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Role of prosthetic therapy in the rehabilitation of the hemiplegic patient

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Key words: hemiplegia, electromyography, cephalometric analysis

Summary

The authors evaluate the effect of rehabilitation on the temporal and masseter muscles of the elevator mandible. Parallel studies were conducted on the status of occlusion and dental arch and cephalometric analysis of the physiognomy was performed to evaluate the recovery of the mimical muscles in 31 hemiplegic patients. A significant difference in the EMG activity of the masticatory muscles and in cephalometric values was observed between the healthy and hemiplegic side during rehabilitation. The analysis showed a difference in the stages of recovery of the temporal and masseter muscles even though one would expect the parallel recovery of the elevator mandible and mimical muscles. This means that masticatory muscles recover much slower than mimical muscles. The authors conclude that hemiplegic rehabilitation especially of the masticatory muscles, will be much slower if occlusion is deficient. The authors suggest that for fast recovery of the masticatory muscles, and thus mastication, complete sanation of the teeth and prosthetic rehabilitation should be carried out as soon as possible to obtain optimal conditions for the balance of occlusion and articulation.

One of the severest manifestations of damage to the motor area of the cortex or pyramidal tract, induced by cerebral hemorrhagie, is hemiplegia. Clinically it is described as paralysis or weakness of voluntary movements on one side of the body. Rarely is only the motor neuron damaged; rather other disturbances (sensitive, trophic, vasomotor and psychological) may occur as a result of a lesion in surrounding structures.

After treatment of the acute motor deficiency, whose intensity depends on the localization and size of lesion, the hemiplegic patient must undergo rehabilitation. In recent years, the professional opinion has prevailed that active rehabilitation should begin as early as possible, that is, ten days after the vascular incident.

Since activity of the masticatory muscles, as of the remaining skeletal muscles on the hemiplegic side, is reduced, we wanted to evaluate the status of the temporal and masseter muscles during the rehabilitation process. Parallel investigations thus were conducted on the status of occlusion and dental arch in all patients, and cephalometric analysis of the physiognomy was performed to evaluate the recovery of the mimical muscles.

Although therapeutic rehabilitation of the hemiplegic is dealt with exclusively in general medicine and its specialized branch, on the basis of data analysis, we wanted to confirm the role of prosthetic therapy in rehablitation of hemiplegic patients.

PATIENTS AND METHODS

A parallel investigation of the dental arch and stage of recovery of masticatory muscles was performed on 31 hemiplegics who experienced the cerebrovascular insultus at least three months before the investigation and who underwent therepeutic and rehabilitative exercisses. Simultaneous recordins of both the healthy and impaired temporal and masseter muscles were made with surface electromyography at the Department of Removable Prosthetics (Zagreb Faculty of Dentistry) to compare their functions and determine the extent of damage on the hemiplegic side. An electromyograph with a built-in digital integrator, which enabled quantification of the data, was utilized. Muscular activity was registered in the central occlusion (Figure 1) and the mean value of three consecutive recordings showing the digitally integrated sums of action potentials within two seconds each was used for the statistical analysis.

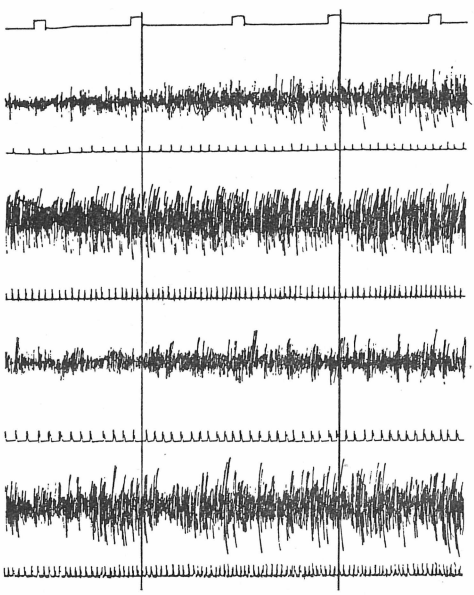


Fig. 1. Electromyogram of patient with marked hemiplegia on right side.

Since hemiplegic lesions induce either marked or only slight facial asymmetry — a shift of the lower part of the healthy facial side (due to marked muscular tonus) and fall of the corner of the mouth and loss of normal nasolabial furrows on the paralyzed side (Figure 2) — a cephalometric analysis was made on a photography of the patient's physiognomy. Angular projections of the cephalometric points were determined according to M a r t i n a n d S a l l e r.[1] The basic mediosagittal line in the cephalometric analysis was created when the vertical line passed through the angular projections of the glabella (g), methopion (m), trihion (tr) and vertex (v) (Figure 3). Using the mediosagittal line as a reference point, we measured the fall of the corner of the mouth on the paralyzed side with a protractor and compared the results with the healthy side.

Statistical data were analyzed with t-test, i. e. the difference of arithmetic means of a few samples (N e a v e[2], P e t z[4]).

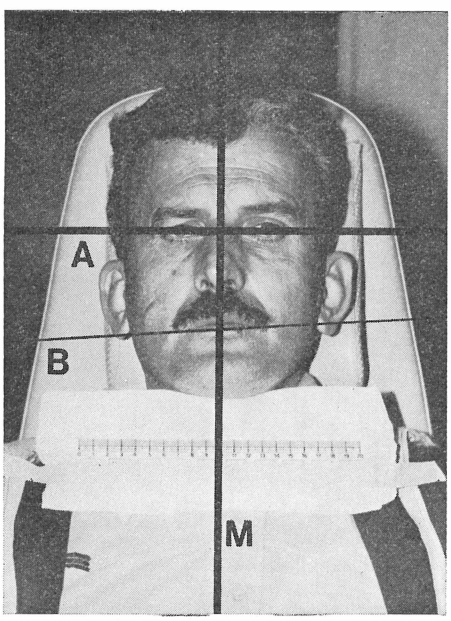
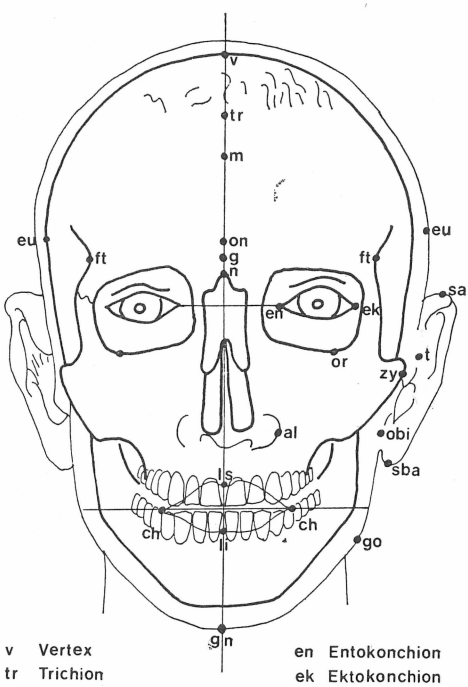


Fig. 2. Photograph of patient with asymmetrical face
A — Bipupillary line
B — Line joining corners of mouth
C — Mediosagittal line



v Vertex
tr Trichion
m Metopion
on Ophryon
g Glabella
n Nasion
ls Labrale superius
li Labrale inferius
ch Cheilion
gn Gnathion
go Gonion
en Entokonchion
ek Ektokonchion
or Orbitale
al Alare
ft Frontotemporale
zy Zygion
eu Euryon
sa Superaureale
sba Subaureale
t Tragion
obi Otobasion

Fig. 3. Cephalometric points according to Martin

RESULTS

In all hemiplegics, occlusion was defective with incomplete contact of the dental arches in supporting zones, and defects in individual quadrants which caused uneven bimaxillary pressure of the left and right lateral dental arches.

Table 1 showes electromyographic and cephalometric data of all examinees. The impaired hemiplegic side is marked in the second column with the letters

TABLE 1

No.	demaged side	EMG central occlusion				cheilion-cheilion angle mediosagittal line		
		temporal		masseter				
		Z	H	Z	H	Z	H	d
1	L	13	19	20	13	90	91	1
2	L	13	9	31	9	90	92	2
3	L	34	13	43	21	90	92	2
4	D	11	8	16	12	90	91	1
5	D	36	29	56	38	90	94	4
6	L	27	29	22	38	90	91	1
7	D	16	15	20	10	90	93	3
8	D	12	14	52	29	90	93	3
9	L	48	26	31	21	90	92	2
10	L	17	16	25	16	90	94	4
11	L	24	36	33	12	90	90	0
12	D	12	16	17	11	90	95	5
13	L	32	37	78	45	90	90	0
14	L	27	18	16	16	90	93	3
15	D	53	43	54	39	90	90	0
16	L	24	9	14	30	90	90	0
17	L	7	19	28	19	90	94	4
18	D	16	19	16	13	90	94	4
19	D	13	9	5	8	90	92	2
20	L	12	13	5	7	90	90	0
21	L	42	34	58	59	90	92	2
22	L	13	13	9	13	90	94	4
23	D	16	12	39	40	90	92	2
24	D	12	7	21	14	90	90	0
25	L	16	13	22	6	90	92	2
26	D	51	32	48	29	90	95	5
27	L	23	13	9	6	90	90	0
28	D	24	25	11	6	90	90	0
29	L	13	11	7	6	90	91	1
30	D	31	7	45	31	90	96	6
31	D	13	7	12	5	90	90	0

TABLE 1. Electromyographic and cephalometric data for all patients.
EMG — digital integrated sums of action potentials in central occlusion for temporal and masseter muscles. Z — healthy side. H — hemiplegic side
Cheilion-Cheilion angle, mediosagittal line
Z — healthy side, H — hemiplegic side d — difference in the angles on healthy and hemiplegic side

L (left) and D (right). Also the values of the digitally integrated sums of action potentials of temporal and masseter muscles on the healthy (Z) and hemiplegic (H) sides, registered during maximal bilateral muscular contraction in central occlusion, are presented in the same table. It contains values of difference between the Cheilion-Cheilion line (joins both corners of mouth) and the mediosagittal line on the healthy (Z) and hemiplegic (H) sides. The values (d) were obtained by calculating the difference between the angle on the hemiplegic side and 90° which is a normal angle, and which joins the Cheilion-Cheilion line with the mediosagittal line.

The level of significance obtained with the t-test was $P < 0.05$ for the temporal muscle, $P < 0.001$ for the masseter muscle and $P < 0.001$ for cephalometric values (Table 2).

TABLE 2

VARIABLES	DEGREES OF FREEDOM	LEVEL OF SIGNIFICANCY
EMG TEMPORAL	30	$P < 0.001$
EMG MASSETER	30	$P < 0.001$
CEPHALOMETRIC VALUES	30	$P < 0.05$

TABLE 2. Statistical significance of electromyographic and cephalometric variables

TABLE 3

No.	demaged side	EMG central occlusion temporal		masseter		cheilion-cheilion angle mediosagital line		
		Z	H	Z	H	Z	H	d
11	L	24	36	33	12	90	90	0
13	L	32	37	78	45	90	90	0
15	D	53	43	54	39	90	90	0
16	L	24	9	14	30	90	90	0
20	L	12	13	5	7	90	90	0
24	D	12	7	21	14	90	90	0
27	L	23	13	9	6	90	90	0
28	D	24	25	11	6	90	90	0
31	D	13	7	12	5	90	90	0

TABLE 3. Electromyographic and cephalometric data for patients with recovered mimical muscles EMG — digital integrated sums of action potentials in central occlusion for temporal and masseter muscles. Z — healthy side H — hemiplegic side
Cheilion—Cheilion angle, mediosagittal line
Z — healthy side, h H — hemiplegic side d — difference in the angles of healthy and hemiplegic sides

Table 3 includes patients whose mimical muscles recovered and the difference in the angles of the Cheilion-Cheilion/mediosagittal lines on the healthy (Z) and hemiplegic (H) sides was O° for all of these patients.

DISCUSSION AND CONCLUSIONS

Table 1 shows that the difference between the activity of masticatory muscles on the healthy and hemiplegic side was statistically significant during rehabilitation. Likewise, there was a significant difference in changes of cephalometric values (Table 2). Logically, it can be expected that a difference in the degree of rehabilitation of the examinee varies depending on the basic process which induced the damage.

As Table 3 shows, examinees whose mimical function recovered had normal cephalometric values. However, attention should be paid to the difference in the stages of recovery of the temporal and masseter muscles, even though one would expect the parallel recovery of the elevator mandible and mimical muscles. We observed that masticatory muscles recover much slower than the mimical muscles which correlates with the findings of Smorto and Basmajian[5] who confirmed that mimical muscles repair faster than the other skeletal muscles. One reason for the rapid recovery of mimical muscles might be their constant activity during speech, expression of emotion and mastication.

In 1974, Nikšić et al[3] confirmed that activity of the masticatory muscles on the side with the dental arch defect is reduced. Therefore, we believe that hemiplegic rehabilitation, especially of the masticatory muscles, will be much slower if occlusion is deficient. Since in the central occlusion there is bilateral, simultaneous and isometric contraction of the elevator mandible, for masticatory muscles it is necessary that he hemiplegic apply equal bilateral pressure on the dental arches. We suggest therefore that for fast recovery of the masticatory muscles, and thus mastication, complete sanation of the teeth and prosthetic rehabilitation should be carried out as soon as possible to obtain optimal conditions for the balance of occlusion and articulation.

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Sažetak

ULOGA PROTETSKE TERAPIJE U REHABILITACIJI HEMIPLEGIČARA

Danko NIKŠIĆ, Melita VALENTIĆ, Ivan EREŠ

Ključne riječi: hemiplegija, elektromiografska registracija, kefalometrijska analiza.

Skeletna muskulatura koja je zahvaćena hemiplegijom vraća se u svoju funkciju to brže što se aktivnije podvrgava vježbama sa radnim opterećenjem muskulature. Iz tog razloga autori su željeli istražiti stanje rehabilitacionog procesa kod temporalisa i masetera, iz grupe elevatora mandibule. Ujedno su izvršili ispitivanje okluzije i statusa zubnih nizova kod svih ispitanika, kao i kefalometrijsku analizu fizionomije, radi procjene oporavka mimične muskulature. Istraživanje je bilo izvršeno na 31 ispitaniku hemiplegičaru.

Statističkom analizom dokazano je da postoji izrazita razlika u aktivnosti mastikatorne muskulature zdrave (Z) i bolesne strane (H) u hemiplegičara koji se nalaze u toku rehabilitacionog procesa (Tabela I). Također je dokazana izrazita signifikantnost razlika u promjenama ispitivanih kefalometrijskih vrijednosti (Tabela II). Međutim, logično je očekivati razliku u stupnju rehabilitacije ispitanika od kojih je formiran uzorak. Stoga su posebno analizirani ispitanici kod kojih je došlo do oporavka mimične muskulature sa posljedicama izraženih pravilnosti ispitivanih kefalometrjskih vrijednosti (Tabela III). Za tu grupu ispitanika pokazala je analiza da postoje razlike u stupnju oporavljenosti temporalisa i masetera, bez obzira na to što se na temelju mjerenja vrijednosti točaka na fizionomiji moglo očekivati jednakomjerni oporavak elevatora mandibule. To znači da se oporavak mastikatorne muskulature vrši mnogo sporije nego mimične muskulature. Na temelju analize statusa okluzije ispitanika uzorka, digitalno integriranih podataka elektromiografskih registracija ispitivanih mišića, ispitivanja kefalometrijskih vrijednosti fizionomije, kao i analize rezultata ostalih istraživanja u tom području, autori su došli do zaključka da će rehabilitacija hemiplegičara biti usporenija u grupaciji mišića elevatora mandibule, ukoliko im okluzija nije uredna. Iz tih razloga autori predlažu da se radi bržeg oporavka mastikatornih mišića, a time i funkcije mastikacije, u samoj početnoj fazi rehabilitacionog procesa hemiplegičara izvrši potpuna sanacija zubala, kao i protetska rehabilitacija, kojom će se svaki pacijent hemiplegičar približiti uvjetima idealne okluzije i idealne artikulacijske ravnoteže.