mm	5 (11.9%)	2 (4.8%)
Linearna udaljenost • Linear distance ≤ 0.2 mm	18 (42.9%)	13 (31.0%)
Linearna udaljenost • Linear distance ≤ 0.3 mm	27 (64.3%)	27 (64.3%)
Linearna udaljenost • Linear distance ≤ 0.4 mm	40 (95.2%)	39 (92.9%)

Rasprava

U ovom istraživanju proučavala se ponovljivost položaja centrične relacije kod ispitanika s dislokacijom diska s redukcijom i onih sa zdravim temporomandibularnim zglobom. Statističkom analizom rezultata nije ustanovljena razlika u dobivenim udaljenostima između različitih registrata centrične relacije u eksperimentalnoj i kontrolnoj skupini.

Većina autora (7, 17 – 19) proučavala je razlike položaja kondila između različitih registrata centrične relacije na razini anteroposteriorne, vertikalne i transverzalne osi Kartezije-

Discussion

In this study, the authors investigated reproducibility of centric relation position in subjects with disc displacement with reduction and, also, subjects with healthy temporomandibular joints. Statistical analysis of the results showed no significant difference in obtained distances between different centric relation records, between the experimental and control groups.

Most authors (7, 17-19) studied condylar position discrepancies between different centric relation records at an-

va koordinatnog sustava. Rezultati ovog istraživanja (tablica 1 – 3) pokazali su varijacije uzastopnih registrata centrične relacije kod vrijednosti gledanih na razini osi i istinskih linearnih vrijednosti gdje su linearne udaljenosti bile veće. Prosječne vrijednosti na razini osi mogu prikriti prave linearne vrijednosti pomaka kondila između uzastopnih registrata centrične relacije.

Najsličnije eksperimentalne skupine imala su istraživanja Harpera i Schneidermana (5) te Zonnenberga i Muldera (8). Harper i Schneiderman (5) proučavali su centričnu relaciju i pomake kondila pri unutarnjim poremećajima temporomandibularnog zgloba. Os rotacije kondila u položaju centrične relacije pokazala je značajno više varijacija među ispitanicima u horizontalnoj ravnini (kontrolna skupina), što je u suprotnosti s rezultatima ovog istraživanja (tablica 1. i 2.). Ipak, njihova eksperimentalna skupina uključila je i povijest boli unutar temporomandibularnog zgloba, škljocanje i ograničenje kretnji donje čeljusti, što obuhvaća širu skupinu poremećaja od skupine s izoliranom dislokacijom diska s redukcijom. Zonnenberg i Mulder (8) također su imali različitu eksperimentalnu skupinu. Autori su proučavali ponovljivost centrične relacije kod pacijenata s TMD-om. U grupama su bili ispitanici s miofascijalnom boli, miofascijalnom boli s dislokacijom diska s redukcijom, dislokacijom diska bez redukcije i osteoartrozom. Rezultati nisu pokazali razliku varijabilnost položaja centrične relacije između različitih grupa TMD-a i kontrolne skupine. Iako ispitne skupine nisu istovjetne, a ni tehnike određivanja položaja centrične relacije, rezultati se mogu usporediti s rezultatima ovog istraživanja (tablica 1. i 2.). Sa sigurnošću se može zaključiti da ne postoji razlika u ponovljivosti položaja centrične relacije između pacijenata s dislokacijom diska s redukcijom i onih sa zdravim temporomandibularnim zglobom. U praksi određeni autori (20) sugeriraju terapiju nagriznim udlagama, kad je riječ o pacijentima s unutarnjim poremećajima, kako bi se odredio točan i ponovljiv položaj centrične relacije tijekom izrade završnoga protetičkog rada. Rezultati ovog istraživanja potvrdili su da u slučaju određivanja centrične relacije na pacijentu s dislokacijom diska s redukcijom prije toga postupka nije potrebna terapija nagriznom udlagom te da su dovoljne standardne mjere opreza.

Schmitt i suradnici (17) proučavali su ponovljivost Rothove metode određivanja centrične relacije. Mjereni pomaci kondila između različitih registrata centrične relacije iznosili su od 0,2 do 0,68 milimetara (SD 0,17 – 0,52). Ipak, ponavljani registrati centrične relacije pokazali su pozitivan test razdvojenih modela (koristeći se *shim stock* folijom od 0,005 mm) kod svih ispitanika, što je indikator kliničke preciznosti. Rezultati sličnih istraživanja (7, 17, 18) koji su u skladu s rezultatima ovog istraživanja (tablica 1. i 2.), sugeriraju da minimalni pomaci na razini kondila nemaju klinički utjecaj na preciznost određivanja centrične relacije.

Pieshlinger i suradnici (7) raspravljaju o sintagmama *centrik u točki* i *područje referentnog položaja* kao o terminima za položaj centrične relacije. Autori (7) tvrde da riječ *područje* ima više smisla kad je riječ o biološkim sustavima gdje se i očekuju minimalni pomaci. Harper i Schneiderman (5) zaključili su da koncept centrične relacije u normalnim temporomandibularnim zglobovima mora uključiti raspon dina-

teroposterior, vertical and transversal axes of the Cartesian coordinate system. The results of the present study (Table 1-3) revealed variations of repeated centric relation records in axis values and true linear values, where linear values were greater. The average axis values can mask true value of linear distortion between consecutive centric relation records, measured at condylar level.

Most similar experimental groups had investigations of Harper and Schneiderman (5) and Zonnenberg and Mulder (8). Harper and Schneiderman (5) studied condylar movement and centric relation in patients with internal derangement of temporomandibular joints. The axis point of condylar rotation in centric relation had significantly greater within-subject variability in the horizontal plane for the control group, which is contrary to the results of this study (Table 1 and 2). Yet, their experimental group included a history of TMJ pain, clicking or restricted jaw movement, which is a larger experimental group than the group with disc displacement with reduction alone. Zonnenberg and Mulder (8) also had different experimental groups. The authors investigated centric relation reproducibility in TMD patients. The groups included patients with myofascial pain, myofascial pain with disc displacement with reduction, disc displacement without reduction, and osteoarthrosis. The results showed no variability in centric relation position between any group of TMD-patients and control subjects by means of the leaf gauge. Although there are not any similar study groups and techniques for obtaining the position of the centric relation, the results are comparable to the present study (Table 1 and 2). It is safe to conclude that there is no difference in reproducibility of centric relation position between patients with disc displacement with reduction and patients with healthy temporomandibular joints. In practice, some authors (20) suggest splint therapy in patients with internal derangement, in order that a correct and reproducible centric relation position can be recorded for the final restorative treatment. The results of the present study confirmed that when doing centric relation record on a patient with disc displacement with reduction, there is no need for previous splint therapy, and standard precautions are acceptable.

Schmitt et al. (17) studied reproducibility of the Roth power centric in determining the centric relation. The measured deviations of the condylar position between different centric relation records were from 0.2 mm to 0.68 mm (SD 0.17 till 0.52). However, the repeated centric relation records showed a positive split cast check (using shim stock foil 0.005 mm) for all participants, which is an indicator of clinical precision. The results of similar studies (7, 17, 18), which are in concordance with present study results (Table 1 and 2), suggest that minimal shifts at condylar level do not have clinical significance on precision of the centric relation recording.

Pieshlinger et al. (7) discuss the terms "*centric in point*" and "*reference position area*" for the centric relation position. The authors (7) state that the term "*area*" makes more sense in biological systems, where minimal dispersion is expected. Harper and Schneiderman (5) concluded that the concept of centric relation in normal temporomandibular joints must include a dynamic range of horizontal adaptation to the po-

mičke horizontalne adaptacije na potencijalni biomehanički i biološki stres povezan s oralnom funkcijom. Kogawa i suradnici (21) te Grasso i Sharry (22) također dovode u pitanje centričnu relaciju kao rigidan položaj. Rezultati ovog istraživanja pridonose mišljenju da je centrična relacija određeno područje, a ne jedna točka. S obzirom na normalnu varijabilnost unutar bioloških sustava, može se očekivati da *centrično područje* ne može imati istu veličinu u svim temporomandibularnim zglobovima. Rezultati ovog istraživanja (tablica 3.) sugeriraju da će kod dvije trećine ispitanika kondilarni položaj pri uzastopnom ponavljanju određivanja centrične relacije biti unutar 0,3 milimetra u promjeru. Za više od 90 posto ispitanika to je područje unutar 0,4 milimetra.

Zaključak

Određivanje položaja centrične relacije pacijentima s dislokacijom diska s redukcijom ima istu ponovljivost kao i onima sa zdravim temporomandibularnim zglobom. Terapija udlagom prije određivanja položaja centrične relacije kod pacijenata s dislokacijom diska s redukcijom nije potrebna. Rezultati ovog istraživanja sugeriraju da će u slučaju ponovljenog određivanja centrične relacije položaj kondila biti unutar promjera od 0,4 milimetra.

Sukob interesa

Sukoba interesa nije bilo.

tential biomechanical and biological stresses related to oral function. Kogawa et al. (21) and Grasso and Sharry (22) also question the centric relation as a rigid position. The results of the present study support the claim that centric relation is one area rather than one point. Due to the normal variability in biological systems, it can be expected that the "*centric area*" cannot have the same distance for all temporomandibular joints. The results of the present study (Table 3) suggest that two thirds of participants will demonstrate condylar position of the repeated centric relation recording within the area of 0.3 mm in diameter. The area was within 0.4 mm for more than 90% of participants.

Conclusion

Recording of centric relation position in patients with disc displacement with reduction has same reproducibility as in patients with healthy temporomandibular joints. Prior splint therapy when recording centric relation position in patients with disc displacement with reduction is not needed. The results of the present study suggest that it is very likely that repeated centric relation recording will position condyles within a diameter of 0.4 mm.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Abstract

Objective: The aim of this study was to investigate reproducibility of the position of centric relation in patients with disc displacement with reduction. **Materials and methods:** The test group included 30 subjects, diagnosed with disc displacement with reduction in right, left or both joints. The control group included 12 individuals with no signs and symptoms of temporomandibular disorders. Using chin point guidance with a jig, centric relation record was made three times by every participant, in a single session. Left and right condylar position for each centric relation record was determined and recorded using the electronic ultrasonic measuring device. The data were transferred to the computer, processed and analyzed. Condylar distances between centric relation records were measured (anteroposterior, vertical, transversal and linear values), and the data were statistically analyzed using the t and the F tests. **Results:** No statically significant difference was found between the test and the control groups. Two thirds of study participants demonstrated condylar position of the repeated centric relation recording within the area of 0.3 mm in diameter. For more than 90% of participants that area was within 0.4 mm. **Conclusions:** There is no difference in reproducibility of the centric relation between patients with disc displacement with reduction and healthy temporomandibular joint individuals (p>0.05). When doing centric relation record on a patient with disc displacement with reduction there is no need for previous splint therapy and standard precautions are acceptable. The obtained results must be interpreted within the experimental group, and not projected on the other groups of temporomandibular disorders.

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Key words
Temporomandibular Joint Disc; Centric Relation; Mandibular Condyle; Vertical Dimension; Dental Occlusion, Centric

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