Surgery in the Outcomes of Traumatic Wrist ("Coxa Manus'" Surgery)

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Key words: Coxa Manus, biomechanics, carpal kinetics, wrist, carpal instability, biarticular concentric carpal model, wrist fractures, scaphoid non-union, carpal collapse, wrist's arthrosis, STT arthrosis.

Summary

Introduction: In this study the authors explain the principal concepts of the Biarticular Concentric Carpal Mechanics (BCCM) in reference to the injured wrist. The clinical application of BMMC have allowed to develop a new clinic methodology that we can summarize in this concept: " the new post-surgical normality in a traumatic wrist must take aim to restore the biomechanical function and include the fit restoration, also substitutive, of the rotational carpal centre's (displaced in the head of the capitate).This is the " Coxa Manus' " Surgery in the clinical practice.

Material and Methods: The authors present some new operations in support of the Biarticular Concentric Carpal Mechanics: the Reconstruction of the Coxa Manus, the Substitutive Reconstruction of the Coxa Manus, the Substitutive Centre-Carpal Resection-Arthroplastic and the STT Substitutive Arthroplastic. These new operations foresee, also, the utilitation of articular prosthesis for the head of the capitate and/or distal scaphoid.

Results: The preliminary results with regards to 15 patients are discussed.

Conclusions: The authors think that this new surgical methodology is interesting and teeming of ulterior development.

Introduction

In this study, the clinical applications of the Biarticular Concentric Carpal Mechanics (BCCM) to the injured wrist (1,2), are referred (3,4,5,6,7).

The BCCM makes clear ad adequately determines the gears and the

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reciprocal adjustments between the two carpal rows. And, what's more, gives (with bio-mechanic terms) the reason for the carpal single bone's peculiar form or, in general, for wrist's architecture. Central conception of BCCM is that the wrist's function consists in the "stationary maintenance of rotation carpal centre's position (displaced in the capitate's head)". In fact, the carpal condyle (the whole proximal carpal row) screwing on the distal radius, forces the capitate's head to orbit in the same point in which the hand's mechanical axis and the radio-ulnar carpal joint mechanical axis are meeting to constitute the rotation system centre's. The consequence of this fact is the carpal height's invariance.

Accepting an efficacious analogy, the carpus is similar to a biarticular femur's prosthesis in which the small-head prosthesis' articulation is represented by the capitate's head that, on the scaphoid and lunate, forms a real enarthrosis (fig. 1).

The "Coxa Manus" is this enarthrosis formed by the capitate's head and by middle-carpal versant of the carpal condyle (so-called, the Cotile Manus); this is the "true" wrist's joint. In other words, the carpal condyle is the container of the Coxa Manus and warrants the mechanical stability, like a meniscus (fig. 2).

In practice, the carpal condyle is the custodian of wrist's stability and every its serious lesion - that lead to the dislocation of the capitate's head - causes mechanical instability because it moves the rotation carpal centre.

This means that the ascertainment of a significative dislocation of the capitate's head is the pathognomonic sign that consents the generic

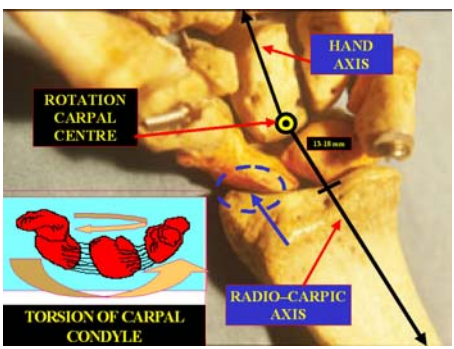

Fig.1: The function of the carpal condyle is the stationary manteinance of rotation centre position that is localized in the head of the capitate.The carpale condyle, spinning on the radius, obliges the head of capitate to orbite in the same point where the axis of the hand and the radio-carpal axis meet in constituting the rotation centre of the all system.

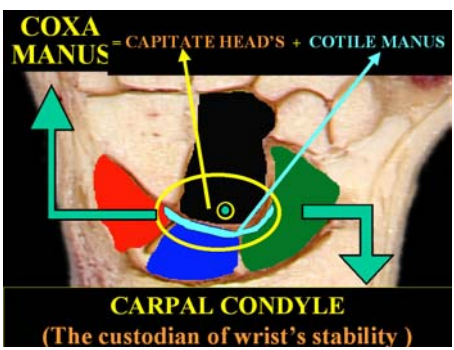

Fig.2: The carpus is similar to a biarticular femur prosthesis in wich the small-head prosthesis articulation is represented by the head of capitate that, on the scaphoid and lunate, forms a real enarthrosis. This enarthrosis is the Coxa Manus that is formed by the head of the capitate and by middle-carpal versant of the carpal condyle (so called Cotile Manus)

diagnosis of carpal instability: in fact, is possible verify that - in the DISI – VISI patterns of instability (8 – 22) - the Intercalated Segment sub-luxation allows, in any case, the proximal dislocation of the capitate and the consequence Coxa Manus' disruption (fig. 3).

Materials and Methods

Interesting surgical solutions spring from BCCM applied to the injured wrist's problems in accord to this concept: *" the new post-surgery normality of the injured wrist must take aim to restore the biomechanical function and include the fit restoration, also substitutive, of the rotation carpal centre's (displaced in the capitate's head)* ". In the clinical practice this is the "Coxa Manus" Surgery.

It is indicated follows this praxis, when the carpal condyle's osseous components and/or the distal radius and/or the capitate's head present irreparable injures with a condition of antalgic or mechanic stiffness. The potential advantages of this surgery is the maintenance of a lot of physiological articulation that avoids the panarthrodesis or the destroying prosthesis. These are the wrist's diseases that can present these conditions: the SLAC wrist (Scapho-lunate Advanced Collapse), the SNAC wrist (Scaphoid-Non-union Advanced Collapse), the arthritic and/or SCAC wrist (Scaphoid Chondrocalcinosis Advanced Collapse), the outcomes of malunion and/or arthrosic distal radius fractures, the failure of scaphoid-non-union surgical traitments, the STT arthrosis, the Kienboeck, etc. (23).

We have realized the first operations in 1977 and in a few of cases have utilized substitutive prosthesies for the capitate's head or the distal scaphoid - actually, we are using a prosthesies prototype made in Italy by SAMO – Cadriano di Granarolo Emilia (BO) - Now, in succession, some examples are reported: in fig. 4 (A,B) the case n°

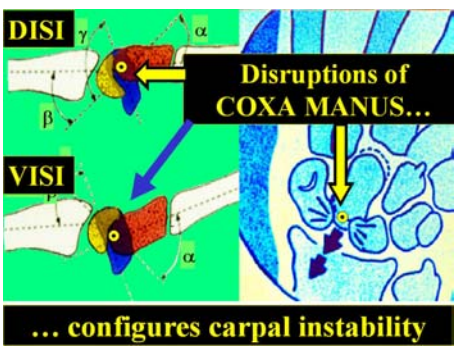

Fig.3: The ascertainment of a significative dislocation of the head of the capitate is the patognomonic sign that enables the generic diagnosis of carpal instability.In fact,it is possible to verify this in every DISI or VISI instability.

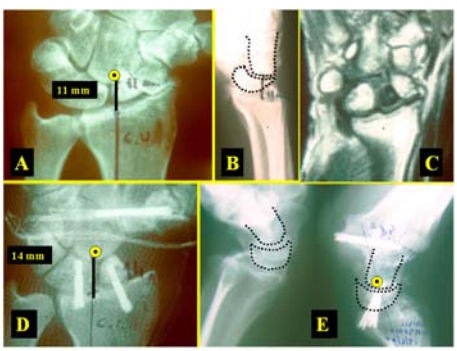

Fig.4: Case n° 1: Reconstruction of the Coxa Manus in a left SNAC wrist,.

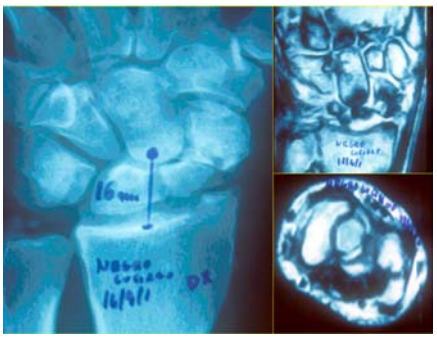

Fig.5: Case n° 2: Right SNAC wrist suffering from head necrosis of the capitate. In this case the authors effected the Substitutive Reconstruction of the Coxa Manus

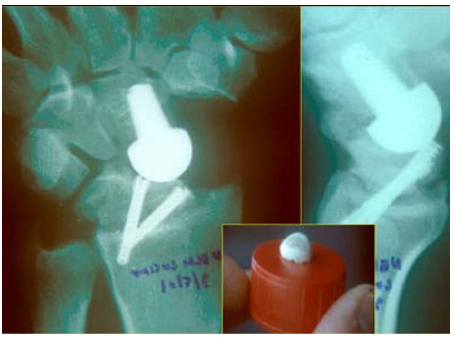

Fig.6: Case n° 2: The Rx examination after the operation. We can see the wide erosion in the resected head of the capitate on low square.

1, a 33 years old man with a left SNAC wrist; the RM shows the necrosis of proximal scaphoid (C). In this case the BCCM counsels an operation able to restore the position and the stability of the rotation carpal centre: " the Reconstruction of the Coxa Manus" that consists in the rebuilding of Cotile Manus by a radius-lunate-emi-scaphoid artrhrodesis. In this way, the capitate's head is centred and provided with a new stable support. In the patient the x-ray control, to 2 years, shows that the rotation carpal centre has gone up again with regression of DISI instability (D, E).

A variant of this operation, to utilize when the capitate's head is destroyed, foresees a prosthesis for the capitate. In fact, in the case n° 2: a farmer with a right SNAC wrist (fig. 5), so it has been done (fig. 6). This operation is the Substitutive Reconstruction of Coxa Manus.

Other surgical applications of BMMC originate from the ascertainment that the resection of the first carpal row is an excellent operation, because the bony demolition, so apparently serious, is a meniscectomy, after all. After this operation the axis of the hand and the axis of the radio-ulnar carpal joint continue to converge in the head of the capitate where, under lee of the dimple of lunate, they constitute a new carpal rotation centre. The resection of the first carpal row is contraindicate if the dimple of lunate or the head of the capitate have been damaged. What can we make in this 49 years old farmer that has a stiff and painful SNAC wrist with the destruction of the head of the capitate (case n° 3 – fig. 7).

The logic of BMMC points at "Substitutive Centre-carpal Resection-Arthroplastic" for these cases. This is the operation and the Rx examination made after 18 months from operation. In this case the authors associated the resection of the first carpal row with the prosthesis of the head of the capitate. As we can verify, the distal radius and the capitate tolerate the titanium prosthesis very well (fig 8).The clinical result is excellent after over two years (fig.9).

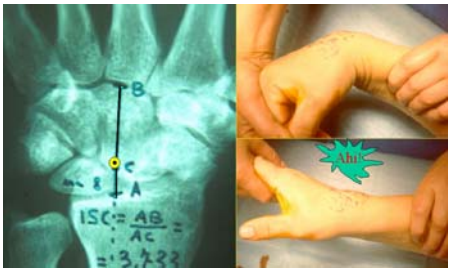

Fig.7: Case n° 3: Left SNAC wrist with head necrosis of the capitate and with a grand painful and mechanical stiffness In this case the authors effected the Substitutive Centre carpal Resection Arthroplastic.

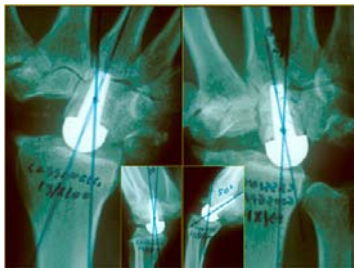

Fig.8: Case n° 3: The RX examination after 18 months from operation.

Fig.9: Case n° 3: The clinical check after 18 months from operation shows the nearly complete recovery of articular movement of wrist.

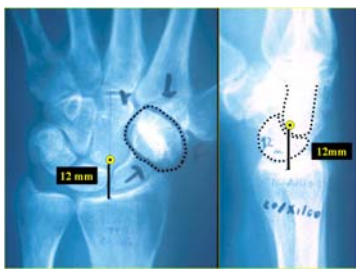

Fig. 10: Case n° 4: STT arthrosis with DISI carpal instability.In this case the authors effected a STT Substitutive Arthroplastic

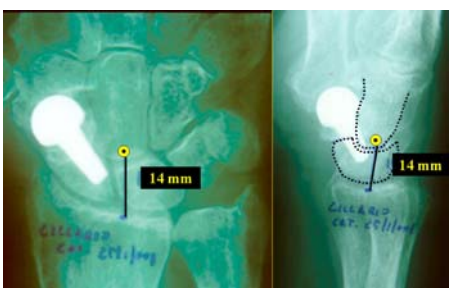

Fig. 11: Case n° 4: The RX examination after 20 months from operation, where it is documented the carpal re-alignment.

One of the most common diseases of the wrist is the arthrosis of STT that the BMMC consider an instability, because in these cases there is often a DISI malalignment with the proximal dislocation of the carpal

rotation centre. We can verify it in these RX of a 52 years old housewife that has a serious arthrosis and a left DISI instability (cases 4 fig 10).The authors know how it is difficult to treat this disease, because the ideal operation should treat both arthrosis and instability. We can realize this through the " STT Substitutive Arthroplastic ". This operation, deduced from the principles of BMMC, consists in a prosthesis inserted in the distal pole of scaphoid that is adapted to trapezium so as to restore the articular movement of the SST and the carpal height. The figures show the post-operating rx examination of above-said housewife effected after 12 months from operation. (fig11). The rx shows that the arthrosis is eliminated, the wrist joint is lined up and the head of capitate is gone up again of 2mm.

Results

The results of the above-said operations are reported in the (Table 1) and estimated in accordance with the parameters of the Mayo Wrist Score Chart (Insert 1 - 24, 25). The least follow-up is 1,5 years from the operation. On the whole the results can be considered satisfactory, but preliminary, because this is small casuistry with a very short follow-up.

A early opinion about this new four operations is that the Reconstruction of Coxa Manus is more suitable for SLAC and SNAC wrist that maintain some mobility, especially in patients that have a good bony and cartilaginous stock. The Substitutive Resection-Arthroplastic seems more suitable for a stiff SLAC, SNAC or SCAC wrist, where the distal radius surface or the head of the capitate are damaged. The STT Substitutive Arthroplastic seems grant better results if the DISI, that

Table 1

OPERATION	NAME PAZIENT	AGE	PATOLOGY	DATE	MAYO WRIST SCORING CHART				
					PAIN	SATISF.	ROM	GRIP	RESULT
RICOSTRUCTION OF THE COXA MANUS	C.U. Case 1	37	L. SNAC Wrist	11/05/99	25	25	10	25	80 (Good)
	S. ROSARIO	40	R. SNAC Wrist	26/06/01	20	25	5	15	65 (Fair)
	P. MAURIZIO	53	R. SNAC Wrist	18/12/01	20	25	10	25	80 (Good)
	B. DANILO	30	R. Nec. Scaf. PO	15/01/01	20	25	5	15	65 (Fair)
	S. VITTORIA	68	R. SCAC Wrist	23/01/01	20	20	15	15	70 (Fair)
SUBSTITUTIVE REC. OF THE COXA MANUS	N.L. Case 2	39	R. SNAC Wrist	17/04/01	20	25	10	15	70 (Fair)
	B. ANDREA	21	L. Nec. Scaf. PO	22/01/01	15	25	5	15	60 (Poor)
SUBSTITUTIVE RESECTION ARTHROPLASTIC CENTRE-CARPIC	C. G. Case 3	38	L. SNAC Wrist	24/11/99	25	25	15	15	80 (Good)
	V. MARIA	71	R. SCAC Wrist	08/05/01	20	20	15	15	65 (Fair)
	F. NATALE	84	L. SCAC Wrist	09/05/00	20	25	15	15	75 (Fair)
	B. GIUSEPPINA	61	R. SCAC Wrist	2/11/'99	25	25	15	15	80 (Good)
	B. GIUSEPPINA	62	L. SCAC Wrist	12/12/00	25	25	15	15	80 (Good)
STT SUBSTITUTIVE ARTHROPLASTIC	C. FRANCA	61	R. Arthros. STT	06/03/01	10	20	25	10	65 (Fair)
	C. C, Case 4	67	L. Arthros. STT	28/11/00	20	25	25	15	85 (Good)
	M. SILVANA	59	R. Arthros. STT	12/11/00	20	25	25	15	85 (Good)

Insert 1

MAYO WRIST MODIFIED SCORING CHART		
CATEGORY	**SCORE**	**FINDINGS**
PAIN (25 pt)	25	*No pain*
	20	*Mild pain with vigorous activities*
	20	*Pain only with weather changes*
	15	*Moderate pain with vigorous activities*
	10	*Mild pain with daily living activity*
	5	*Moderate pain with daily living activity*
	0	*Pain at rest*
SATISFACTION (25 pt)	25	*Very satisfied*
	20	Moderately satisfied
	10	*Not satisfied, but working*
	0	*Not satisfied, unable to work*
ROM (% of normal) (25 pt)	25	100%
	15	*75 → 99%*
	10	*50 → 74%*
	5	*25 → 49%*
	0	*0 → 24%*
GRIP STRENGTH (% of normal) (25 pt)	25	100%
	15	*75 → 99%*
	10	*50 → 74%*
	5	*25 → 49%*
	0	*0 → 24%*
FINAL RESULT	**EXCELLENT**	*90 -- 100*
	GOOD	*80 -- 89*
	FAIR	65 -- 79
	POOR	< 65

of Coxa Manus is more suitable for SLAC and SNAC wrist that maintain some mobility, especially in patients that have a good bony and cartilaginous stock. The Substitutive Resection-Arthroplastic seems more suitable for a stiff SLAC, SNAC or SCAC wrist, where the distal radius surface or the head of the capitate are damaged. The STT Substitutive Arthroplastic seems grant better results if the DISI, that goes with the arthrosis, can be easly corrected and there is a good bony and cartilaginous stock.

Conclusions

The authors think the BMMC has re-built the knowledge of wrist physiology with a new and simple biomechanical concept. Beginning from this concept we have projected and carried out new experimental operations that have given good even if preliminary results. This could be the future wrist surgery.

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