Facing society : A study of identity through head shaping practices among the indigenous peoples of the Caribbean in the ceramic age and colonial period

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7 RESULTS

The previous chapters of this dissertation discussed various ways in which intentional cranial modification may serve as an expression of identity, hypothesised what traces and patterns this process may leave in archaeological skeletal populations, and provided information on Caribbean skeletal assemblages and our previous knowledge regarding head shaping practices among the indigenous populations of the region.

The results have been divided into four separate sections discussing the demographic composition of the sample, the cranial metrics, the social variables, and the chronological patterns. The first section will discuss aspects of the demographic composition of the overall sample, including sex, age, and ancestry. The second portion will focus on analysing the practice using the cranial metrics gathered from the crania. This section will explore differences in the measurements between the modified and normal subset of the sample, different types and subtypes of modification, and variation in cranial metrics between those of Amerindian and suspected non-Amerindian ancestry. This section will also evaluate the methods proposed by Clark and colleagues (2007) and O'Brien and Stanley (2013) for determining modification status and type based on measurements.

The third segment of this chapter is aimed at discovering potential patterns which may explain the social motivations behind head shaping. Head shaping practices will be correlated to a suite of social variables that will be investigated from a multiscalar perspective starting with individual life histories and moving towards local patterns and regional trends. The fourth and final section will undertake a temporal exploration of patterns seen in the data on cranial modification in the Caribbean in order to examine the rise and decline of the practice among the indigenous communities as well as any temporal shifts that may have occurred.

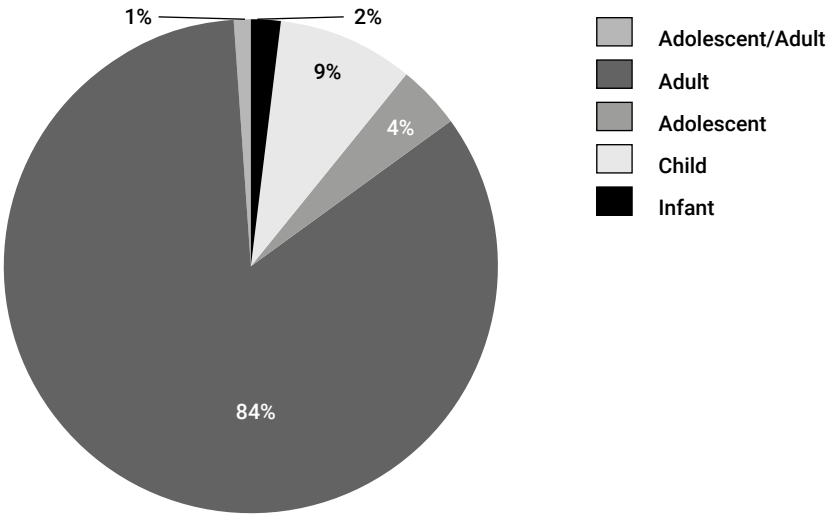
7.1 DEMOGRAPHIC OVERVIEW OF SAMPLE

Several demographic aspects of the combined sample consisting of 556 individuals from a variety of sites and locations in the Caribbean require further consideration before an analysis of cranial modification patterns can be executed. These include the

representation of different age groups and the distribution of males and females in the total sample as well as questions on the ancestry of particular individuals.

Age Distribution of Total Sample

The age distribution of the overall sample used in this research shows a peculiar picture that requires further discussion. An overview of the distribution of the different age categories has been visualised in Graph 1. The overview shows that the vast majority of the sample (84.1%) consists of adult individuals and that the remainder of the age categories is greatly underrepresented.



Graph 1 **The percentages of each age category in the total sample.**

This pattern of relatively low numbers of infants and children in skeletal assemblages has previously been noted both globally (Lewis 2007:20-23) and in the Caribbean (Curet 2005), in particular for a number of Puerto Rican collections. Several explanations have been provided for the underrepresentation of non-adult skeletal remains, which will be discussed briefly here (see Lewis 2007:20-37 for an overview of the matter).

However, before the dissemination of these arguments one crucial factor should be noted: the sample presented here only represents those individuals with a relatively complete cranial vault that were selected for study, and thus the distribution of age presented here is not reflective of the actual age distribution within specific sites. In fact, this factor may lead to a marked bias, as infant and child crania tend to be more fragile and are therefore more likely to be excluded from study. However, despite this,

it is important to consider the factors that may have contributed to the significant skewing of the distribution seen in Graph 1.

Firstly, the absence of non-adult individuals in assemblages is often considered a result of the inherently poor preservation of these fragile remains. As a rule of thumb good adult preservation indicates a similar state for children and enhances the recovery rate of non-adult remains (Lewis 2007). Morbán Laucer (1979) specifically discusses the poor state of preservation of foetal remains from the site of La Caleta, so this factor should not be ruled out for the Caribbean assemblages even though most adult remains from the site were in excellent condition.

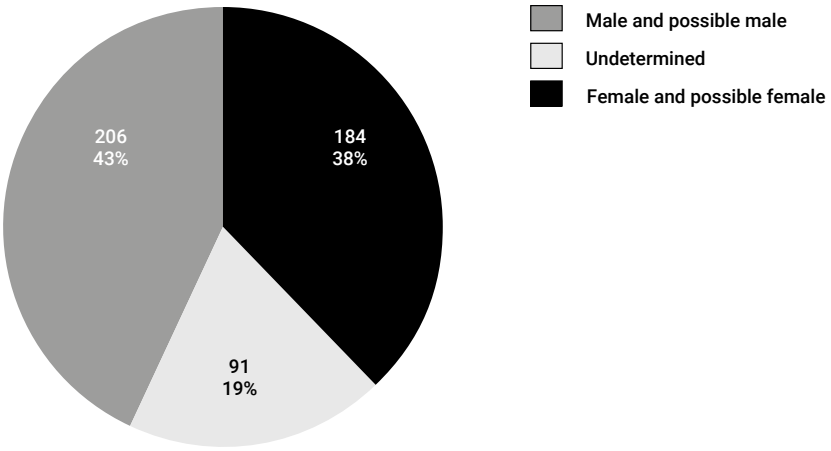
The second explanation for a lack of non-adults in a skeletal assemblage is misidentification of the remains, due to a lack of experience with these complex and small remains by excavators (Lewis 2007). The misidentification of human foetal remains as animal bones at the site of Kwatta Tingiholo in Suriname is an excellent Caribbean example of this problem (van Duijvenbode 2012).

Thirdly, special mortuary treatment of certain age categories in past societies may bias our sample (Lewis 2007). Burial of infants and children in different locations or in specified locales within the communal burial area may mean they are not recovered during excavation. Furthermore, different burial practices, for example cremation, for non-adult remains may hinder the recognition of these remains and the potential for data recovery (Lewis 2007).

Any combination of the factors mentioned above may be responsible for the skewed age categorisation in the overall sample. However, since age-at-death is not a relevant explanatory tool in determining the social motivations behind the practice of intentional cranial modification (see the section on Age in Chapter 5), the clear bias of the sample towards adult individuals does not have a negative impact on the usability of this sample to answer the research questions.

Sex Distribution of Total Sample

The distribution of sex of the adult individuals per country can be seen in Graph 2. The relatively large number of individuals for which the sex could not be determined with accuracy is due to the poor preservation of skeletal remains and comingling of individuals in certain assemblages. The categories of female and possible female and male and possible male were pooled for this analysis to provide a larger sample size.



Graph 2 **The distribution of biological sex in the total sample.**

The expected overall ratio of males to females in a normal population is 1:1. A Chi-square goodness-of-fit test was executed to determine whether the observed distribution of sex differed from the expected ratio. The results of the Chi-square goodness-of-fit test were chi-square=1.241, 1 d.f., p=0.265. This indicates that the null hypothesis cannot be rejected and that there is no statistically significant difference between the observed frequencies of male and females in the sample and the expected 1:1 ratio.

Ancestry

Several of the crania encountered in skeletal collections originating from the Caribbean were potentially non-Amerindian origin, based either on contextual information or observations of cranial morphology. Determination of geographic ancestry based solely on skeletal material is complicated from a methodological and social point of view. These analyses have only been undertaken here due to the importance of restricting the sample to the Amerindian inhabitants of the Caribbean in order to study indigenous head shaping practices. All crania mentioned in Table 11 and described in this section are registered as suspected non-Amerindian in this study and any indications to a particular geographic ancestry should be considered speculative. Further testing of the cranial measurement means of this group will take place in the following section on cranial metrics.

In several cases, a combination of cranial morphological traits and contextual information suggesting a colonial period date were used to label individuals as suspected non-Amerindian in origin. CBV691 was found on the colonial Caneel Bay plantation on St John in the US Virgin Islands. The dentition of DCAB001 has a bilateral pipe notch created by pipe smoking, a practice which was only introduced in the Caribbean after

the arrival of Europeans in AD 1492. DCAB002, obtained at the same time from the same source, is therefore probably also colonial in date. Three crania from the early colonial site of El Chorro de Maíta, where interaction between Amerindians, Europeans, and Africans took place (Valcárcel Rojas 2012), have morphological traits that suggest they may represent individuals of non-Amerindian descent.

Cranium DCAJ012 from Jamaica is the most likely match for an African skull described in Flower's 1891 analysis of the Jamaican skeletal material. Unfortunately, the Fordisc 3.0 analysis of the cranial measurements is inconclusive, indicating an almost equal distance to Amerindian and African groups. The skull of DCAJ027, also from Jamaica, was marked 'Uncle Ben'. The missing facial portion of the cranium prevented a reliable ancestry determination using Fordisc 3.0. In both cases, the crania have conservatively been considered of non-Amerindian ancestry. DCAJ026 from Jamaica and a number of crania from the island of Guadeloupe, EC250, EC254, EC260, EC270, and PEC275, lacked all contextual information. Here, ancestry determination was based solely on cranial morphology and assessment of cranial metrics using Foredisc 3.0.

Table 11 **Overview of individuals with suspected non-Amerindian ancestry. S= significant result, NS= non-significant result.**

ID Code	Island	Site	Fordisc 3.0	Source
CBV691	St John (VI)	Caneel Bay Plantation	–	
CDM22	Cuba	El Chorro de Maíta	–	Weston 2012
CDM45	Cuba	El Chorro de Maíta	–	Weston 2012
CDM81	Cuba	El Chorro de Maíta	–	Weston 2012
DCAB001	Barbados	Barbados US1	Black Males (S) Distance 19.4, PP 0.812, TF 0.382, TC 0.189, TR 0.292	
DCAB002	Barbados	Barbados US1	White (NS) Distance 28.1, PP 0.633, TF 0.015, TC 0.005, TR 0.006	
DCAJ012	Jamaica	Pedro Bluff Cave	Inconclusive	Flower 1891
DCAJ026	Jamaica	Jamaica US2	–	
DCAJ027	Jamaica	Jamaica US2	Inconclusive	
EC250	Guadeloupe	Guadeloupe US1	Black Females (S) Distance 13.4, PP 0.783, TF 0.511, TC 0.343, TR 0.278	
EC254	Guadeloupe	Guadeloupe US1	White (NS) Distance 28.0, PP 0.724, TF 0.293, TC 0.176, TR 0.288	
EC260	Guadeloupe	Guadeloupe US1	Black (NS) Distance 37.8, PP 0.797, TF 0.015, TC 0.001, TR 0,010	
EC270	Guadeloupe	Guadeloupe US1	Black (S) Distance 20.7, PP 0.989, TF 0.250, TC 0.078, TR 0.147	
PEC275	Guadeloupe	Petit Canal	Black Females (S) Distance 28.0, PP 0.995, TF 0.794, TC 0.215, TR 0.351	

This section will investigate the data gathered from the cranial measurements collected during the study. The standard suite based on Buikstra and Ubelaker (1994) consists of 24 cranial measurements, but the collection is severely influenced by the state of preservation of the cranium. A complete skull will yield all measurements, but this is rarely the case with archaeological specimens. In this study, the overall mediocre preservation of the Caribbean skeletal material and relatively high degree of fragmentation has resulted in significant amounts of unobtainable measurements.

The high degree of missing data impacts the choice of statistical methods as well as the reliability of the results. Pooling the data for large scale analysis, predominantly Caribbean comparisons between different groups, was successful and these tests are presented below. Unfortunately, the data did not allow for a reliable exploration of smaller scales of analysis such as region, country, or site.

Comparisons between the means of different groups on a regional level will be presented first. Statistical methods by Clark and colleagues (2007) and O'Brien and Stanley (2013) to recognise modification status and shape through cranial metrics will then be tested on this Caribbean skeletal dataset.

Comparing Means

Comparing the means between different groups is a simple and efficient way to analyse the cranial measurements without issues due to the large amount of missing data in this dataset. This section will test whether significant differences exist in relation to ancestry, modification status, and cranial shape.

Ancestry

Normal cranial shape variation exists within and between different populations, so the crania belonging to individuals of suspected non-Amerindian ancestry are likely to differ from the non-modified Amerindian crania in the sample. This was tested with an Independent Samples t-test.

Table 12 Results of Independent Samples t-test comparing the cranial measurement means between Amerindians and those of suspected non-Amerindian origin.

Measurement	Ancestry	N	Mean	SD	SE	T	DF	Sig	Mean Difference	SE Difference
Maximum Cranial Length	Amerindian	84	171.476	8.6198	0.9405	–2.949	95	0.004	–7.5238	2.5516
	Suspected Non-Amerindian	13	179	8.1445	2.2589					
Biauricular Breath	Amerindian	66	124.833	6.475	0.797	2.169	76	0.033	4.4167	2.0364
	Suspected non-Amerindian	12	120.417	6.5707	1.8968					
Minimum Frontal Breath	Amerindian	86	94.221	4.6511	0.5015	–2.172	98	0.032	–2.9219	1.345
	Suspected non-Amerindian	14	97.143	4.7694	1.2747					
Biorbital Breath	Amerindian	32	95.031	3.9225	0.6934	–2.456	37	0.019	–4.1116	1.6744
	Suspected non-Amerindian	7	99.143	4.4508	1.6822					
Interorbital Breath	Amerindian	38	23.026	2.1622	0.3507	–4.329	44	0.000	–3.8487	0.8891
	Suspected non-Amerindian	8	26.875	2.8504	1.0078					
Frontal Chord	Amerindian	90	105.867	4.7291	0.4985	–2.41	100	0.018	–3.55	1.473
	Suspected non-Amerindian	12	109.417	5.2822	1.5248					
Frontal Arc	Amerindian	59	117.237	6.1176	0.7964	–2.844	65	0.006	–6.6377	2.3336
	Suspected non-Amerindian	8	123.875	6.7915	2.4012					
Parietal Chord	Amerindian	81	104.457	6.5289	0.7254	–2.659	92	0.009	–5.3124	1.9976
	Suspected non-Amerindian	13	109.769	7.6502	2.1218					
Occipital Arc	Amerindian	53	110.491	8.1727	1.1226	–1.885	62	0.064	–5.1458	2.7295
	Suspected non-Amerindian	11	115.636	8.5706	2.5841					
Mastoid Length	Amerindian	32	25.219	3.8247	0.6761	–2.677	36	0.011	–4.6146	1.7235
	Suspected non-Amerindian	6	29.833	4.1673	1.7013					

The analysis shows that several measurements have significantly different means, indicating cranial shape differences between the two groups as was expected. This supports the exclusion of these individuals from the remainder of all following analyses unless expressly otherwise indicated.

Modification Status

The measurement means are compared between the modified and non-modified subsets of the population. Any crania of suspected non-Amerindian ancestry were excluded from the analysis to ensure differences in normal cranial variation did not impact on the results. A one-way Independent Samples t-test showed significant

differences existed between the two groups for the maximum cranial length, maximum cranial breath, minimum frontal breath, upper facial breath, orbital height, interorbital breath, frontal arc, parietal chord, and the parietal arc, as can be seen in Table 13.

Table 13 Results of Independent Samples t-test comparing the cranial measurement means between modified and non-modified crania.

Measurement	ICM	N	Mean	SD	SE	T	DF	Sig	Mean Difference	SE Difference
Maximum Cranial Length	Yes	165	164.679	79.095	0.6158	6.219	247	<0.001	6.7974	1.0931
	No	84	171.476	8.6198	0.9405					
Maximum Cranial Breath	Yes	158	148.924	6.8334	0.5436	−8.095	234	<0.001	−7.5138	0.9282
	No	78	141.41	6.4434	0.7296					
Minimum Frontal Breath	Yes	155	96.465	6.3146	0.5072	−2.88778099	239	0.00423546	−2.2435859	0.77692384
	No	86	94.221	4.6511	0.5015					
Upper Facial Breath	Yes	138	106.232	5.0128	0.4267	−2.75228616	217	0.00641891	−1.84916801	0.67186619
	No	81	104.383	4.4118	0.4902					
Orbital Height	Yes	93	36.022	4.4842	0.4650	−2.02643084	128	0.04479843	−1.56204592	0.77083604
	No	37	34.459	2.1291	0.3500					
Interorbital Breath	Yes	73	24.932	3.7688	0.4411	−2.87570876	109	0.0048494	−1.90519106	0.66251183
	No	38	23.026	2.1622	0.3507					
Frontal Arc	Yes	96	110.448	7.1875	0.7336	6.033967558	153	1.158E−08	6.789371469	1.12519191
	No	59	117.237	6.1176	0.7964					
Parietal Chord	Yes	158	97.133	5.7585	0.4581	8.888	237	0.000	7.3239	0.8240
	No	81	104.457	6.5289	0.7254					
Parietal Arc	Yes	117	108.795	8.1055	0.7494	5.853514867	176	2.3049E−08	7.319882303	1.25051059
	No	61	116.115	7.5434	0.9658					

The mean differences in the maximum cranial length, frontal arc, parietal chord, and parietal arc show that modified crania are shorter than their normal counterparts, whereas the maximum cranial breath, minimum frontal breath, and upper facial breath means indicate they are broader. The significant difference in orbital height and interorbital breath shows that these changes are not restricted to the vault but also impact the upper half of the facial area, which is confirmed by the minimum frontal breath and upper facial breath.

Modification Types

An Anova test was executed to see if different modification types result in different metric patterns. Three types of modification were compared: frontal flattening, fronto-occipital modification, and occipital flattening. The number of measurements available for the other cranial shapes recognised in this investigation was too small.

Table 14 Results of an Anova comparing the cranial measurement means of different modification types.

Measurement	Type	N	Mean	SD	SE	F	DFm	DFr	P	Posthoc
Maximum Cranial Length	Frontal Flattening	26	168	7.642	1.4987	3.535	2	185	0.031	Yes
	Fronto-Occipital	151	164.629	8.0138	0.6522					
	Occipital Flattening	11	160.727	8.6034	2.594					
Parietal Chord	Frontal Flattening	26	98.5	6.2498	1.2257	3.885	2	179	0.022	Yes
	Fronto-Occipital	144	96.931	5.4832	0.4569					
	Occipital Flattening	12	101.417	7.5614	2.1828					

Two measurements show statistically significant differences between the means of different modification types: the maximum cranial length and the parietal chord. A post hoc Tukey HSD test was executed on these two measurements.

Table 15 Results of a post hoc Tukey HSD test of significant differences between modification types. * indicates the mean difference is significant at the 0.05 level.

Measurement	(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
Maximum Cranial Length	Fronto-Occipital	Frontal Flattening	–3.3709	1.6982	0.119
		Occipital Flattening	3.9019	2.4977	0.265
	Occipital Flattening	Frontal Flattening	–7.2727*	2.8766	0.033
Parietal Chord	Fronto-Occipital	Frontal Flattening	–1.5694	1.2239	0.407
		Occipital Flattening	–4.4861*	1.7257	0.027
	Occipital Flattening	Frontal Flattening	2.9167	2.0044	0.315

This post hoc test shows that difference in maximum cranial length is only significant between frontal and occipital flattening. Fronto-occipital modification, a combination of frontal and occipital flattening, falls between the two.

The parietal chord changes are significant only for occipital and fronto-occipital flattening. This seems to indicate that the positional change of lambda created by occipital flattening and fronto-occipital modification is more important than the shift in bregma created by frontal flattening and fronto-occipital modification.

Modification Subtypes

An Anova analysis was executed to determine if the subtype of modification impacts the cranial measurement means. Three subtypes were tested: parallel, parallel-vertical, and vertical modification.

Table 16 Results of an Anova test comparing the cranial measurement means of different modification subtypes.

Measurement	Subtype	N	Mean	SD	SE	F	DFm	DFr	P	Posthoc
Maximum Cranial Length	Parallel	116	166.457	7.5773	0.7035	18.154	2	144	<0.001	Yes
	Parallel-Vertical	6	156.667	10.3473	4.2243					
	Vertical	25	157.64	5.5818	1.1164					

Only the maximum cranial length showed significant differences between the three subtypes. A post hoc Tukey HSD test was executed to study the results further.

Table 17 Results of a post hoc Tukey HSD test of significant differences between modification subtypes. * indicates the mean difference is significant at the 0.05 level.

Tukey HSD					
Dependent Variable	(I) Subtype	(J) Subtype	Mean Difference (I-J)	Std. Error	Sig.
Maximum Cranial Length	Parallel	Parallel-Vertical	9.7902*	3.0983	0.005
		Vertical	8.8169*	1.6318	0.000
	Vertical	Parallel-Vertical	0.9733	3.3642	0.955

The Anova test and Post Hoc analysis both show that the parallel subtype clearly differs from parallel-vertical and vertical modification but the latter two are very similar and cannot be differentiated based on the measurement means.

Testing for Cranial Modification

The recognition of cranial modification solely by visual inspection is subjective and creates variation between different investigators, adding to the analytical issues created by different standards and classifications for altered head shapes and the difficulty in distinguishing mild modifications from normal cranial shape variation. Recent studies by Clark and colleagues (2007) and O'Brien and Stanley (2013) have attempted to overcome this issue by creating methods for identifying modified crania based on cranial metrics. Both methods have been tested on the Caribbean skeletal assemblage and will be assessed and compared with the visual inspection and each other.

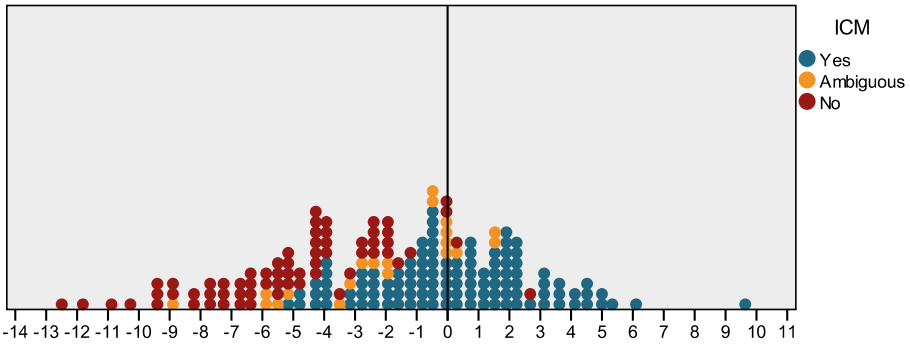
Clark et al. (2007)

The method developed by Clark and colleagues (2007) requires six cranial measurements using four landmarks along the mid-sagittal plane. These measurements were only available for 30% of the total sample. The outcome of Clark's method in comparison to the visual inspection by the author can be seen in Table 18. There is a 68% correspondence rate between the two assessments. There are two factors that influence the difference in assessment: the conservative regression formula and the cranial shape.

Table 18 Comparison of classification by Clark et al. (2007) and the visual assessment by the author.

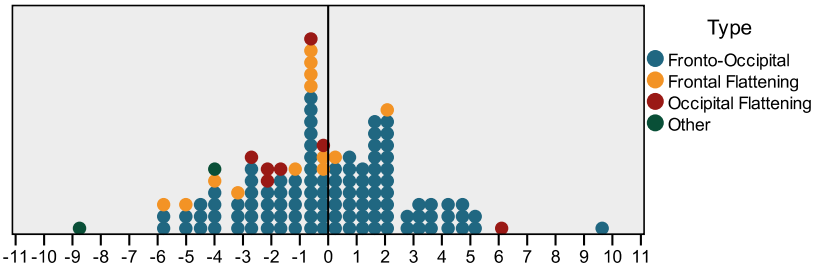
		Visual Assessment		
		Yes	No	Total
Clark	Yes	56	3	59
	No	52	61	113
	Total	108	64	172

The regression formula used by Clark et al. (2007) is conservative in nature, meaning that normal skulls should never score as modified. The down side is that mild modification will likely be scored as unmodified and this is partially responsible for the gap between the visual assessment and regression score. Caribbean cranial modification is often relatively mild and this creates difficulties for the Clark method. This can also be seen in Graph 3, which shows the score produced by the function (where everything above 0 is considered modified) and the visual assessment. Clearly, the majority of disagreements consist of crania that show signs of modification in the visual classification yet produce a score below 0.



Graph 3 Visual representation of the comparison between the method by Clark et al. (2007) and the visual assessment by the author.

The type of cranial modification also plays a role in the effectiveness of the method by Clark et al. (2007). A test by the authors suggested the method was less likely to correctly identify frontal flattening and this is clearly supported by Graph 4 showing cranial type in relation to the Clark score. All but two cases of frontal flattening are classified as unmodified and a similar pattern can be seen in cases of occipital flattening.



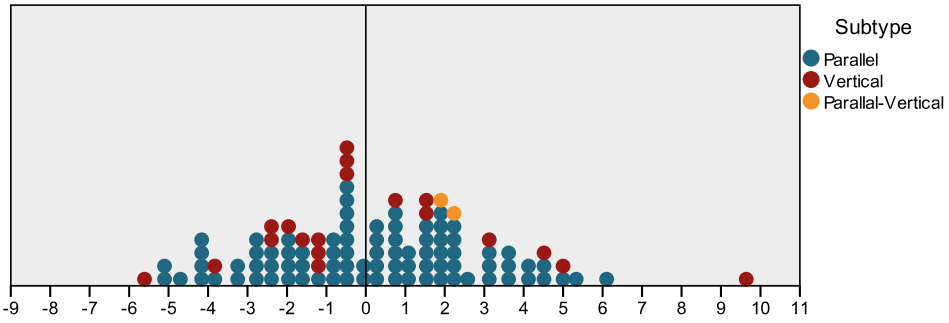
Graph 4 **Visual representation of the comparison between the method by Clark et al. (2007) and the visual assessment by the author for each modification type.**

The correspondence rates between the visual classification of type and the Clark score, based on the data in Table 19 which excludes cases classed as ambiguous in the visual classification, confirms this picture. There is 58% agreement for crania with fronto-occipital modification, but this drops to 20% for both frontal and occipital flattening.

Table 19 **Comparison of classification by Clark et al. (2007) and the visual assessment by the author for each modification type.**

Clarke	Fronto-Occipital	Frontal Flattening	Occipital Flattening
Yes	53	2	1
No	39	8	4
Total	92	10	5

Looking at the relationship between subtype and score provides a different picture. Graph 5 does not show a clear patterning.



Graph 5 **Visual representation of the comparison between the method by Clark et al. (2007) and the visual assessment by the author for each modification subtype.**

Table 20 shows the same relationship without the crania marked ambiguous in the visual classification. The correspondence rates between the Clark method and the visual inspection are 57% for the parallel subtype, 41% for the vertical subtype, and 100% for the parallel-vertical subtype.

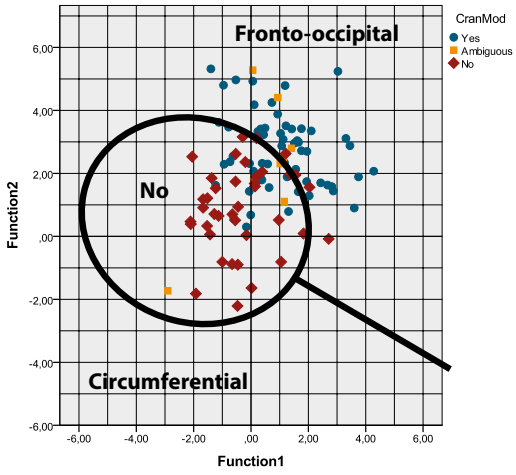
Table 20 Comparison of classification by Clark et al. (2007) and the visual assessment by the author for each modification subtype.

	Subtype		
Clarke	**Parallel**	**Vertical**	**Parallel-Vertical**
Yes	43	7	2
No	32	10	0
Total	75	17	2

O'Brien and Stanley (2013)

O' Brien and Stanley (2013) present a method for assessing cranial modification using a discriminant function analysis looking at the mid-sagittal and coronal plane based on four measurements and seven cranial landmarks. The advantage of this function is that it looks at both modification status and shape: it will indicate whether a skull is modified and whether the shape is more consistent with circumferential or fronto-occipital modification (O'Brien and Stanley 2013). The disadvantage is that the necessity of considering more landmarks requires better cranial preservation and this effect can be seen in the current sample where these four measurements are only present in 104 Amerindian skulls and an additional 10 crania of disputed ancestry out of a total of 571 crania or a mere 20% of the total sample.

The results of the two discriminant functions are plotted in Graph 6, showing the classification by O'Brien and Stanley alongside the results of the visual classification.



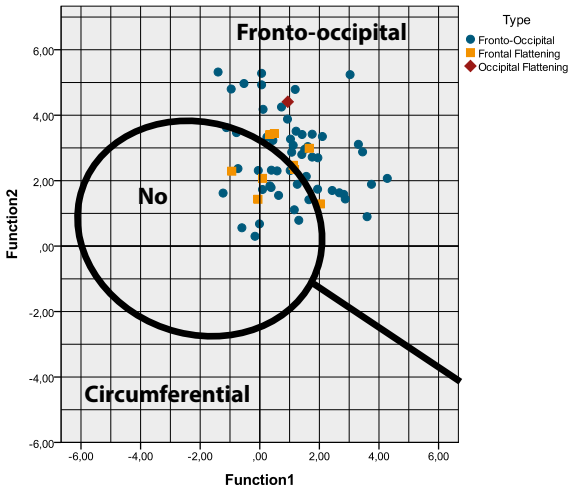
Graph 6 Visual representation of the comparison between the method by O'Brien and Stanley (2013) and the visual assessment by the author.

Table 21 shows the outcome of the O'Brien and Stanley function in relation to the visual classification by the author. The correspondence rate between the two methods is 73%.

Table 21 **Comparison of classification by O'Brien and Stanley (2013) and the visual assessment by the author.**

		Visual Assessment		
		Yes	**No**	**Total**
O'Brien and Stanley	Yes	39	6	45
	No	20	33	53
	Total	59	39	98

The results of O'Brien and Stanley were also plotted in relation to the type of modification in Graph 7 to determine if shape designated by the function corresponds to the visual assessment and whether the method is influenced by different cranial shapes. The method developed by O'Brien and Stanley (2013) distinguishes between fronto-occipital and circumferential modification. Frontal and occipital flattening are not given a separate category according to this method, but would likely produce similar, if less marked, results as fronto-occipital modification. The single cranium with circumferential modification in the sample did not produce all necessary measurements required for this method.



Graph 7 **Visual representation of the comparison between the method by O'Brien and Stanley (2013) and the visual assessment by the author for each modification type.**

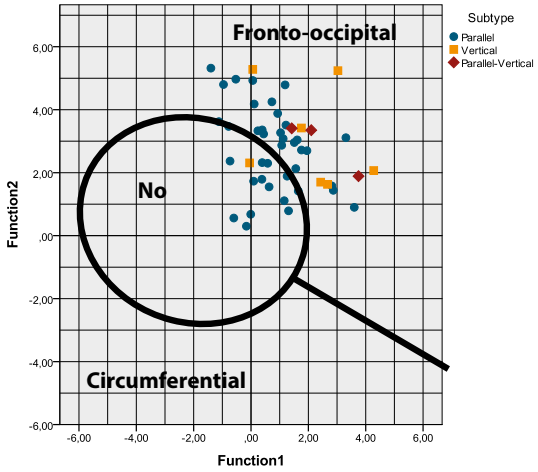
The results of O'Brien and Stanley in relation to the visual classification of types are represented in Table 22. Any crania with ambiguous status have been removed from the analysis. The correspondence rates between fronto-occipital modification and frontal flattening are very similar at 68% and 63%, respectively. This similarity seems to indicate that the O'Brien and Stanley method is not influenced by differences in

type. No definite cases of occipital modification provided all necessary landmarks for measurement, the single individual depicted in Graph 7 was classed as ambiguous during the visual inspection.

Table 22 **Comparison of classification by O'Brien and Stanley (2013) and the visual assessment by the author for each modification type.**

		Visual Assessment	
		Fronto-occipital	Frontal Flattening
O'Brien and Stanley	Fronto-occipital	34	5
	No	16	3
	Total	50	8

The results of the discriminant function have been plotted in Graph 8 for each subtype, in order to see if the subtype impacts the results of the method.



Graph 8 **Visual representation of the comparison between the method by O'Brien and Stanley (2013) and the visual assessment by the author for each modification subtype.**

The same relationship is shown in Table 23 without the inclusion of ambiguous crania. The correspondence rates are 65% for parallel, 83% for vertical, and 100% for parallel-vertical. Although there is some variation in rates, the overall agreement is relatively high and subtype appears to have no impact on the results of the method.

Table 23 Comparison of classification by O'Brien and Stanley (2013) and the visual assessment by the author for each modification subtype.

		Visual Assessment		
		Parallel	**Vertical**	**Parallel-Vertical**
O'Brien Stanley	Yes	24	5	3
	No	13	1	0
	Total	37	6	3

Comparison

The previous sections have looked more closely at each method, but here they are contrasted to determine the agreement between the methods. Table 24 shows the correspondence between the results of the Clark and O' Brien-Stanley methods.

Table 24 Comparison of the results of Clark et al. (2007) and O'Brien and Stanley (2013).

		Clark		
		Yes	**No**	**Total**
O'Brien and Stanley	Yes	20	21	41
	No	7	45	52
	Total	27	66	93

The correspondence rate is 70%, indicating a relatively high agreement between the results. The conservative nature of the Clark method is demonstrated by the relatively low number of skulls considered modified by Clark, but normal according to O'Brien and Stanley.

Table 25 shows the agreement between both methods and the visual inspection executed by the author. The correspondence rate – those cases in which all three methods agree – is 56%. It is interesting to notice that all crania that score as modified in Clark and O'Brien and Stanley are also considered modified in the visual inspection. Total disagreement – in other words where both methods indicate normal but the visual inspection has seen evidence of modification – only occurs in 15% of cases. Just over three-quarters of these crania (77%) showed mild degrees of head shaping.

Table 25 Comparison of the results of Clark et al. (2007), O'Brien and Stanley (2013), and the visual assessment by the author.

		Visual Assessment	
Clarke	**O'Brien and Stanley**	**Yes**	**No**
Yes	Yes	20	0
Yes	No	5	2
No	Yes	12	6
No	No	13	28

7.3 SOCIAL VARIABLES

This section will present the results of analyses looking at the relation between social variables and intentional cranial modification on the individual, local, and regional level. The identities expressed through intentional cranial modification can vary substantially and lacking living individuals to question, archaeologists must use bodily and material proxies to approach such social issues. Five different themes have been selected here in order to evaluate these social variables in relation to head shaping: prevalence, shape, sex, burial practices, and isotopes.

The prevalence of cranial modification can provide insight into the extent of the expressed identity within the group and provides a useful tool for comparing different communities. The same can be said of variations in type and subtype: different shapes may represent different identities within communities. The resulting cranial shapes also allow the reconstruction of head shaping practices. The relation between head shaping and biological sex is investigated through the ratio of females and males with and without modification as well as a more detailed look at variation in type and subtype between men and women.

The relation between cranial modification and burial practices will also be investigated in order to determine whether the identity expressed by head shaping affected the manner of burial. In particular, this study looks at the nature of the burial (primary or secondary), the amount of individuals buried in the grave (single or collective), the position (flexed or extended) and orientation (lateral, supine, prone) of the body in the grave, and the presence or absence of grave goods. Finally, the results of strontium isotope analyses to determine ancient mobility patterns will be correlated to the data on cranial modification to investigate whether head shaping practices are local or brought in from elsewhere.

The data are structured according to these five themes at each level of analysis, beginning at the individual life histories and ending with the larger regional trends. If data was not present or insufficient for analysis, the topic has been skipped.

Individual Life Histories

Exploring the social connections of cranial modification in the Caribbean will start at the most detailed and intimate level discussing the life and death of two particular individuals. Individual KR377 from Kelbey's Ridge 2 on Saba and CDM72B from El Chorro de Maíta on Cuba have been selected based on the detailed contextual information available, but more importantly because of the interesting stories they

tell about cranial modification in the pre- and post-Columbian Caribbean. The data on the sites of Kelbey's Ridge 2 and El Chorro de Maíta are presented here to provide the background for the life histories presented in the discussion.

Kelbey's Ridge 2

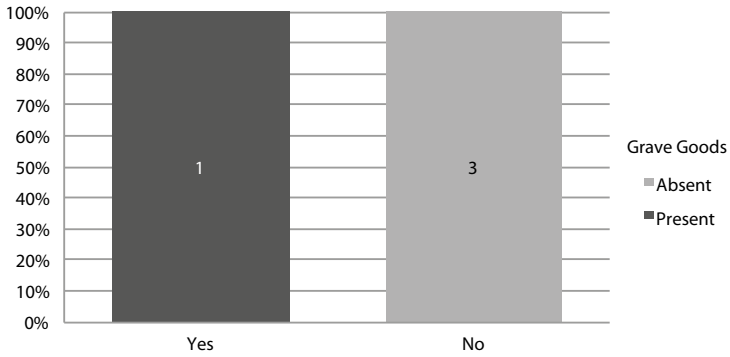
Only a single individual in the skeletal assemblage from Kelbey's Ridge 2 exhibits cranial modification, but the poor shape of the remainder of the cranial material may have hindered recognition. This is evidenced by the fact that only four of the ten crania were considered sufficiently preserved to assess the shape, as can be seen in Table 26.

Table 26 Prevalence of intentional cranial modification at Kelbey's Ridge 2.

	Yes	Ambiguous	No	Total
Kelbey's Ridge 2	1	0	3	4
Prevalence (%)	25	0	75	

The singular case of cranial modification, found in infant KR337, is of the fronto-occipital parallel type. Though the cranium was very fragmented, it showed minor planes of flattening on the frontal and occipital, combined with bulging parietals

Burial practices at Kelbey's Ridge 2 are complex and varied, but the number of individuals in this sample – i.e. only those that could be properly assessed for cranial modification – is relatively small. Even so, an analysis of the burial practices at Kelbey's Ridge 2 shows no significant differences in the type of inhumation or the position and orientation of the body within the grave with the exception of grave goods. The only individual buried with grave goods of the four that could be assessed for cranial modification was KR377, as can be seen in Graph 9. A Fisher's exact test provides a non-significant outcome of p=0.25, indicating that the two variables are independent. This result is likely due to the small sample size. In the overall assemblage, only children were found accompanied by grave goods at Kelbey's Ridge 2 (Hoogland 1996; Hoogland and Hofman 1993).



Graph 9 **Distribution of grave goods in relation to cranial modification at Kelbey's Ridge 2.**

Strontium isotope analysis was carried out in order to determine ancient patterns of mobility. All individuals from Kelbey's Ridge 2 have strontium signatures that correspond to the local range. However, this range was unexpectedly large and has a significant overlap with other Caribbean signatures. This makes interpreting the strontium results from Kelbey's Ridge difficult (Laffoon and Hoogland 2012).

El Chorro de Maíta

The majority of individuals found at El Chorro de Maíta had undergone intentional cranial modification. Table 27 presents three different prevalence calculations of head shaping at the site. The first provides the percentages of each category in the overall sample. The second set of percentages has been adjusted for the presence of ambiguous cases of modification by removing these from the sample. Finally, three individuals without cranial modification have a suspected non-Amerindian ancestry. In the final prevalence calculations these have been removed from the sample to provide the true prevalence among the Amerindian subset of the sample. The latter is considered most important when discussing the Amerindian social motivations for the practice.

Table 27 **Prevalence of intentional cranial modification at El Chorro de Maíta. * Indicates suspected non-Amerindian ancestry.**

ICM	Number of Individuals	Prevalence (%)	Adjusted Prevalence (%)	Adjusted Amerindian Prevalence (%)
Yes	58	79.45	85.29	89.23
Ambiguous	5	6.85		
No	7 + 3*	13.70	14.71	10.77
Total	73	100	100	100

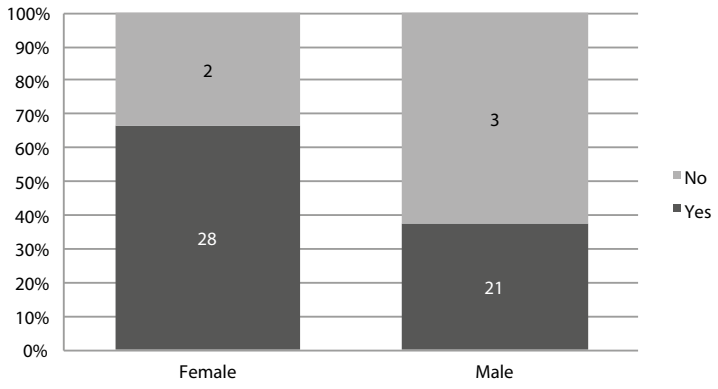
An outright majority of individuals – 86 percent – of the cranial shapes encountered at El Chorro de Maíta can be classified as fronto-occipital modification. The predominant subtype, found in more than half of the total modified population, is parallel modification with a low plane of occipital flattening. Two exceptions, a case of parallel-vertical and

vertical occipital orientation respectively, were found in the collection. Damage to the crania hindered the assessment of the subtype of modification in a quarter of cases. A handful of crania were classified as solely frontal or occipital flattening. In most cases, damage to the cranium hindered full assessment and too little evidence of fronto-occipital modification was present to classify them as such.

Table 28 Overview of modification types and subtypes at El Chorro de Maíta.

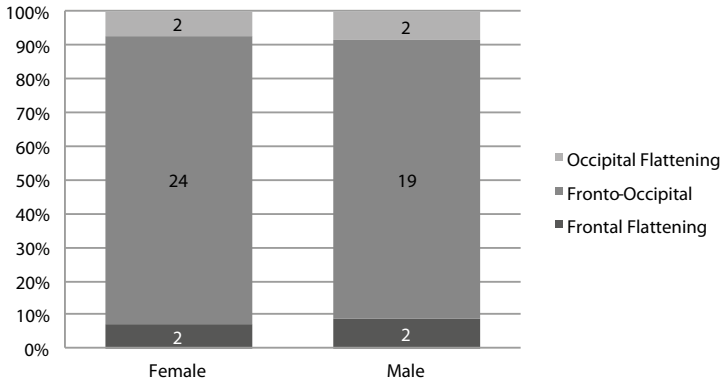
Type	Subtype	Number of Individuals	Percentage
Fronto-Occipital	Parallel	33	56.90
	Parallel-Vertical	1	1.72
	Vertical	1	1.72
	Undetermined	15	25.86
Frontal Flattening		4	6.90
Occipital Flattening	Parallel	1	1.72
	Undetermined	3	5.17
Total		58	100.00

Several analyses were carried out to determine if modification practices are related to sex at El Chorro de Maíta. Graph 10 shows the ratio of females to males in relation to the presence or absence of modification. A Fisher's exact test was executed to determine whether the proportion of males and females differed substantially between the modified and non-modified subset of the population. The result is p=0.646, indicating that the null hypothesis cannot be rejected and that there is thus no significant difference in the ratio of males to females between the two groups.



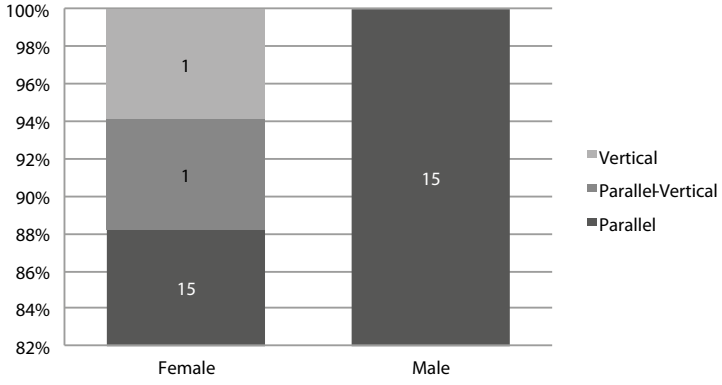
Graph 10 Relation between biological sex and cranial modification at El Chorro de Maíta.

The relationship between the sex of the individual and the main type of modification can be seen in Graph 11. The ratios of females and males look relatively similar in each category and this is confirmed by the non-significant p=1.000 of produced by a Fisher's exact test.



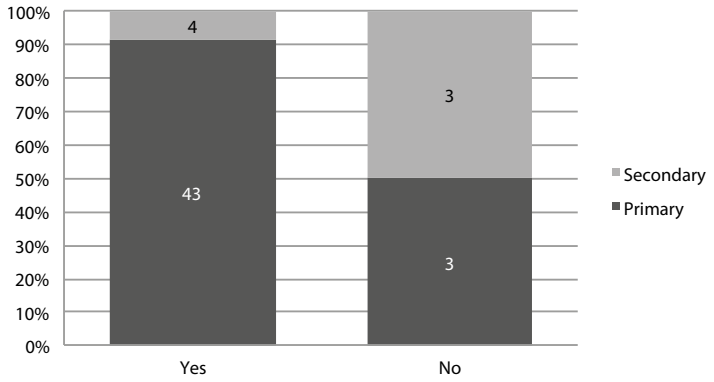
Graph 11 **Relation between biological sex and type of modification at El Chorro de Maíta.**

The relation between sex and subtype seen in Graph 12 does show an interesting result. The two individuals with vertical and parallel-vertical modification at the site are both female. The ratio of females to males in the parallel category is exactly 1:1. A Fisher's exact test produced a non-significant p=1.000 value, likely due to the very small number of individuals in the parallel-vertical and vertical sub-categories.



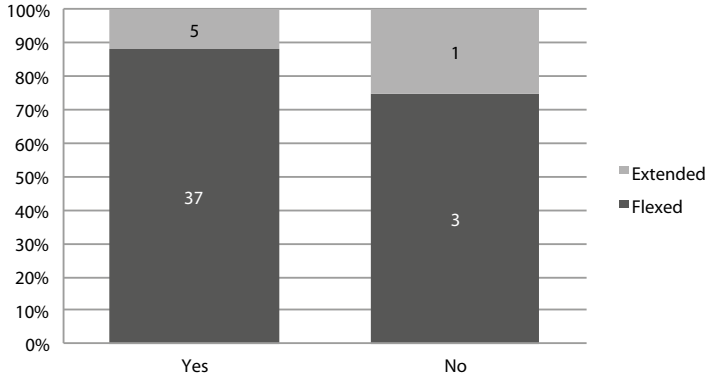
Graph 12 **Relation between biological sex and subtype of modification at El Chorro de Maíta.**

The majority of burials were primary in nature with minor indications of secondary burial practices as can be seen in Graph 13. The high proportion of secondary burial practices among the non-modified individuals is remarkable. A Fisher's exact test produced a p=0.025, which indicates that there is a statistically significant difference between the proportions observed among the different groups. However, the small sample size in certain categories should be taken into account when interpreting this result.



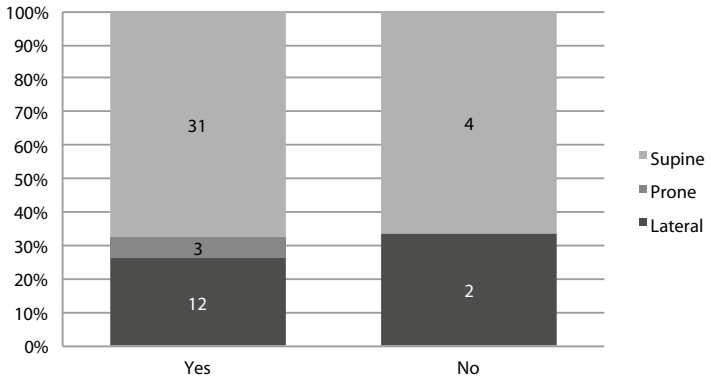
Graph 13 **Relation between type of burial and cranial modification at El Chorro de Maíta.**

When studying the burial position in more detail, most individuals have been buried in a flexed position considered traditional for the indigenous inhabitants of the region during the Late Ceramic Age, as can be seen in Graph 14. A Fisher's exact test was executed to determine whether the ratio of the different burial positions was significantly different between groups. The outcome of p=0.440 is not significant.



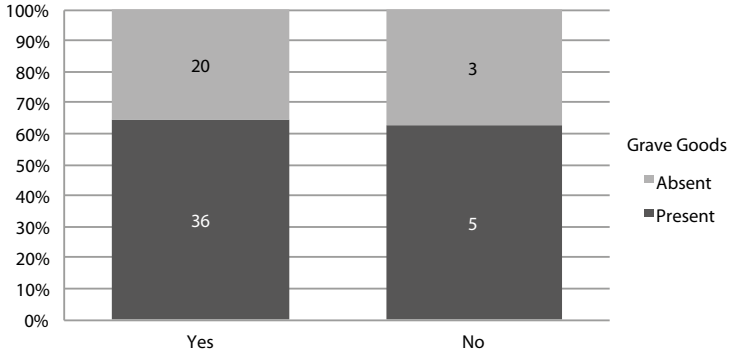
Graph 14 **Relation between burial position and cranial modification at El Chorro de Maíta.**

Graph 15 shows the different positions of the body in the grave per modification category, again varying widely among the population although a majority was placed supine. Three individuals were found in a prone position and all have cranial modification. A Fisher's exact test yielded a p= 1.000. This means the results are not statistically significant and the null hypothesis cannot be rejected. There is thus no difference in the proportions of the burial manner among the categories of modification.



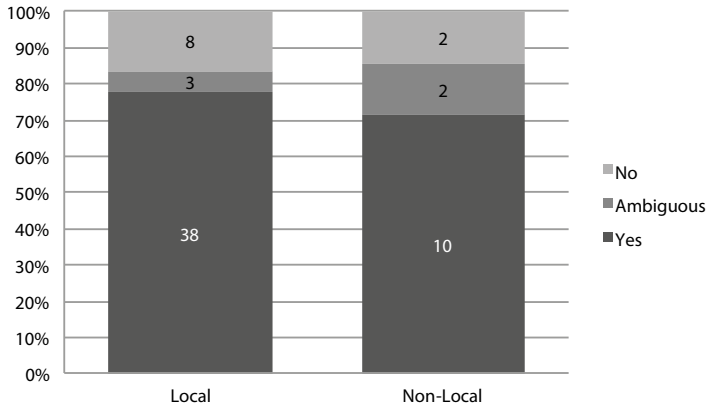
Graph 15 **Relation between body orientation and cranial modification at El Chorro de Maíta.**

The presence and absence of grave goods in relation to cranial modification is displayed in Graph 16. A substantial minority of the assemblage was found without grave goods. A Fisher's exact test gave a non-significant outcome of p=1.000. This means that the presence or absence of grave goods is not related to intentional cranial modification at El Chorro de Maíta.



Graph 16 **Distribution of grave goods in relation to cranial modification at El Chorro de Maíta.**

The prevalence of cranial modification among the local and non-local subsets of the population is shown in Graph 17. A Fisher's exact test was executed to determine whether intentional cranial modification and strontium signature were independent. The outcome of p=0.582 suggests that the null hypothesis cannot be rejected and that there is no statistically significant difference in proportion between the two groups.



Graph 17 **Relation between isotopic signature and cranial modification at El Chorro de Maíta**

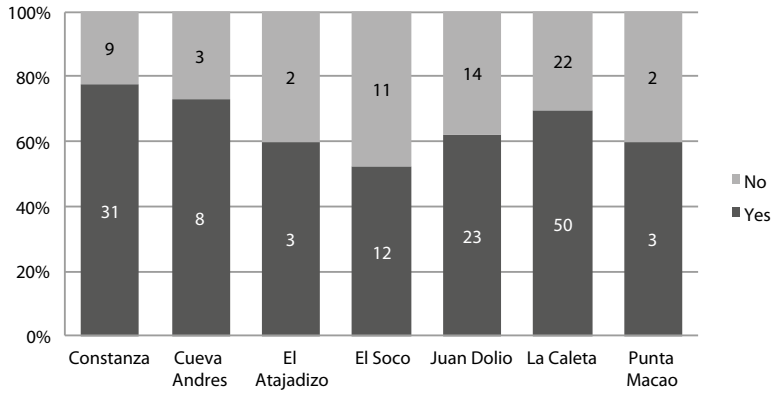
Dominican Republic

Moving on from the individual scale, head shaping practices at different sites in the Dominican Republic will be described and compared. The Dominican Republic has been chosen because it has proven the richest source for skeletal material in the region, providing 43% of the entire sample. Furthermore, historic sources have provided detailed information on the indigenous societies of the island of Hispaniola –shared by modern nations Haiti and the Dominican Republic – in the early colonial period, including the presence of different dialects, making this an excellent location for studying potential differences in head shaping practices between communities on a single island.

The results presented here will start by contrasting the different sites to see if there is a significant differences between assemblages. Sites with less than five individuals were removed from this comparative analysis to prevent issues with skewing and outliers. If similar patterns are found at each site, the data will be combined to show the wider trends occurring across the country.

Prevalence

The prevalence of cranial modification in the Dominican Republic is shown in Graph 18. A glance at the graph shows comparable modification rates for all sites with only minor differences. This is confirmed by the non-significant p=0.471 outcome of the Fisher's exact test. Modification rates are thus comparable in all sites and form a trend across the Dominican Republic.



Graph 18 **The prevalence of cranial modification for each examined site from the Dominican Republic.**

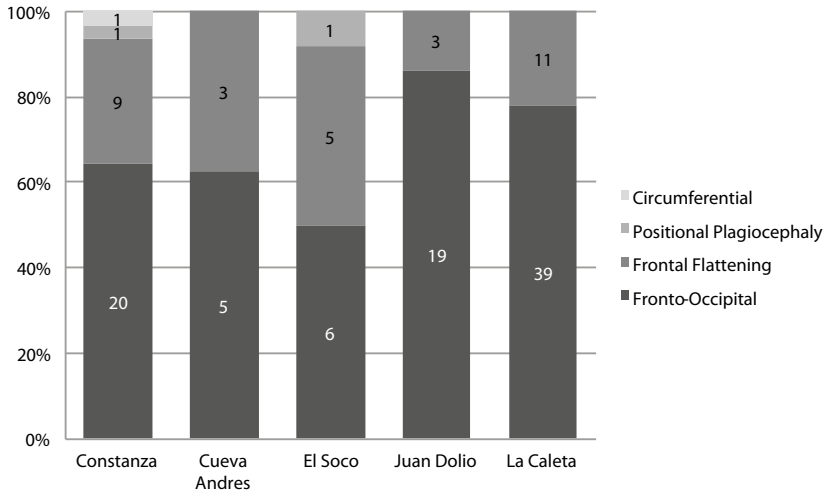
Table 29 provides an overview of cranial modification in the skeletal assemblages from the Dominican Republic. The overall prevalence suggests just over half of all individuals were subjected to intentional cranial modification. The adjusted prevalence – calculated by removing the ambiguous cases – is higher at 69%.

Table 29 **Prevalence of cranial modification in the Dominican Republic.**

Prevalence % (N)			Adjusted Prevalence % (N)	
Yes	Ambiguous	No	Yes	No
54.80 (137)	20.00 (50)	25.20 (63)	68.50 (137)	31.50 (63)

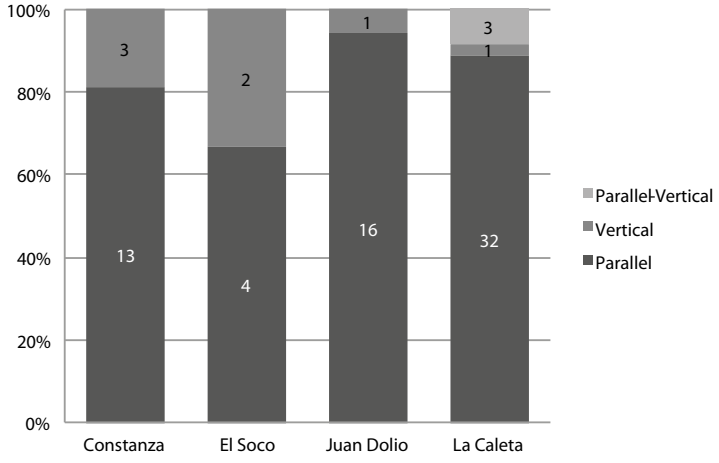
Shape

Graph 19 shows the main types of modification encountered within each site assemblage on the Dominican Republic. It is clear that fronto-occipital modification and frontal flattening make up the majority of cases encountered, but there is some mild variation in the rates between different sites. A Fisher's exact test was carried out to determine if significant different patterns exist. The outcome of p=0.183 is not statistically significant and indicates there is no substantial difference between these sites based on the main type of modification.



Graph 19 **Types of cranial modification found per site in the Dominican Republic.**

The different subtypes encountered in each assemblage are displayed in Graph 20. The outright majority of cases in the Dominican Republic have been classified as parallel modification. A Fisher's exact test produced an outcome of p=0.093, indicting there is no statistically significant difference in the subtypes encountered at the different sites.



Graph 20 **Subtypes of cranial modification found per site from the Dominican Republic.**

An overview of the different modification types encountered in the skeletal material from the Dominican Republic can be seen in Table 30. The predominant type of modification, fronto-occipital, is present in 73% of all modified crania when only the main type is taken into account. This is followed by frontal flattening, seen in approximately a quarter of this sample. The remaining types are only represented by single cases in the data set. The

predominance of fronto-occipital and frontal flattening points towards the importance of the flattened forehead, a feature shared by these two types of modification.

Of great interest is the sole case of circumferential modification encountered in this assemblage. The cranium has a very long sloping forehead – in line with the fronto-occipital modification and frontal flattening seen at the site – but the remainder of the vault is narrow and elongated as opposed to broad and short. Unfortunately, there is some damage to the lower occipital region.

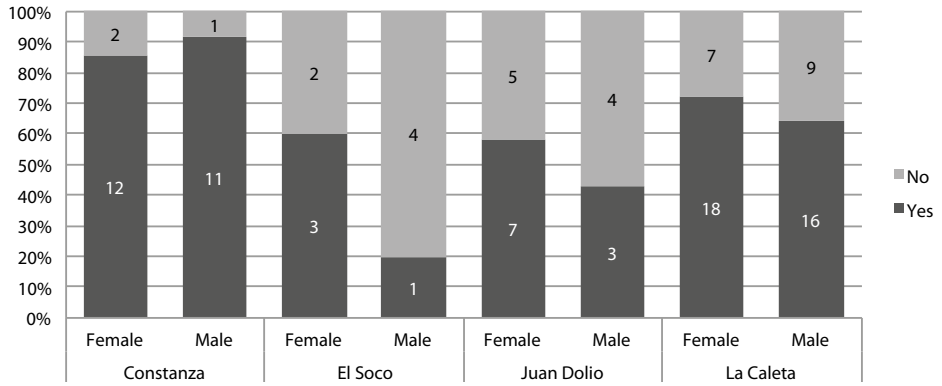
Table 30 Overview of modification types and subtypes found in the Dominican Republic.

Type	Subtype	Number of Individuals	Percentage
Fronto-Occipital	Parallel	77	56.20
	Parallel-Vertical	4	2.92
	Vertical	8	5.84
	Undetermined	11	8.03
Frontal Flattening		33	24.09
Circumferential	Parallel	1	0.73
Positional Plagiocephaly		2	1.46
Undetermined	Undetermined	1	0.73
Total		137	100.00

When looking at the subtypes of cranial modification in more detail, it becomes apparent that the parallel position of the occipital board is by far the most common. This subtype is seen in 56% of the overall modified subset of the population and present in 77% of individuals with fronto-occipital modification. Other positions of the occipital board, parallel-vertical and vertical, are only represented by a handful of individuals from the sites of Juan Dolio, El Soco, La Caleta, and Constanza.

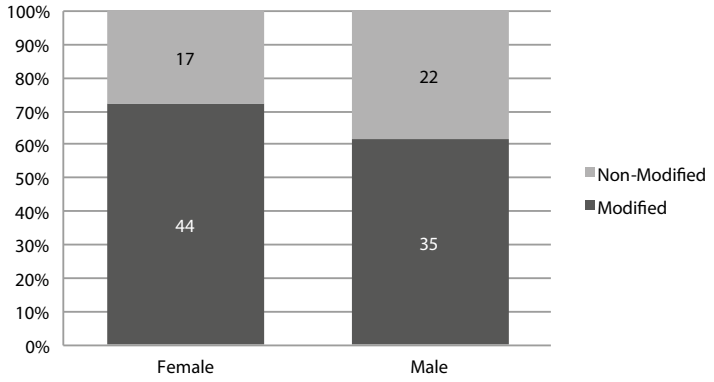
Sex Division

The rate of cranial modification among males and females for the four largest sites on the island is shown in Graph 21. A comparison of male and female proportions per site shows roughly similar rates of modification. This is confirmed by separate Fisher's exact tests looking at the intra-site variation, producing non-significant values of p=1.000 for Constanza, p=0.524 for El Soco, p=0.650 for Juan Dolio, and p=0.762 for La Caleta. There do appear to be minor variations in rates between the different locations. Two Fisher's exact tests were executed to compare the ratios of females and males respectively between the different sites. The female modification rates show no significant difference between the sites with a p=0.404. There is a significant difference between the males with p=0.018, likely due to the low amount of male modification found at El Soco.



Graph 21 **Rates of modification among males and females at the different sites in the Dominican Republic.**

Graph 22 shows the relation between cranial modification and sex for the entire population of the Dominican Republic. A Fisher's exact test was executed to determine whether a relationship is present. The outcome of p= 0.244 is statistically not significant and means that the null hypothesis cannot be rejected. In other words, no relation was found between the biological sex and head shape of an individual in the skeletal material from the Dominican Republic.



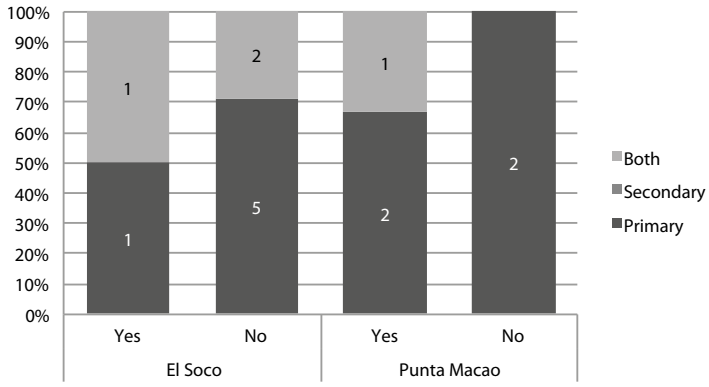
Graph 22 **Rates of modification among males and females in the pooled sample from the Dominican Republic.**

Burial Practices

Unfortunately, very limited contextual information of individual burials has survived for the majority of the skeletal material from the Dominican Republic. The comparative analyses on the potential relation between cranial modification and burial type, position, or grave goods are therefore rather limited.

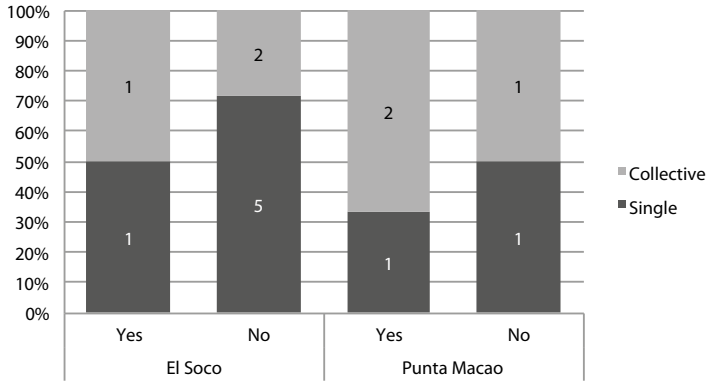
Graph 23 shows the burial types per site and cranial modification category. It is immediately clear that the number of individuals per category is very low and there are no clear patterns. Separate Fisher's exact tests were executed to determine whether

differences exist within the sites or between the modified and non-modified subsets of the sample. The resulting p=1.000 for all four analyses supports the fact that there are no significant differences in the burial types encountered within or between each site.



Graph 23 **Burial types in relation to cranial modification at El Soco and Punta Macao.**

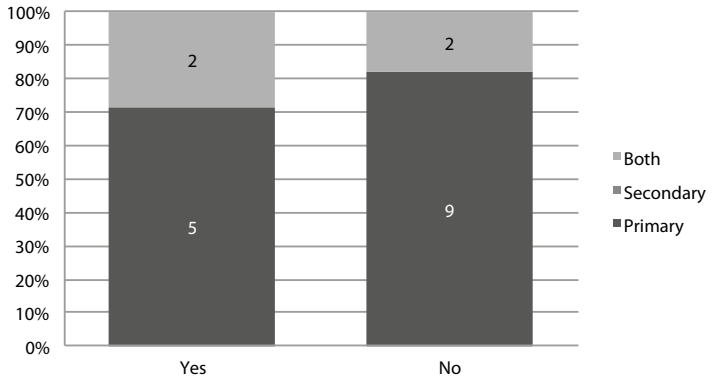
The situation is rather similar in the comparison between single or collective burials. Again, only a small amount of data is available and no clear pattern can be seen in Graph 24. This was confirmed by the results of a Fisher's exact test run for each site which produced a p-value of 1.000 in both cases as well as a comparison between the modified and non-modified subset of each site which also resulted in two p-values of 1.000.



Graph 24 **Nature of burial in relation to cranial modification at El Soco and Punta Macao.**

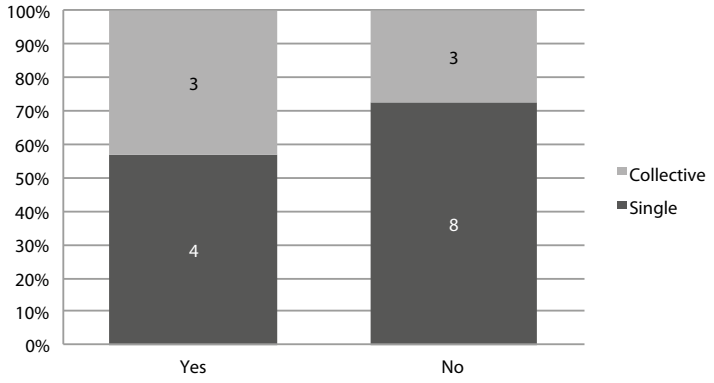
All individuals in the Dominican Republic for whom burial information was available were found in a flexed position and not enough data was present to analyse burial orientation or grave goods in relation to cranial modification for each of the different sites. Combining the data for all sites on the island gives a better result.

A distribution of different burial types among the various cranial modification categories can be seen in Graphs 25 and 26. Clearly, the limited number of individuals represented in these graphs – 18 out of 251 individuals from the Dominican Republic or 7% – is very low and unlikely to be representative. The limited information points towards varied mortuary rites and does not show a relation between burial type and cranial modification depicted in Graph 25, as evidenced by the outcome of the Fisher's exact test of p=1.000.



Graph 25 **Rates of modification for each burial types in the Dominican Republic.**

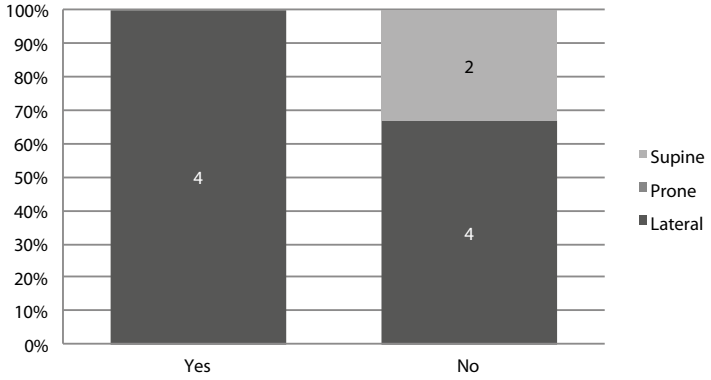
Graph 26 depicts the relationship between cranial modification and the amount of individuals encountered in a grave for the entire Dominican sample. Again, the ratios appear similar and this is confirmed by a non-significant result of p=0.627 produced by a Fisher's exact test.



Graph 26 **Rates of modification for single and collective burials in the Dominican Republic.**

Information on burial position is similarly limited. All eighteen individuals with a known burial position were flexed, although Graph 27 shows there is some variation in the orientation. A Fisher's exact test produced a non-significant outcome of p=0.467.

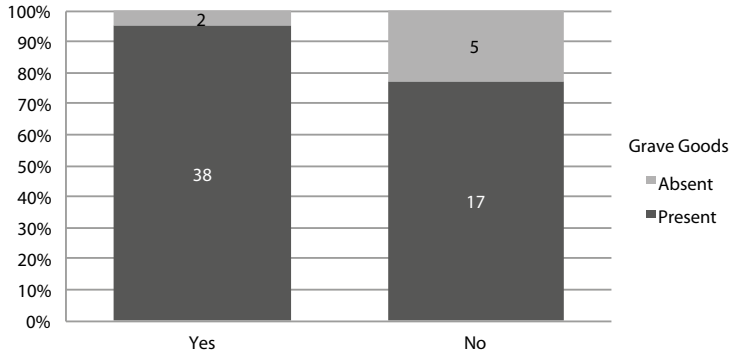
However, the small sample size again hinders any reliable extrapolation of this data to the prehistoric population at-large.



Graph 27 **Relation between body orientation and cranial modification in the Dominican Republic.**

The lack of information on individual burial contexts has hindered analysis of the relation between burial practices and cranial modification, as has been discussed in the previous paragraphs. The presence of objects of material culture in a substantial number of boxes of human remains in the *Museo del Hombre Dominicano* led to a secondary manner of gathering information on grave goods. Such items were assumed to have been found in direct relation to the skeletal remains and recorded as such. Although this is clearly a tenuous assumption at best, it was considered the only potential proxy to retrieve the lost contextual information. A downside of this method is that only presence was recorded, as absence of material culture in a box with skeletal material could not be equated with absence of grave goods. The individuals without grave goods in Graph 28 are those few for which reliable contextual information was found in reports.

This makes it abundantly clear that Graph 28 does not constitute a reliable representation of prehistoric burial goods in these populations and should be used only with extreme caution. Based on this very limited data, a Fisher's exact test yielded a statistically not significant p=0.086 which indicates that there is no significant difference in the present/absent ratio among modified and non-modified individuals.



Graph 28 **Distribution of grave goods in relation to cranial modification in the Dominican Republic.**

Local Patterns

This section shows, contrasts, and discusses the patterns found at each location for the five main themes of prevalence, shape, sex, burial practices, and isotopes set out at the beginning of this chapter.

Prevalence

The prevalence of cranial modification in each location can be seen in Table 31 and the adjusted prevalences have been visualised in Figure 12 and Graph 29.

Table 31 **Prevalence of intentional cranial modification for each location in the sample.**

Location	Prevalence % (N)			Adjusted Prevalence % (N)	
	Yes	Ambiguous	No	Yes	No
Bahamas	100.00 (3)	0.00 (0)	0.00 (0)	100.00 (3)	0.00 (0)
Cuba	77.78 (63)	6.17 (5)	16.05 (13)	82.89 (63)	17.11 (13)
Dominican Republic	54.80 (137)	20.00 (50)	25.20 (63)	68.50 (137)	31.50 (63)
Grenada	0.00 (0)	0.00 (0)	100.00 (1)	0.00 (0)	100.00 (1)
Guadeloupe	46.81 (22)	36.17 (17)	17.02 (8)	73.33 (22)	26.67 (8)
Haiti	60.00 (3)	20.00 (1)	20.00 (1)	75.00 (3)	25.00 (1)
Jamaica	66.67 (22)	18.18 (6)	15.15 (5)	81.48 (22)	18.52 (5)
Puerto Rico	48.15 (13)	18.52 (5)	33.33 (9)	59.09 (13)	40.91 (9)
Saba	20.00 (1)	0.00 (0)	80.00 (4)	20.00 (1)	80.00 (4)
St. Kitts	50.00 (1)	50.00 (1)	0.00 (0)	100.00 (1)	0.00 (0)
Suriname	20.00 (5)	8.00 (2)	72.00 (18)	21.74 (5)	78.26 (18)
Trinidad	0.00 (0)	9.09 (1)	90.91 (10)	0.00 (0)	100.00 (10)
Venezuela	26.00 (13)	8.00 (4)	66.00 (33)	28.26 (13)	71.74 (33)

Several locations are represented by only a handful of individuals and these prevalences are not representative of the whole indigenous population. The larger samples show some interesting patterns. The mainland samples of Suriname and Venezuela have prevalence rates between 20 and 30%, lower than most Caribbean islands that show rates between 60 and 85%. Trinidad, close to the mainland, is an exception with no evidence of head shaping in the skeletal population.

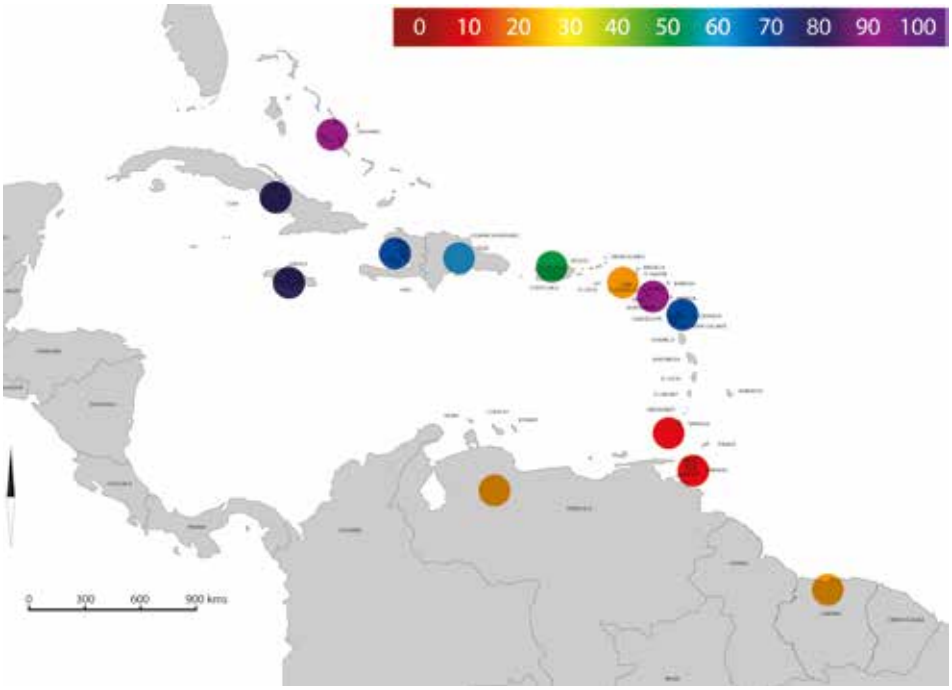
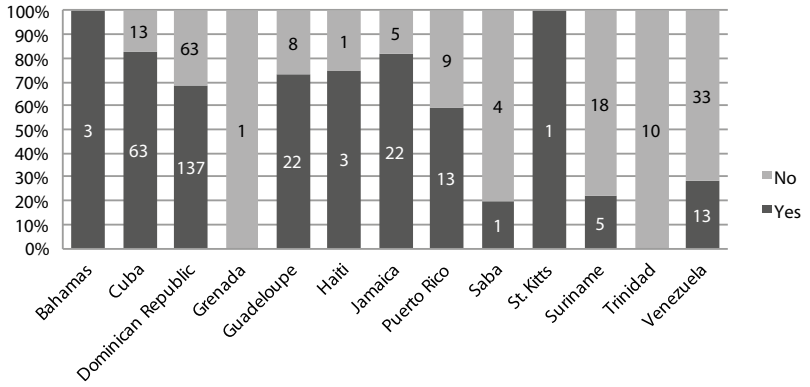


Figure 12 **Visualisation of the distribution of head shaping prevalence in the Caribbean.**

The clear differences in modification rates across these locations are confirmed by the $p<0.001$ value produced by the Monte Carlo method. These results suggest there is a significant difference in the ratios of cranial modification on different islands of the Caribbean and there is merit in investigating regional trends.

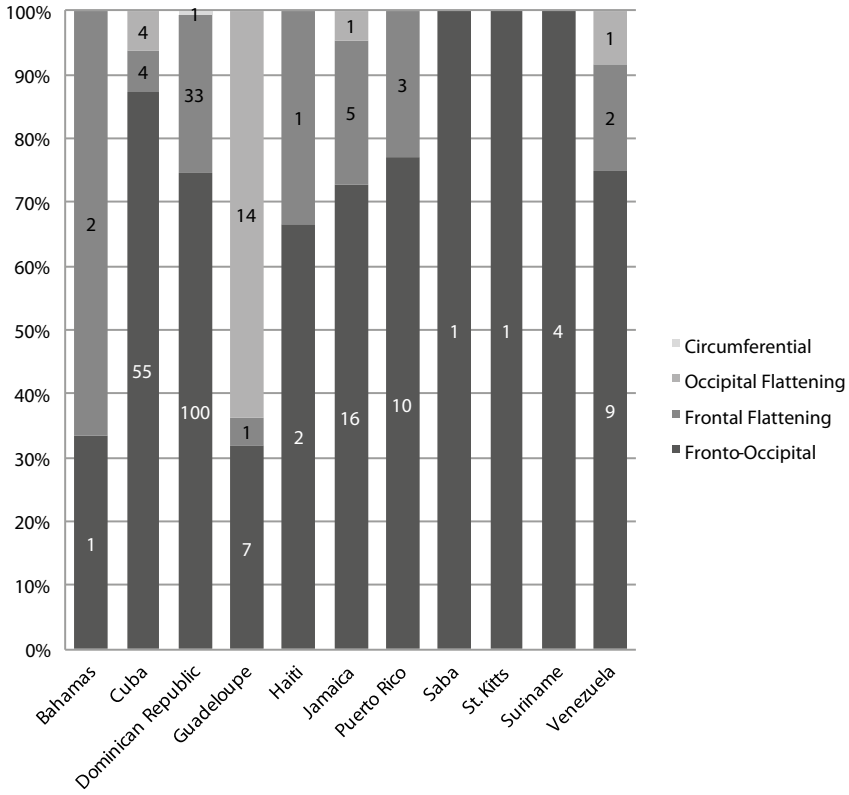


Graph 29 **Adjusted prevalence rates for each location in the sample.**

Shape

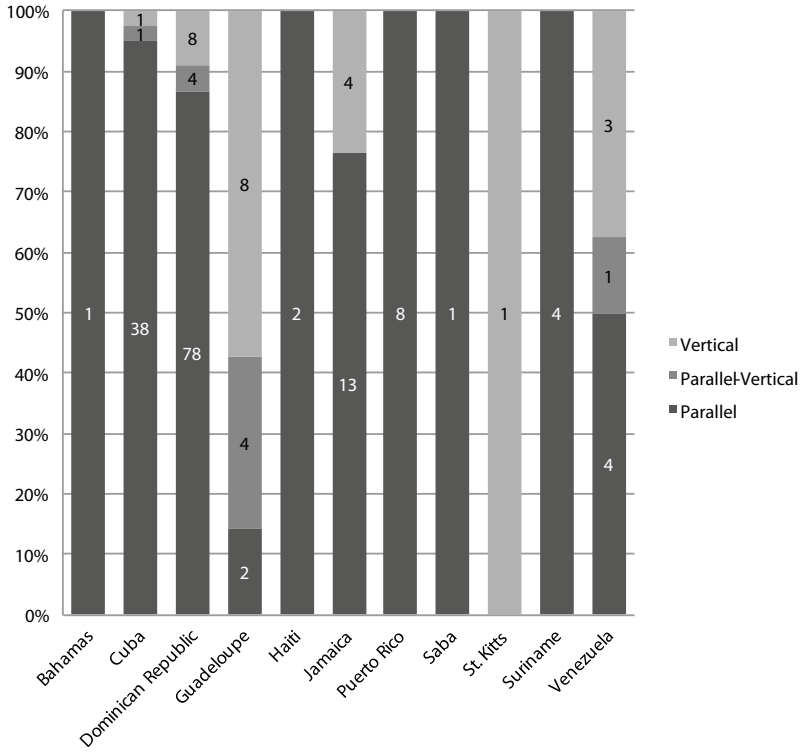
The different shapes created by intentional cranial modification can be categorised in main types and subtypes. There is some variation in the patterns of modification types found at different locations, as can be seen in Graph 30. The difference in sample size must be taken into account once more, with several sites represented by a single skull skewing the picture. Regardless, fronto-occipital modification is clearly the predominant form of cranial modification, followed by frontal flattening. These two types share a sloping frontal and are indistinguishable when viewed from the front during life. Occipital flattening is also present in lower numbers and a single case of circumferential modification is reported on the Dominican Republic. The Monte Carlo method produced a $p<0.001$ indicating significant differences are present between the locations.

A clear deviation from the overall pattern is the island of Guadeloupe, were occipital flattening is the dominant type of modification. Care should be taken when interpreting this pattern due to inherent issues with the skeletal material used in the sample. The crania from Guadeloupe were poorly preserved and are highly fragmented, creating issues for the conservative determinations of modification status and type. Many cases categorised here as occipital flattening represent crania which lacked frontal and sometimes even parietal portions due to poor preservation. The different pattern seen for Guadeloupe in Graph 30 may be a direct result of these issues.



Graph 30 **Types of cranial modification found per location in the Caribbean.**

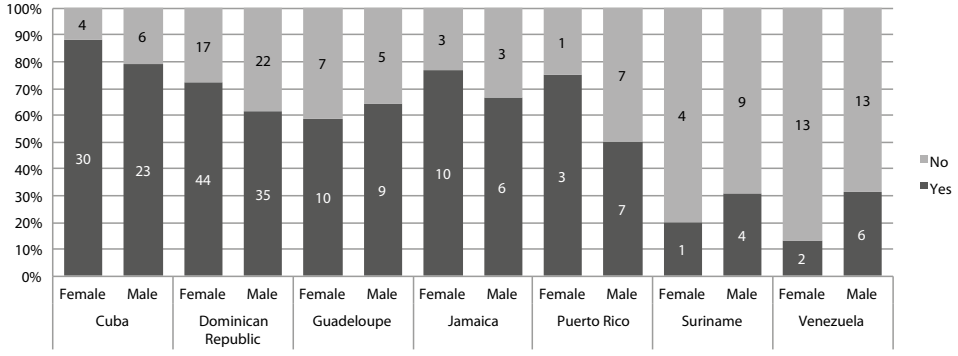
The different subtypes encountered in the sample for this study are shown per location in Graph 31. The dominant subtype in almost all locations is parallel modification. Two clear exceptions are present in the graph: Guadeloupe and St. Kitts. The difficulties regarding the skeletal material from Guadeloupe are apparent and it should be added here that a significant number of the crania was marked as modification of an undetermined subtype, indicating the actual pattern may have been substantially different. The single case of vertical modification on St. Kitts is interesting, but care must be taken not to extrapolate a single individual into a trend without additional evidence. A Fisher's exact test was executed and the outcome of $p<0.001$ confirms there are significant differences between the locations based on the subtypes. The differences in main types and subtypes of modification seen here warrant investigation of regional trends.



Graph 31 **Subtypes of cranial modification found per location in the Caribbean.**

Sex

The distribution of head shaping among the sexes can be seen for each location in Graph 32. The patterns for each location appear relatively similar, although differences between locations are apparent.



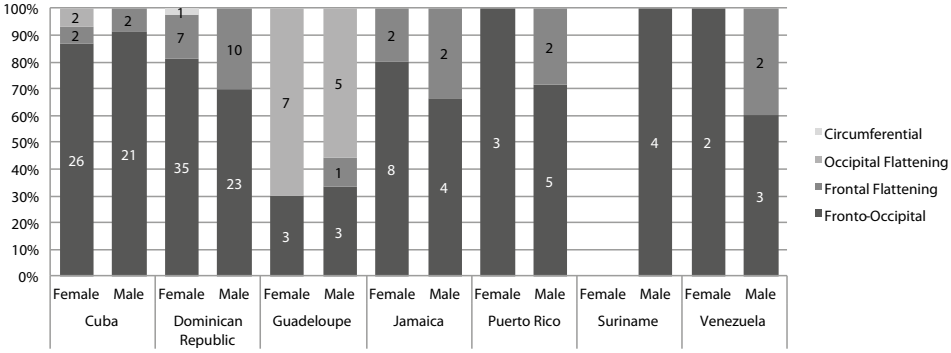
Graph 32 **Rates of modification among males and females per location in the Caribbean.**

This pattern is confirmed by the statistical tests. Several Fisher's exact tests were carried out to determine whether differences existed between males and females within in each assemblage and when comparing female and male rates between the locations. The results can be seen in Table 32. The ratios seem to be very similar for males and females within each assemblage, as is confirmed by the non-significant *p*-values for all within group comparisons. The results do indicate substantial differences in the modification rates seen for each sex at different locations, but this is due to the variation between the locations and not a causal relation between cranial modification and sex.

Table 32 Results of comparative analysis of sex and modification rates using Fisher's exact tests.

Cuba	Dominican Republic	Guadeloupe	Jamaica	Puerto Rico	Suriname	Venezuela	Females	Males
p=0.492	p=0.244	p=1.00	p=0.655	p=0.588	p=1.000	p=0.257	p<0.001	p=0.013

Graph 33 shows the distribution of the main types of modification across the sexes for each location. Once more, the patterns for each location are relatively similar between men and women, suggesting that they are subjected to the same type of modification.



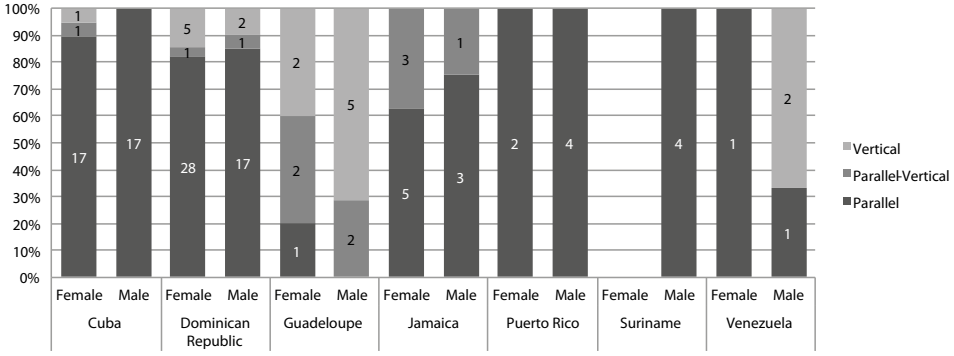
Graph 33 Comparison of the relation between modification type and biological sex per location.

This is confirmed by the non-significant results of Fisher's exact tests executed for each location seen in Table 33. The significant differences between male and female patterns from different locations show the variation in the pattern is due to local differences in practice, not the sex of an individual.

Table 33 Results of comparative analysis of sex and modification type using Fisher's exact tests.

Cuba	Dominican Republic	Guadeloupe	Jamaica	Puerto Rico	Suriname	Venezuela	Females	Males
p=0.651	p=0.218	p=0.800	p=0.604	p=1.000	X	p=1.000	p<0.001	p=0.001

A relationship between subtype and sex for each location can be seen in Graph 34. The local patterns are once again very similar, although there is some variation particularly on Guadeloupe.



Graph 34 **Comparison of the relation between modification subtype and biological sex per location.**

The separate Fisher's exact tests have produced non-significant results for the locations as can be seen in Table 34. No tests could be executed for Puerto Rico and Suriname, as the first only has one subtype and the second sample doesn't contain females. Comparing all female and male patterns with one another does produce significant results, suggestion regional variation in type although this is not related to the sex of the individual.

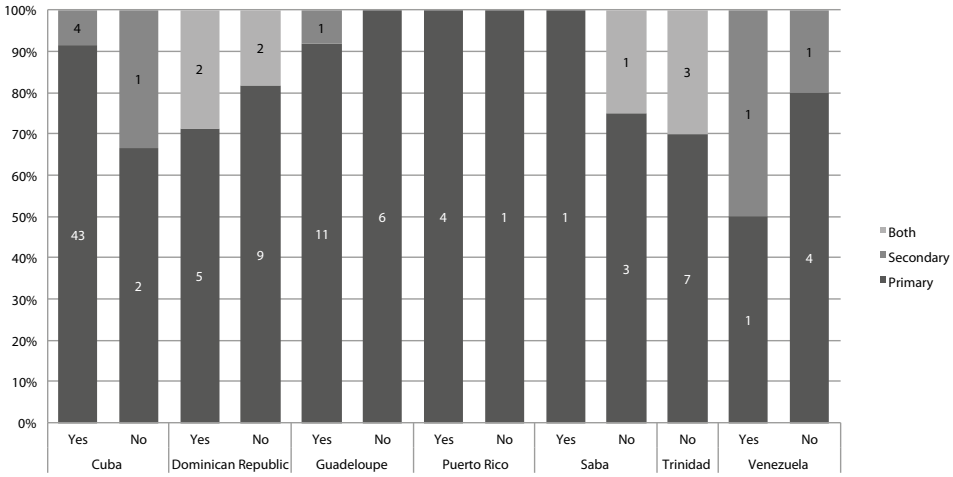
Table 34 **Results of comparative analysis of sex and modification subtype using Fisher's exact tests.**

Cuba	Dominican Republic	Guadeloupe	Jamaica	Puerto Rico	Suriname	Venezuela	Females	Males
p=1.000	p=1.000	p=0.381	p=0.580	X	X	p=1.000	p=0.035	p<0.001

Burial Practices

This section will look at different burial practices, including burial type, the position and orientation of the body in the grave, grave goods and, if available, strontium isotope data.

An overview of the different burial types encountered, split per location and modification status, is shown in Graph 35. Burial practices in the Caribbean region are varied with different patterns seen on each location, although primary inhumation seems to be the predominant manner of burial throughout the region.



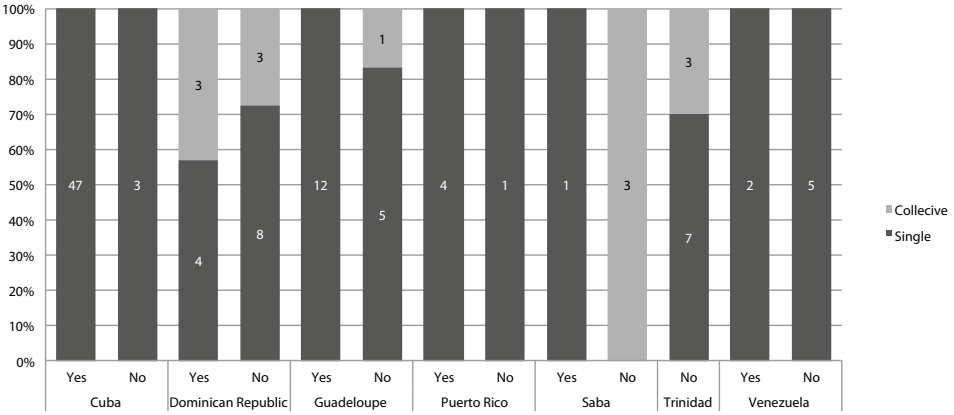
Graph 35 **Relation between the type of burial and cranial modification per location.**

All Fisher's exact tests show an insignificant result, with the exception of the comparison of all modified individuals, as can be seen in Table 35. Puerto Rico and Trinidad could not be analysed, because the former only had primary inhumations and the latter had no modified individuals. The significant result for the modified subset of the population is likely due to regional variation in burial practices not related to cranial modification.

Table 35 **Results of comparative analysis of burial type and modification using Fisher's exact tests.**

Cuba	Dominican Republic	Guadeloupe	Puerto Rico	Saba	Trinidad	Venezuela	Modified	Non-Modified
p=0.276	p=1.000	p=1.000	X	p=1.000	X	p=1.000	p=0.070	p=0.432

The amount of single and collective burials is shown per modification category for each location in Graph 36. The majority of the sample has been buried in an individual grave, but some locations show evidence of collective burial practices.



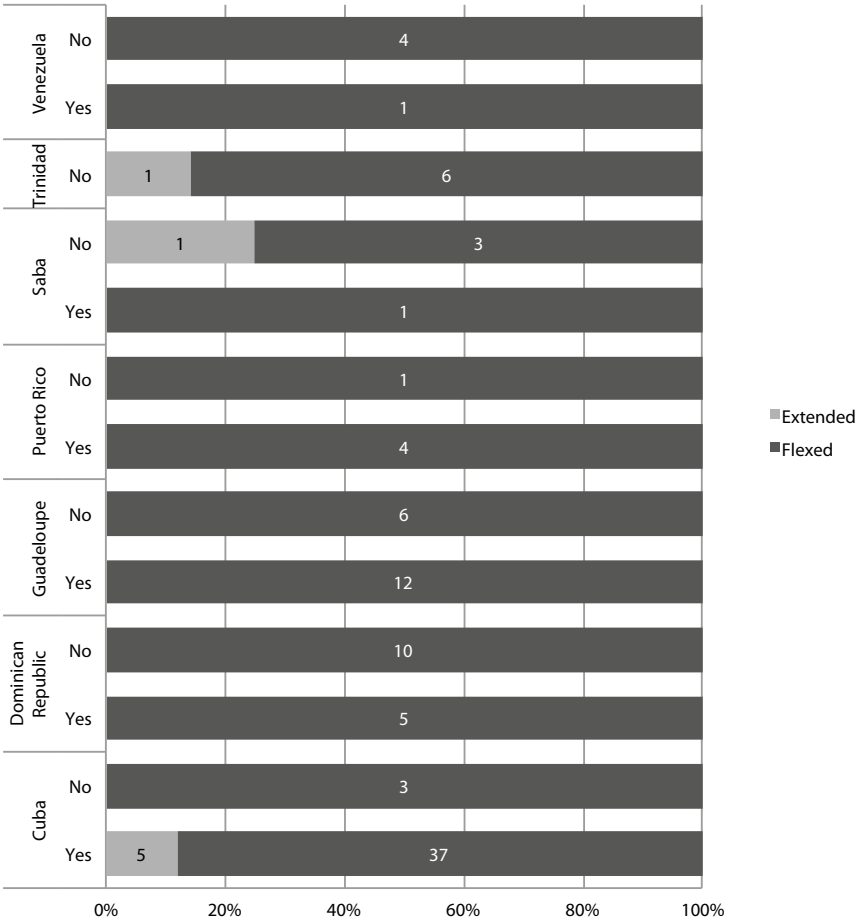
Graph 36 **Relation between the amount of individuals in a grave and cranial modification per location.**

Fisher's exact tests were carried out to determine if intra-location differences exist in these ratios and to compare the ratios of the modified and non-modified groups between the locations. Cuba, Puerto Rico, and Venezuela could not be analysed for variation within these locations as only a single burials were found and Trinidad could not be tested as only non-modified individuals are present. The results can be seen in Table 36. There are no significant differences within each site, but there is a significant variation between the modified individuals. This is likely due to the fact that collective burials with modified individuals were only found on the Dominican Republic.

Table 36 **Results of comparative analysis of modification and collective or single burial using Fisher's exact tests.**

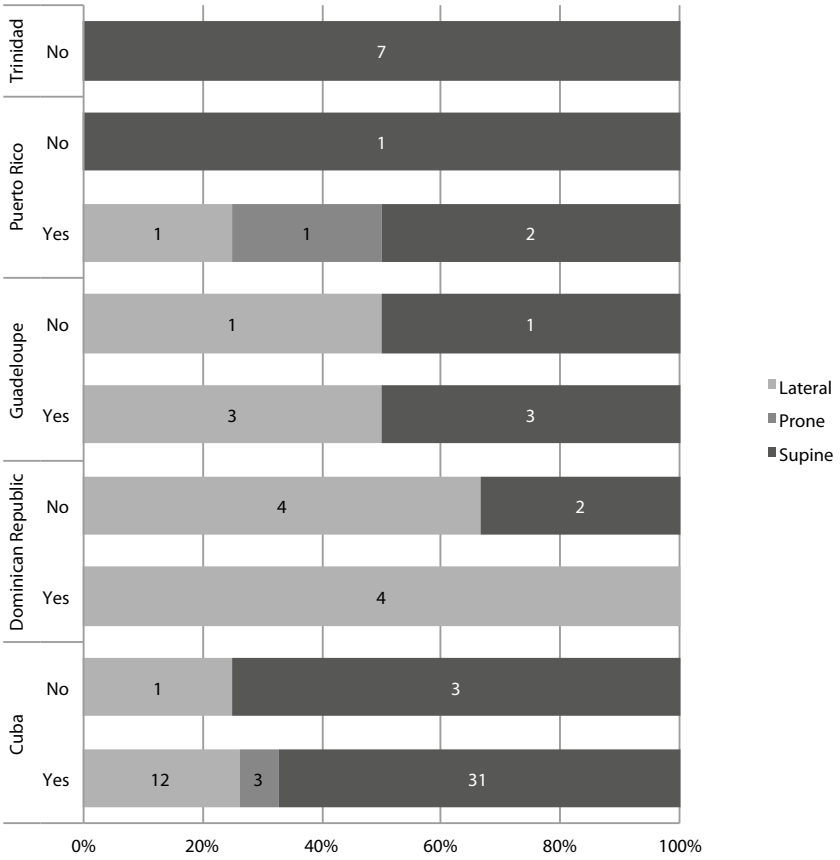
Cuba	Dominican Republic	Guadeloupe	Puerto Rico	Saba	Trinidad	Venezuela	Modified	Non-Modified
X	p=0.627	p=0.333	X	p=0.250	X	X	p=0.003	p=0.090

The burial position within the grave has been shown in Graph 37 for each location and modification status. It is immediately apparent that the majority of individuals were buried in a flexed position, regardless of location. Fisher's exact tests were executed to determine whether there were differences in burial patterns between the different islands in the modified and non-modified subset. The respective results, p=0.894 and p=0.275, are not statistically significant, meaning there are no observed differences in burial pattern related to cranial modification and location.



Graph 37 **Relation between body position and cranial modification per location.**

The relation between cranial modification, location, and the orientation of the body in the grave can be seen in Graph 38. Supine and lateral seem to be two frequent orientations, whereas prone burial is relatively rare.



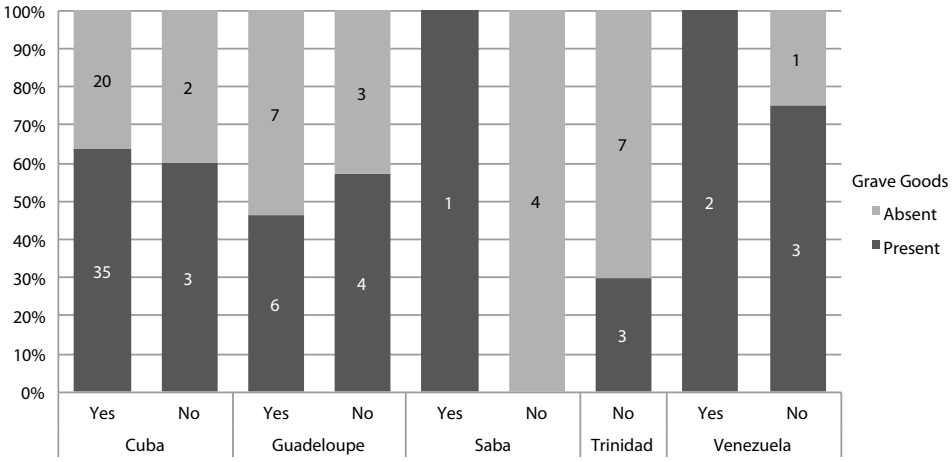
Graph 38 **Relation between body orientation and cranial modification per location.**

Fisher's exact tests were carried out to determine if different patterns exist between cranial modification categories on each island or when comparing the body orientation on different locations for modified and non-modified populations. The results can be seen in Table 37. The non-significant values for all intra-island comparisons suggest no differences exist in the patterns of body orientation on each island. The barely significant *p*-value for modified and just short of significant *p*-value for non-modified individuals indicate there are regional differences in body orientation, although these do not appear to be related to cranial modification.

Table 37 **Results of comparative analysis of body orientation and modification using Fisher's exact tests.**

Cuba	Dominican Republic	Guadeloupe	Puerto Rico	Trinidad	Modified	Non-Modified
p=1.000	*p*=0.467	*p*=1.000	*p*=1.000	X	*p*=0.046	*p*=0.053

The relation between cranial modification status and grave goods has been depicted in Graph 39 for each island. Two Fisher's exact tests were executed: one comparing the ratio of grave goods in the modified and the second in the non-modified subset of the population with results of p=0.397 and p=0.184, respectively. Both results are not statistically significant, indicating no substantial differences exist between the patterns seen on different islands in relation to head shaping.

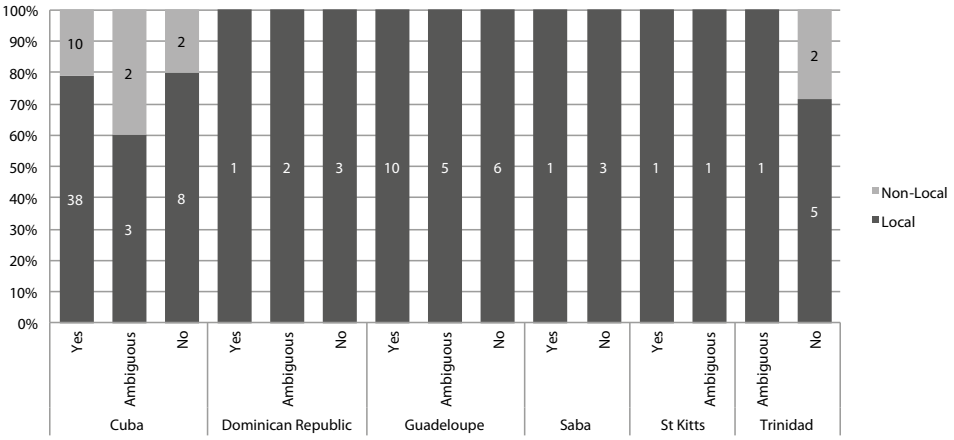


Graph 39 **Distribution of grave goods in relation to cranial modification per location.**

Isotopes

Strontium isotope data was available for part of the sample from a study into migration and mobility in the Caribbean through stable isotope analysis by Jason Laffoon (2012). The strontium ratio extracted from tooth enamel was compared to the local range, based on environmental and faunal data to determine whether an individual fit the local range or was of non-local origin. The former is not necessarily an indication of local birth, as ranges of different locations in the Caribbean overlap. Please refer to Laffoon (2012) for the original data and full procedure.

The relationship between the outcome of the strontium isotope analyses and the data on cranial modification can be seen for each island in Graph 40. The vast majority of individuals for whom isotope data is available have a signature within the local range. There are no apparent patterns in the absence or presence of cranial modification related to origin of individuals.



Graph 40 **Relation between isotopic signature and intentional cranial modification per location.**

Regional Trends

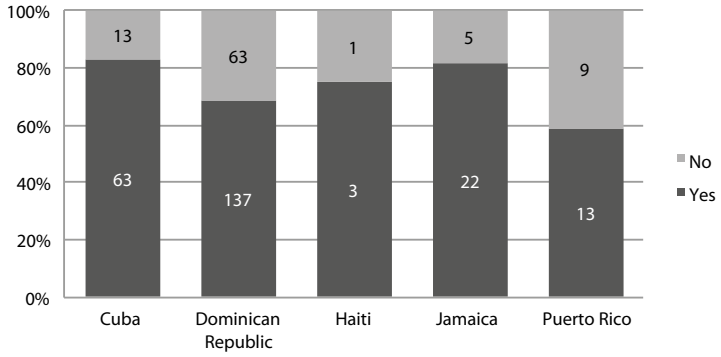
Contrasting the data from each location in the sample has shown that different patterns of prevalence, type, subtype, sex, and several burial practices exist and that this variety may have a spatial component. To evaluate these divisions, the sample will combine locations into three distinct regions. Previous archaeological and historical work has indicated differences between the Greater and Lesser Antilles. Furthermore, despite connections with the archipelago, mainland communities can also be considered as a separate region. This section will look for patterns within and between the different regions to gain a better understanding of where potential boundaries lie, although such boundaries should never be conceived to be static or impermeable in a region as dynamic and connected as the Caribbean.

Greater Antilles

This section looks at the Greater Antilles, composed of Cuba, the Dominican Republic, Haiti, Jamaica, and Puerto Rico. Each theme will start with an intra-regional comparison of different locations to determine whether the patterns seen are similar and will then combine the data from different locations to present general trends for the region.

Prevalence

The adjusted prevalence for each of the Great Antillean islands is displayed in Graph 41. The graph shows that the prevalence rates for modification are relatively high and range between 60 and 85 percent. A Fisher's exact test was executed to determine whether these rates were substantially different between the islands. The resulting p=0.052 is almost significant indicating that the minor differences in the rates, particularly the difference between Cuba and Puerto Rico, are important but that the overall pattern of cranial modification is not significantly different within the Great Antilles.



Graph 41 **The prevalence of cranial modification for each location in the Greater Antilles.**

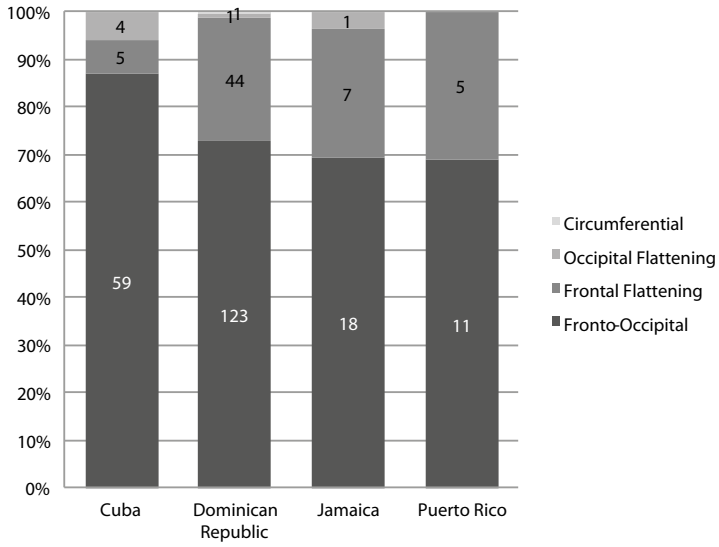
The overall prevalence of cranial modification in the Greater Antilles as a whole can be seen in Table 38. The adjusted prevalence shows that the vast majority of individuals in the Greater Antilles were subjected to the practice of cranial modification. Approximately a quarter of individuals did not show any signs of alteration to the cranial shape.

Table 38 **Prevalence of intentional cranial modification in the Greater Antilles.**

ICM	Number	Prevalence (%)	Adjusted Prevalence (%)
Yes	238	60.10	72.34
Ambiguous	67	16.92	
No	91	22.98	27.66

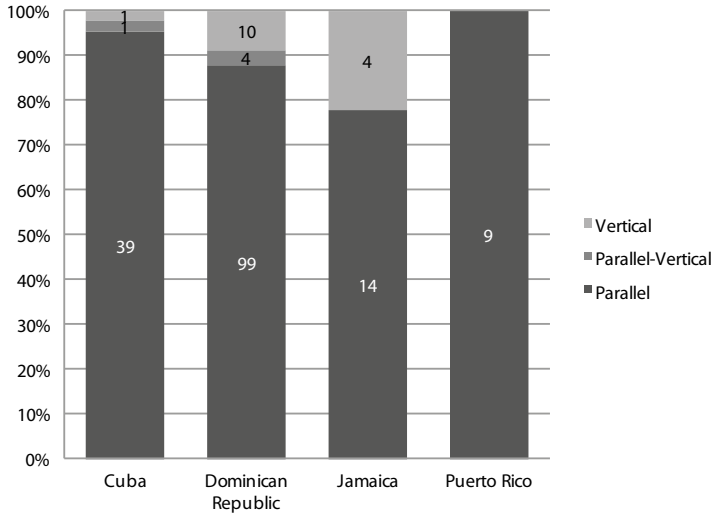
Shape

The cranial shapes encountered in the Greater Antillean population are shown for each island in Graph 42. The main form in every location is fronto-occipital modification, followed by a minor share of frontal flattening. A Fisher's exact test produced a p=0.005, indicating substantial differences exist.



Graph 42 **Types of cranial modification found per location in the Greater Antilles.**

Graph 43 shows the subtypes of modification for each island in the Greater Antilles. The majority of cases are classified as parallel. A Fisher's exact test produced a p=0.284, indicating no significant differences between the islands.



Graph 43 **Subtypes of cranial modification found per location in the Greater Antilles.**

An overview of the cranial shapes encountered in the Greater Antilles can be seen in Table 39. An outright majority of 77% of all individuals have cranial shapes of the fronto-occipital type. Of these, about three-quarters (74%) are of the parallel subtype. In the

overall count, the fronto-occipital parallel crania account for 57% of all modification encountered in the Greater Antilles. Clearly, the fronto-occipital parallel type is the predominant type found in the region. Parallel-vertical and vertical subtypes of fronto-occipital modification are also present but in much lower numbers.

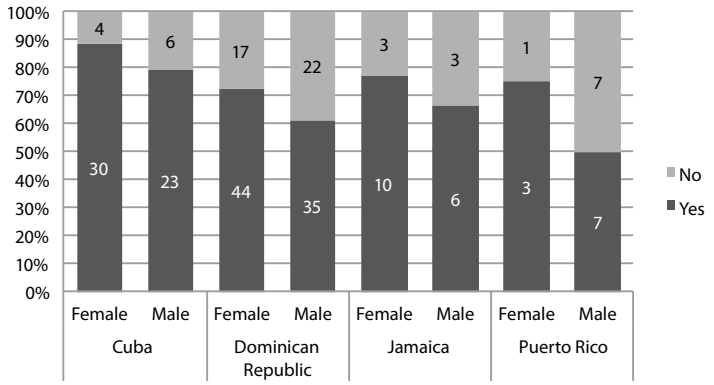
The second most common main type is frontal flattening, which accounts for just under 20% of all modified crania. Fronto-occipital modification and frontal flattening share a plane of pressure on the frontal bone which creates a sloping forehead. Viewed from the front, these types cannot be distinguished and during life they would have looked rather similar. It is clear from the overview in Table 39 that the remainder of modification types is only present in very small numbers of individuals, in some cases below a single percentage point, on this regional level.

Table 39 Overview of modification types and subtypes found in the Greater Antilles.

Type	Subtype	Number of Individuals	Percentage
Fronto-Occipital	Parallel	136	57.14
	Parallel-Vertical	5	2.10
	Vertical	13	5.46
	Undetermined	29	12.18
Frontal Flattening		46	19.33
Occipital Flattening	Parallel	2	0.84
	Vertical	0	0.00
	Parallel-Vertical	0	0.00
	Undetermined	3	1.26
Circumferential	Parallel	1	0.42
Positional Plagiocephaly		2	0.84
Undetermined	Undetermined	1	0.42
Total		238	100.00

Sex

The prevalence rates of males and females are shown in Graph 44 for each location in the Greater Antilles. Rates seem relatively similar within each location, although there is minor variation between different locations within the region.



Graph 44 **Cranial modification and biological sex for each location in the Greater Antilles.**

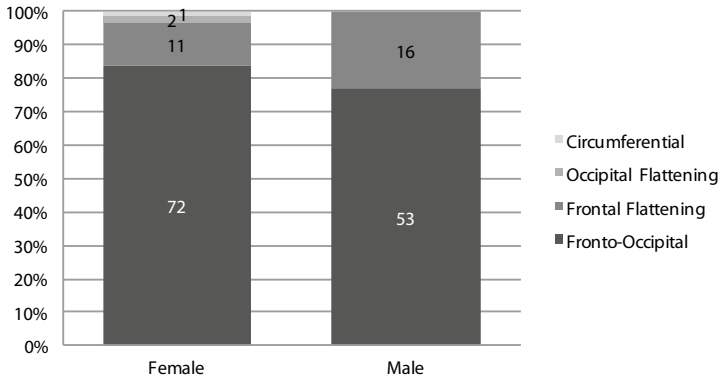
Several Fisher's exact tests were executed to determine whether there was a significant difference between the proportion of cranial modification among males and females on each island and to compare the ratios of females and males on different islands. The results can be seen in Table 40. None of the results are statistically significant, meaning there are no differences within or between the islands of the Greater Antilles.

Table 40 **Results of comparative analysis of sex and modification rates using Fisher's exact tests.**

Cuba	Dominican Republic	Jamaica	Puerto Rico	Females	Males
p=0.492	p=0.244	p=0.655	p=0.588	p=0.275	p=0.212

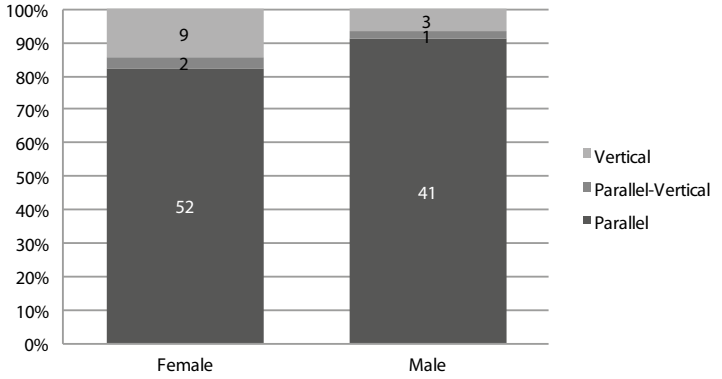
Graph 45 shows the distribution of different types of modification among the male and female inhabitants of the Greater Antilles. There are two dominant types, fronto-occipital modification and to a lesser degree frontal flattening. Females seem to have a little more variety in modification type, with occipital and circumferential modification also present.

A Fisher's exact test was executed to determine whether there was a significant relation between the main type of modification and sex of an individual. The resulting p=0.116 indicates this is not the case.



Graph 45 **Comparison of the relation between modification type and biological sex in the Greater Antilles.**

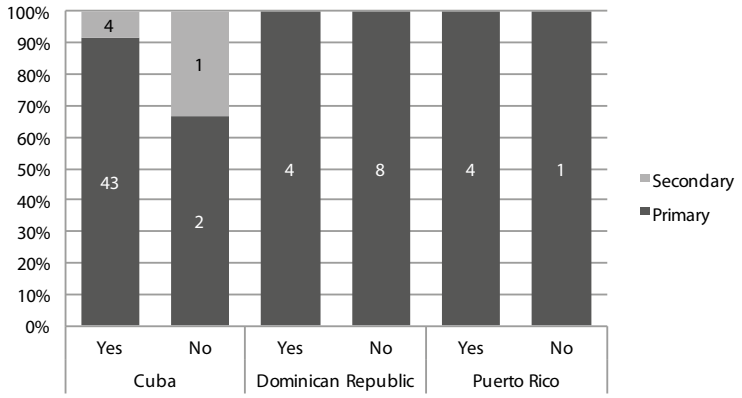
The relationship between subtype of modification and the sex of an individual is depicted in Graph 46. The predominant orientation of occipital flattening is parallel and the patterns seen among males and females look very similar. This is confirmed by the non-significant p=0.523 result produced by the Fisher's exact test.



Graph 46 **Comparison of the relation between modification subtype and biological sex in the Greater Antilles.**

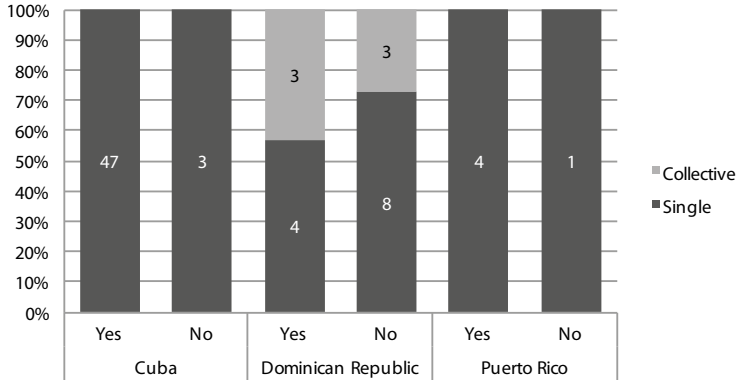
Burial Practices

A variety of burial practices was encountered in the Greater Antilles. Graph 47 shows the burial types per island and modification category. Jamaica is not represented in this section, as all individuals with known provenance from the island in this sample were found in cave contexts. The nature of caves deposits hinders the recognition of burial practices and reports often do not provide detailed information on the type of burial or the position of the body. Cave burials are part of the repertoire on each of the Greater Antilles, although nowhere as ubiquitous as on Jamaica. The dominant form of burial is primary inhumation. A Fisher's exact test provided a p=0.546, indicating no significant differences exist between the islands.



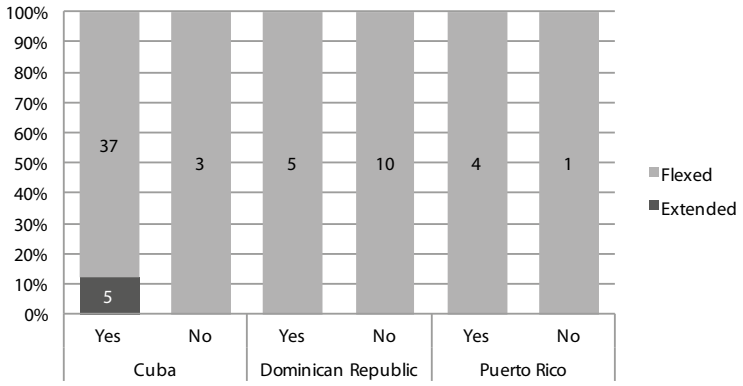
Graph 47 **Relation between the type of burial and cranial modification per location in the Greater Antilles.**

Most burials in the Greater Antilles contain a single individual, as can be seen in Graph 48. Collective burials have been found in the Dominican Republic and contain both modified and non-modified individuals. A Fisher's exact test provides a p=0.001, indicating significant differences exist. This is likely due to the fact that collective burials were found solely in the Dominican Republic in this sample and not related to a trend between the burial practice and cranial modification.



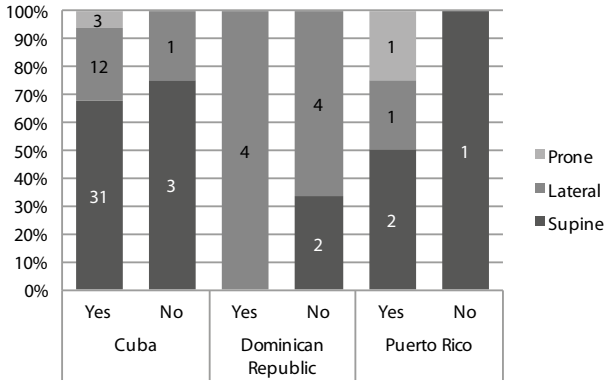
Graph 48 **Relation between cranial modification and single or collective burial per location in the Greater Antilles.**

Almost all individuals in the Greater Antilles have been found in a flexed position as can be seen in Graph 49, with the exception of five extended burials in early-colonial Cuba. A Fisher's exact test confirmed the lack of pattern with a non-significant p=0.864.



Graph 49 **Relation between body position and cranial modification per location in the Greater Antilles.**

The orientation of the body within the grave, on the other hand, shows substantial variation both within and between islands, as can be seen in Graph 50.



Graph 50 **Relation between body orientation and cranial modification per location.**

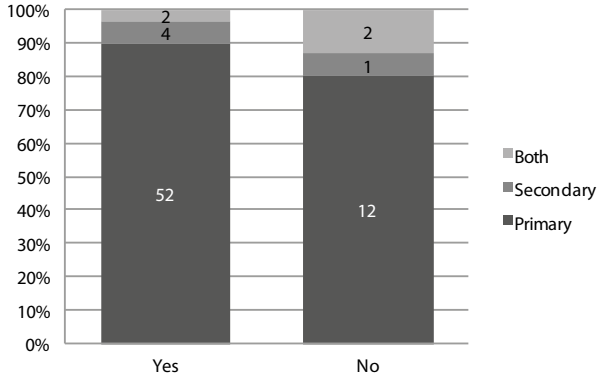
Several Fisher's exact tests were run to determine if a significant relation exists between the two factors within each region and between the different locations. The results can be seen in Table 41. No significant differences were found within each region or when comparing all non-modified individuals. The significant result for the modified subset is likely due to regional variation in the position of the body that is unrelated to cranial modification.

Table 41 **Results of comparative analysis of body orientation and modification using Fisher's exact tests.**

Cuba	Dominican Republic	Puerto Rico	Modified	Non-Modified
p=1.000	p=0.467	p=1.000	p=0.022	p=0.372

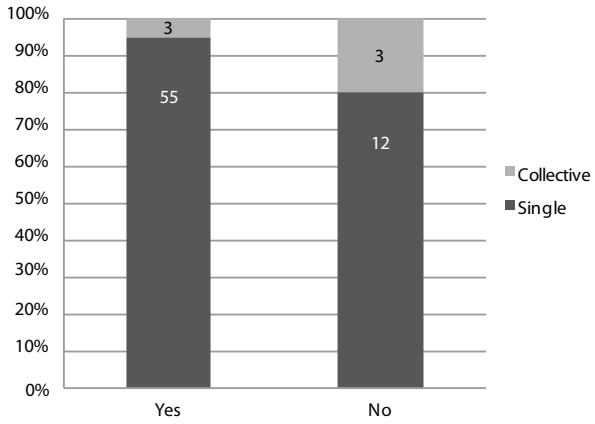
Contrasting the burial patterns from the islands of the Greater Antilles has shown both differences and similarities. The data is now grouped together to present and evaluate trends from the region as a whole.

The relation between the type of burial and the modification status of an individual is displayed in Graph 51. At first glance, the proportion seems to be quite similar regardless of cranial modification. A Fisher's exact test was carried out to determine whether there were any statistically significant differences in the ratios. The outcome of p=0.233 is not statistically significant, indicating that the null hypothesis cannot be rejected and that there are no differences in burial types between the groups.



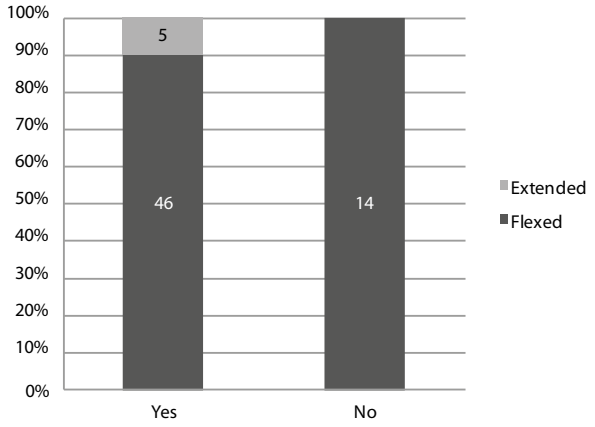
Graph 51 **Relation between the type of burial and cranial modification in the Greater Antilles.**

Graph 52 shows that the vast majority of individuals in the Greater Antilles were found in an individual grave and only a handful of collective burial contexts are present. A Fisher's exact test produced a p=0.097, indicating that no significant relation exists between the amount of individuals in the grave and cranial modification.



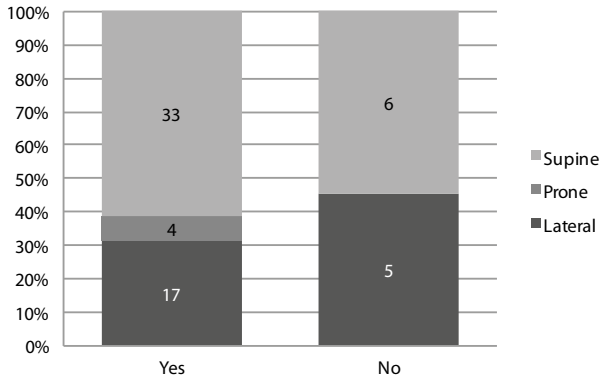
Graph 52 **Relation between cranial modification and single or collective burials in the Greater Antilles.**

Graph 53 displays the burial position in relation to the modification status. It shows that the overall majority of individuals were found in a flexed position regardless of their cranial shape. A Fisher's exact test confirmed the absence of a trend in burial position with a statistically non-significant outcome of p=0.576.



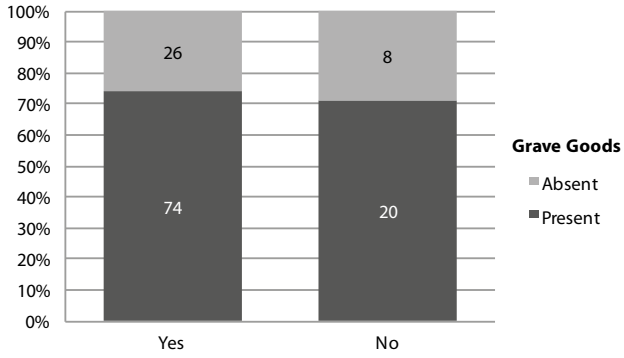
Graph 53 **Relation between body position and cranial modification in the Greater Antilles.**

The orientation of the body within the grave shows much more variety, as can be seen in Graph 54. Supine and lateral positions seem to dominate the Greater Antillean burial record. A Fisher's exact test was run to determine whether there was a relation between cranial modification and burial orientation. The outcome of p=0.556 is not statistically significant, indicating no relationship was encountered.



Graph 54 **Relation between body orientation and cranial modification in the Greater Antilles.**

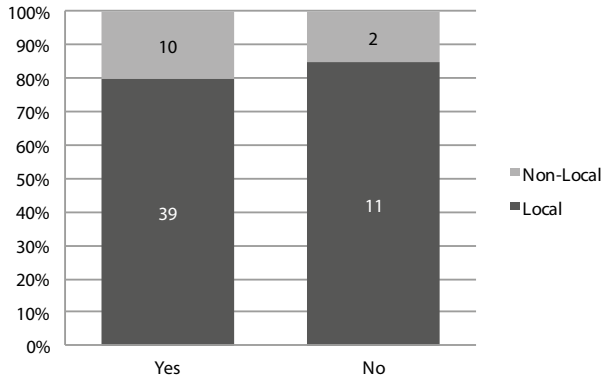
The distribution of grave goods and cranial modification in the Greater Antillean sample can be seen in Graph 55. A first glance indicates ratios are very similar in both modification categories. This is confirmed by a Fisher's exact test, with an outcome of p=0.811 clearly confirming the lack of a relation between grave goods and cranial modification.



Graph 55 **Distribution of grave goods in relation to cranial modification in the Greater Antilles.**

Isotopes

The outcome of the strontium isotope analysis of dental enamel is compared to the information gathered on intentional cranial modification in Graph 56. It shows that the provenience produced by strontium isotope analysis is relatively similar across all modification categories. This is confirmed by the non-significant p=1.000 value produced by a Fisher's exact test.



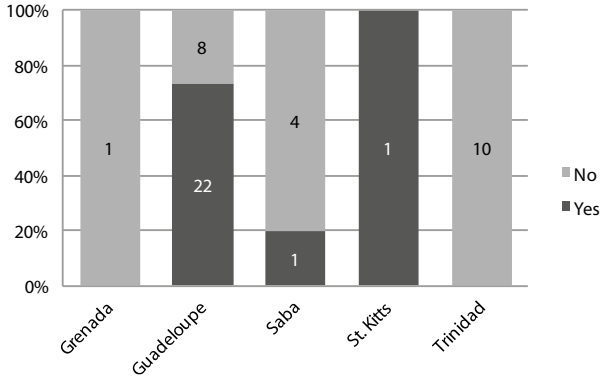
Graph 56 **Relation between isotopic signature and cranial modification in the Greater Antilles.**

Lesser Antilles

The Lesser Antillean island chain consists of a large number of small islands and is underrepresented in this sample for reasons previously discussed. This section discusses the combined results of the skeletal assemblages from the region which were available for study originating from the islands of Grenada, Guadeloupe, Saba, St. Kitts, and Trinidad.

Prevalence

The adjusted prevalence rates of cranial modification per island in the Lesser Antillean arc are shown in Graph 57. The adjusted prevalence, which is calculated by removing the ambiguous cases, is a better representation of the situation in the Lesser Antilles due to the poor preservation of crania that has resulted in a relatively high number of ambiguous cases. Unfortunately, this does reduce the sample size even further.



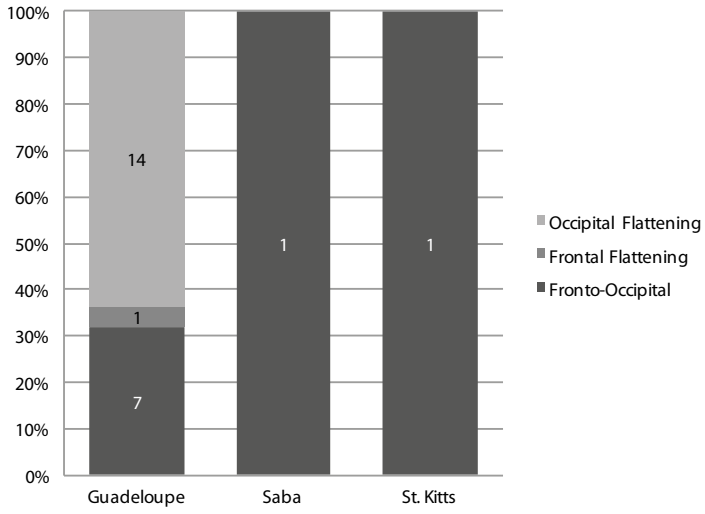
Graph 57 **The prevalence of cranial modification for each location in the Lesser Antilles.**

A Fisher's exact test produced a significant result of $p<0.001$. This suggests that there are significant differences between the rates of modification observed on the different

islands, which is supported visually by the graph. This combined with the great variation in prevalence rates ranging from 0% up to 67% for different sites in the region, suggests combining these sites into a single regional unit is inappropriate.

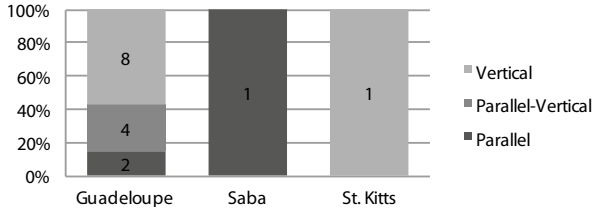
Shape

The main types of cranial modification encountered on the islands of the Lesser Antilles can be seen in Graph 58. The small sample size of three out of four available assemblages make statistical analysis unreliable. Still, Graph 58 shows fronto-occipital modification is present on all Lesser Antillean islands, but there is also some variation in shape, particularly on Guadeloupe.



Graph 58 **Types of cranial modification found per location in the Lesser Antilles.**

The distribution of the different subtypes in each location can be seen in Graph 59. The same issues regarding sample size hinder successful statistical analysis of the subtype, but the graph shows a relatively large diversity in subtypes given the small sample size.



Graph 59 **Subtypes of cranial modification found per location in the Lesser Antilles.**

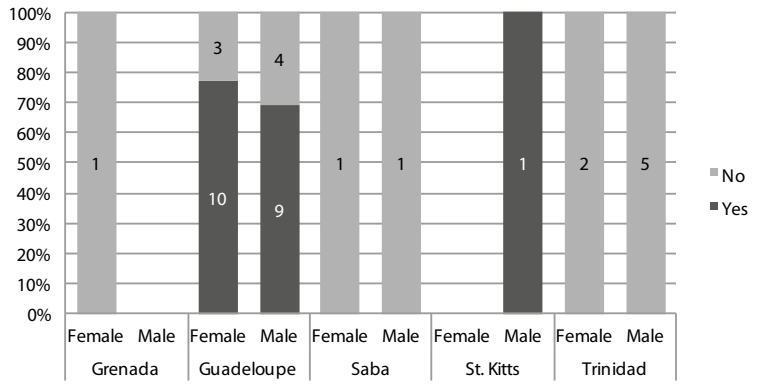
An overview of the cranial modification types and subtypes encountered in the skeletal assemblages from the Lesser Antilles can be seen in Table 42. This shows the variety in cranial shapes present in the region, each represented by relatively low numbers and percentages. The small sample size, resulting from a limited number of assemblages available and poor preservation in some Lesser Antillean samples, should be taken into account. Despite this, it is clear that modification styles seem to be more varied in the Lesser Antilles.

Table 42 **Overview of modification types and subtypes found in the Lesser Antilles.**

Type	Subtype	Number of Individuals	Percentage
Fronto-Occipital	Parallel	1	4.17
	Parallel-Vertical	3	12.50
	Vertical	4	16.67
	Undetermined	1	4.17
Frontal Flattening		1	4.17
Occipital Flattening	Parallel	2	8.33
	Parallel-Vertical	1	4.17
	Vertical	5	20.83
	Undetermined	6	25.00
Total		24	100.00

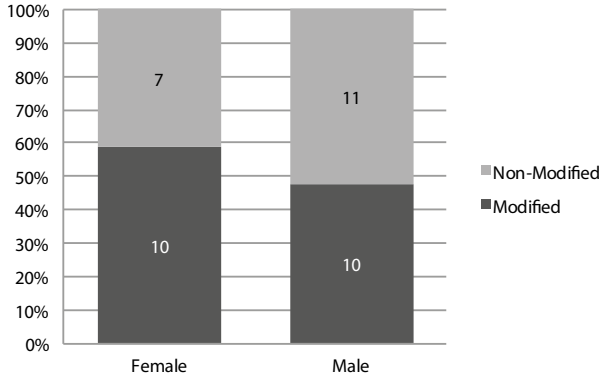
Sex

The potential relation between biological sex and modification practices was investigated for the Lesser Antillean sample. Graph 60 shows the division for each location and the problems with small sample size are immediately apparent. The ratios were statistically tested for Guadeloupe, the only island with a representative sample. The Fisher's exact test returned a p=1.000, indicating no relationship exists between sex and cranial modification in that sample.



Graph 60 **Cranial modification and biological sex for each location in the Lesser Antilles.**

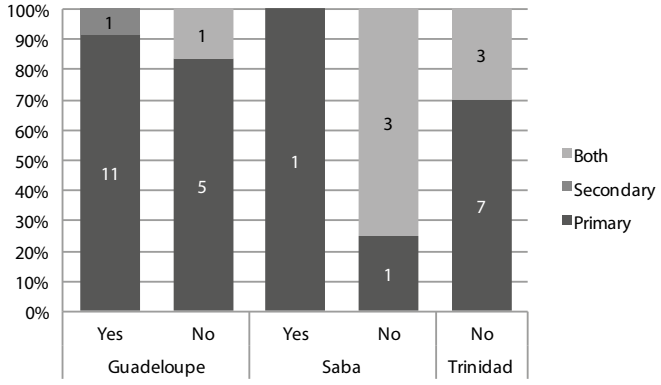
Combining all data for the Lesser Antilles provides a better sample size as can be seen in Graph 61. A Fisher's exact test was executed to determine if there was a significant difference between males and females. The outcome of p=0.532 indicates that there is no statistically significant difference in the presence or absence of modification in relation to biological sex.



Graph 61 **Cranial modification and biological sex in the Lesser Antilles.**

Burial Practices

Graph 62 shows the type of burial found in relation to the modification status of the individual and the island of origin. Primary burial seems to be the main type, with a handful of collective burials and a single case of secondary burial.



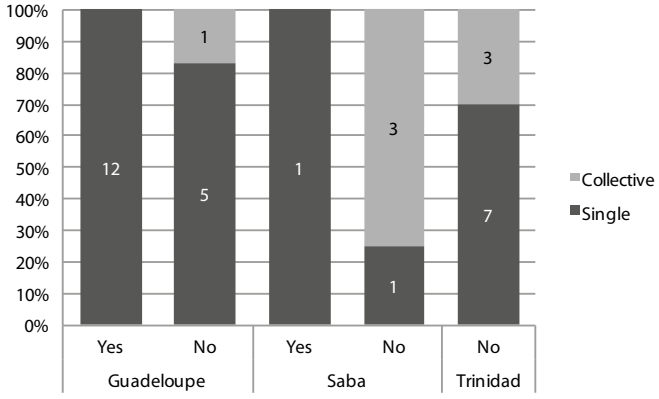
Graph 62 **Relation between the type of burial and cranial modification per location in the Lesser Antilles.**

Several Fisher's exact tests were executed to determine if a significant relationship exists between location, modification, and the type of burial. The results can be seen in Table 43. Trinidad could not be analysed separately, as only non-modified individuals compose the dataset. All results are non-significant, indicating no meaningful relation was found.

Table 43 **Results of comparative analysis of burial type and modification using Fisher's exact tests.**

Guadeloupe	Saba	Trinidad	Modified	Non-Modified
p=0.569	p=0.400	X	p=1.000	p=-0.226

Graph 63 shows the relation between cranial modification and the amount of individuals in a grave for each location. All cases of collective burial involve individuals without cranial modification.



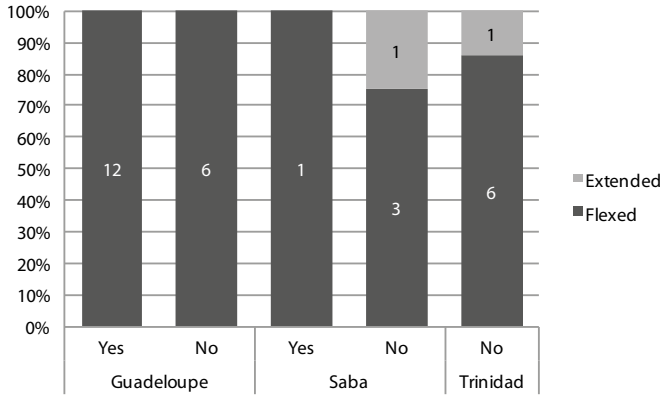
Graph 63 **Relation between cranial modification and single or collective burials per location in the Lesser Antilles.**

Several Fisher's exact tests were executed to see if statistically significant patterns exist. The result can be seen in Table 44. Analysis could not be executed for Trinidad and the modified subset of the population, since only one category is present. The missing data severely hampers the analysis of this interesting trend, but this may be resolved by pooling the data.

Table 44 **Results of comparative analysis of modification and collective or single burial using Fisher's exact tests.**

Guadeloupe	Saba	Trinidad	Modified	Non-Modified
p=0.333	p=0.400	X	X	p=0.226

Graph 64 shows the position of the body in the grave in relation to modification status for three Lesser Antillean islands. The flexed position is dominant, with only two cases of extended burial recorded.



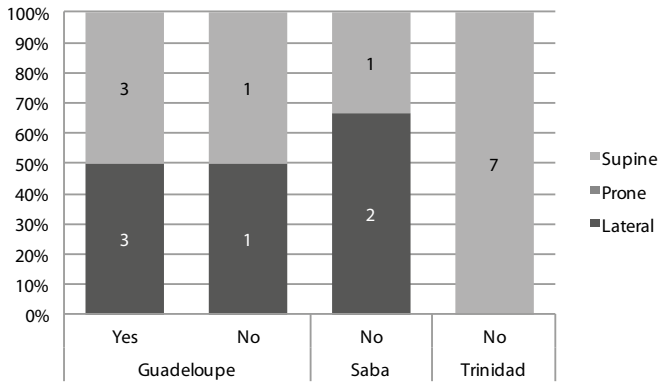
Graph 64 **Relation between body position and cranial modification per location in the Lesser Antilles.**

Fisher's exact tests were carried out to analyse the potential relations and the results can be seen in Table 45. Again, the tests are hampered by the fact that only non-modified individuals are present in Trinidad. None of the resulting *p*-values are significant, indicating no relation can be made between burial position and cranial modification.

Table 45 **Results of comparative analysis of body position and modification using Fisher's exact tests.**

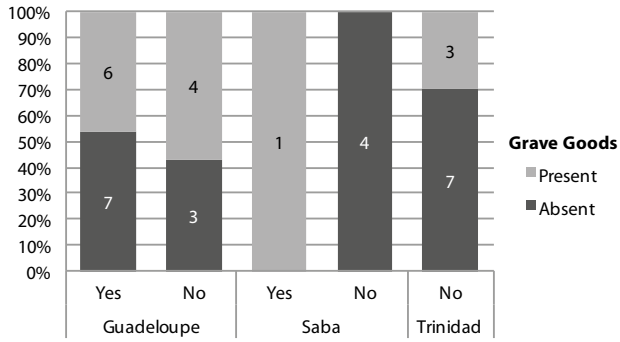
Guadeloupe	Saba	Trinidad	Modified	Non-Modified
p=1.000	p=1.000	X	p=1.000	p=0.691

The orientation of the body in the grave is related to cranial modification and shown for each location in Graph 65. The only data available for modified individuals comes from Guadeloupe, meaning no comparative analysis can be executed. Visually, the data from Guadeloupe and Saba look very similar, whereas the absence of lateral burials on Trinidad is interesting.



Graph 65 **Relation between body orientation and cranial modification per location in the Lesser Antilles.**

The relation between grave goods and cranial modification for the three Lesser Antillean islands is depicted in Graph 66. This patterns shows some variation, but is based on relatively small sample sizes.



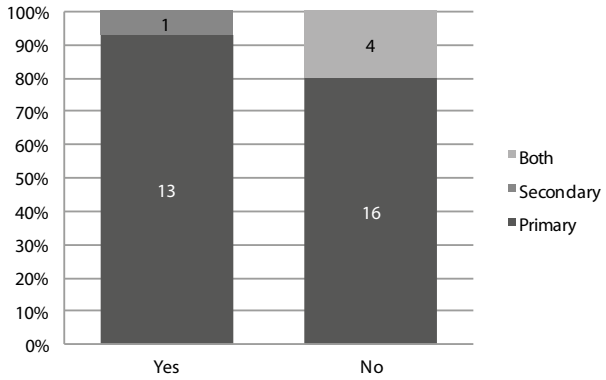
Graph 66 **Distribution of grave goods in relation to cranial modification per location in the Lesser Antilles.**

Several Fisher's exact tests were executed to determine differences within and between the islands, the results of which can be seen in Table 46. None of the *p*-values are significant, indicating no relationships exist between cranial modification and grave goods.

Table 46 **Results of comparative analysis of grave goods and modification using Fisher's exact tests.**

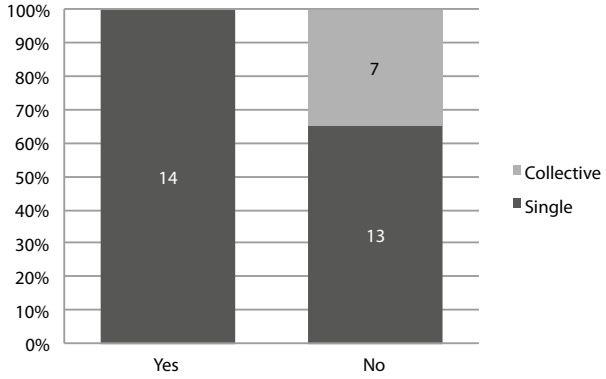
Guadeloupe	Saba	Modified	Non-Modified
p=1.000	p=0.200	p=1.00	p=0.193

The majority of individuals from the Lesser Antilles in this sample were found in a primary burial context, as can be seen in Graph 67. A Fisher's exact test was executed to determine whether there is a relationship between burial type and cranial modification. The outcome of p=0.044 is barely statistically significant, indicating a significant difference in the proportion of burial contexts among the modification groups. The high number of graves with primary and secondary inhumations in the non-modified subset of the population warrants discussion in this regard.



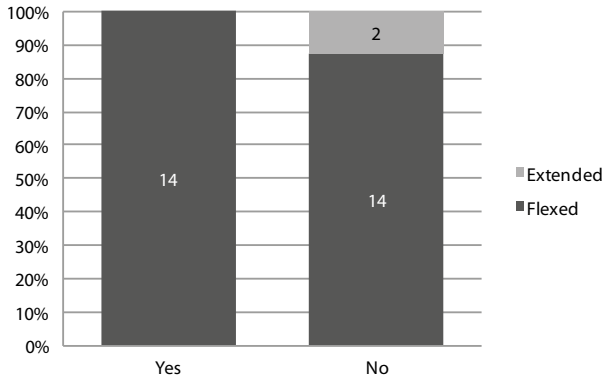
Graph 67 **Relation between type of burial and cranial modification in the Lesser Antilles.**

Most of the individuals from the Lesser Antilles were found buried in an individual grave. A handful of collective burials were encountered, all containing individuals without cranial modification. A Fisher's exact test was executed to determine whether a significant relationship was present. The resulting p=0.026 is statistically significant.



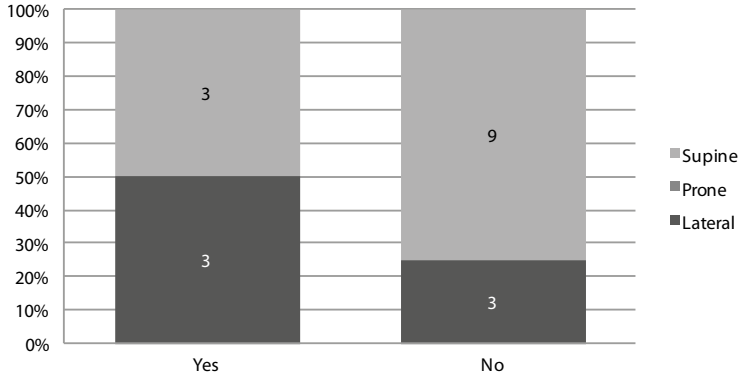
Graph 68 **Relation between cranial modification and single or collective burials in the Lesser Antilles.**

In almost all cases, individuals were found in a flexed position in the grave as can be seen in Graph 69. Only two exceptions of individuals found in extended position were recorded. A Fisher's exact test provided a p=0.485, indicating that the relation between the burial position and cranial modification is not significant.



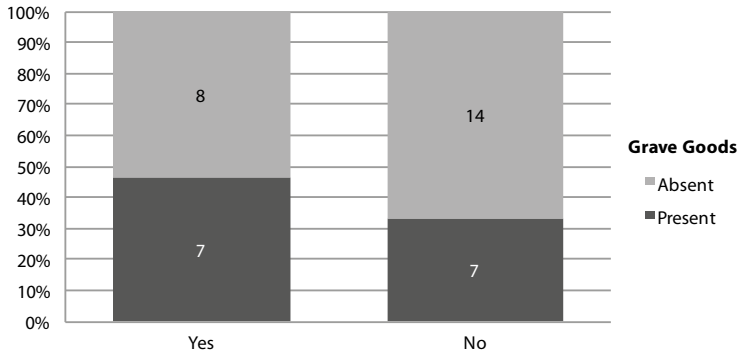
Graph 69 **Relation between body position and cranial modification in the Lesser Antilles.**

Graph 70 shows the orientation of the body within the grave, which shows lateral and supine positions were encountered in the burial record. Individuals without modification are buried more often in a supine position, but this difference is not significant as is confirmed by the outcome of p=0.344 of the Fisher's exact test.



Graph 70 **Relation between body orientation and cranial modification in the Lesser Antilles.**

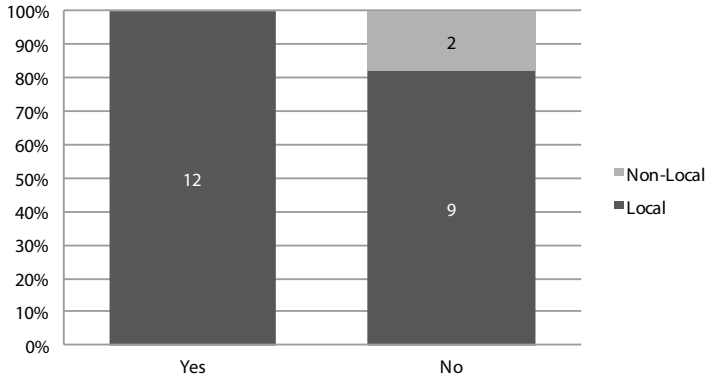
A potential relationship between grave goods within the burial context and cranial modification was investigated. Graph 71 displays the presence or absence of grave goods in relation to modification status. A Fisher's exact test was executed to determine whether a significant relationship was present. The outcome of p= 0.499 does not reach statistical significance and indicates the null hypothesis cannot be rejected.



Graph 71 **Distribution of grave goods in relation to cranial modification in the Lesser Antilles.**

Isotopes

Strontium isotope data from a study into migration and mobility in the Caribbean by Jason Laffoon (2012) were contrasted to the information in head shaping in the Lesser Antilles in Graph 72. The only two individuals with a non-local strontium signature had no indications of an altered head shape.



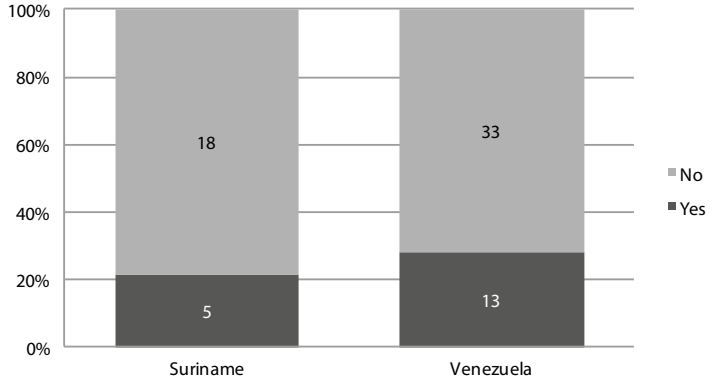
Graph 72 **Relation between isotopic signature and cranial modification in the Lesser Antilles.**

Mainland

The inhabitants of the adjacent areas of the South American mainland were involved in interactions with the island populations throughout the pre-Columbian period. Several skeletal collections from Suriname and the Lake Valencia Basin in Venezuela were analysed and are grouped here under the mainland region. The scarcity of contextual information for these mainland sites means that burial practices could not be analysed.

Prevalence

Despite being from different locations and cultural traditions, the prevalence rate of Suriname and Venezuela depicted in Graph 73 seems rather similar. A Fisher's exact test provided a non-significant result p=0.772, confirming there is no difference in modification rate between these countries.



Graph 73 **The prevalence of cranial modification for each location on the Caribbean mainland.**

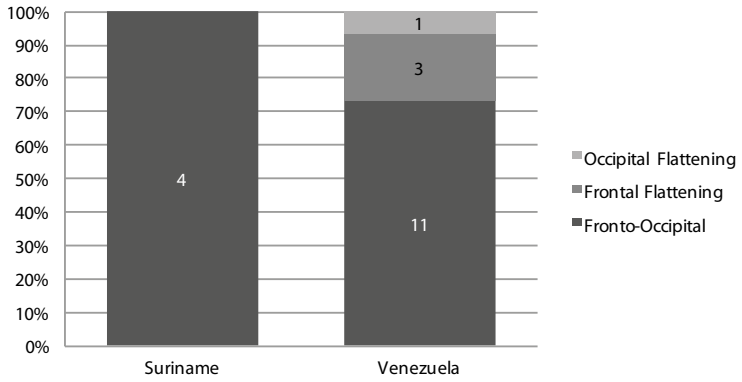
The overall prevalence of cranial modification from the mainland assemblages is provided in Table 47. Notable is the relatively low percentage of modification present.

Table 47 **Prevalence of intentional cranial modification on the Caribbean mainland.**

ICM	Number of Individuals	Prevalence (%)	Adjusted Prevalence (%)
Yes	18	24.00	26.09
Ambiguous	6	8.00	
No	51	68.00	73.91
Total	75	100.00	100.00

Shape

The types of cranial modification found on the mainland are shown per country of origin in Graph 74. Venezuela displays some variation, whilst only fronto-occipital modification was found in Suriname. A Fisher's exact test reports no significant differences with a p=1.000.



Graph 74 **Types of cranial modification found per location on the Caribbean mainland.**

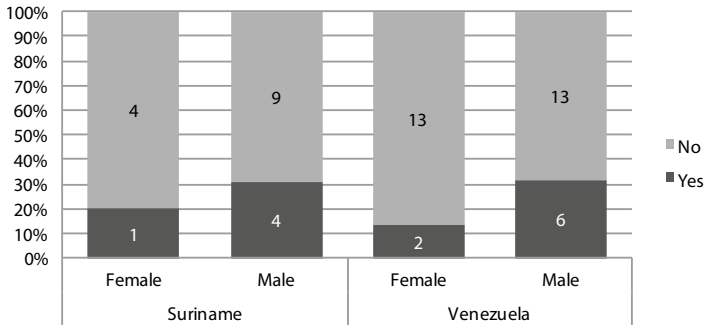
The shapes encountered in the mainland assemblages can be seen in Table 48. The majority of crania can be classified as fronto-occipital modification. There is a clear preference for parallel modification within this group. The remainder of types and subtypes are present in similar low numbers.

Table 48 **Overview of modification types and subtypes found on the Caribbean mainland.**

Type	Subtype	Number of Individuals	Percentage
Fronto-Occipital	Parallel	8	44.44
	Parallel-Vertical	1	5.56
	Vertical	2	11.11
	Undetermined	2	11.11
Frontal Flattening		2	11.11
Occipital Flattening	Vertical	1	5.56
Positional Plagiocephaly		2	11.11
Total		18	100.00

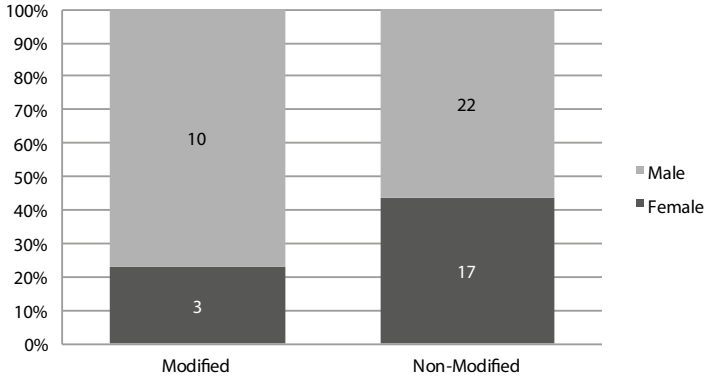
Sex

The relation between sex and cranial modification status is displayed for Suriname and Venezuela in Graph 75. The Fisher's exact tests comparing the intra-location ratios show no significant difference, with a p=1.000 for Suriname and a p=0.257 for Venezuela, respectively. A comparison of the sex distribution between the different locations also yielded a non-significant value of p=1.000 for both females and males. This indicates no differences exist between the within or between the two locations.



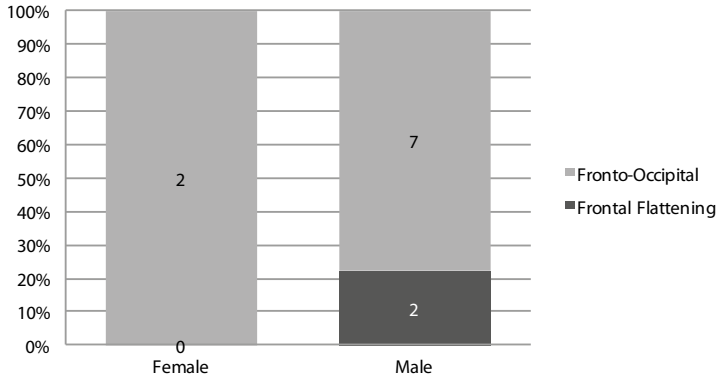
Graph 75 **Cranial modification and biological sex for each location on the Caribbean mainland.**

The relation between modification status and biological sex among mainland populations can be seen in Graph 76. A Fisher's exact test was carried out to determine whether there was a relationship between the two variables. The outcome of p=0.324 indicates there are no significant differences between males and females.



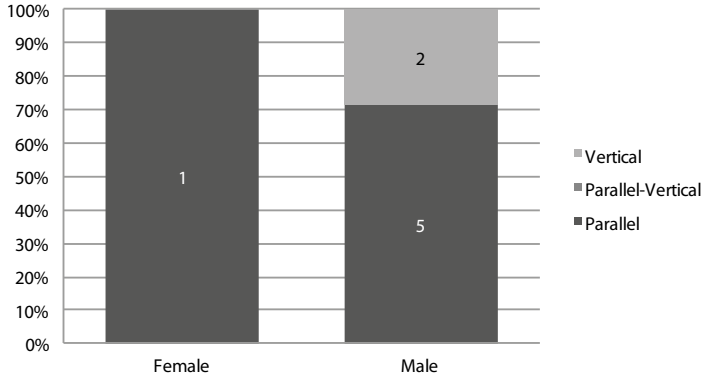
Graph 76 **Cranial modification and biological sex on the Caribbean mainland.**

Graph 77 shows the distribution of different main types of modification between the sexes. Cases of frontal flattening are only found in males, but it should be noted that the number of females in the sample is very limited.



Graph 77 **Type of modification and biological sex on the Caribbean mainland.**

The distribution of the subtypes across the sexes can be seen in Graph 78. Once again, the variation in subtype is only seen in the males, but the female category exists of a single individual.



Graph 78 **Subtype of modification and biological sex on the Caribbean mainland.**

Regional Comparisons

The previous sections have shown that the patterns of cranial modification present in the Greater Antilles and on the mainland are fairly consistent. The Lesser Antilles, on the other hand, show more diverse results and this lack of homogeneity casts doubt on considering this region a valid boundary in the case of cranial modification. In this section, the three regions will be compared directly to determine where regions differ substantially.

Prevalence

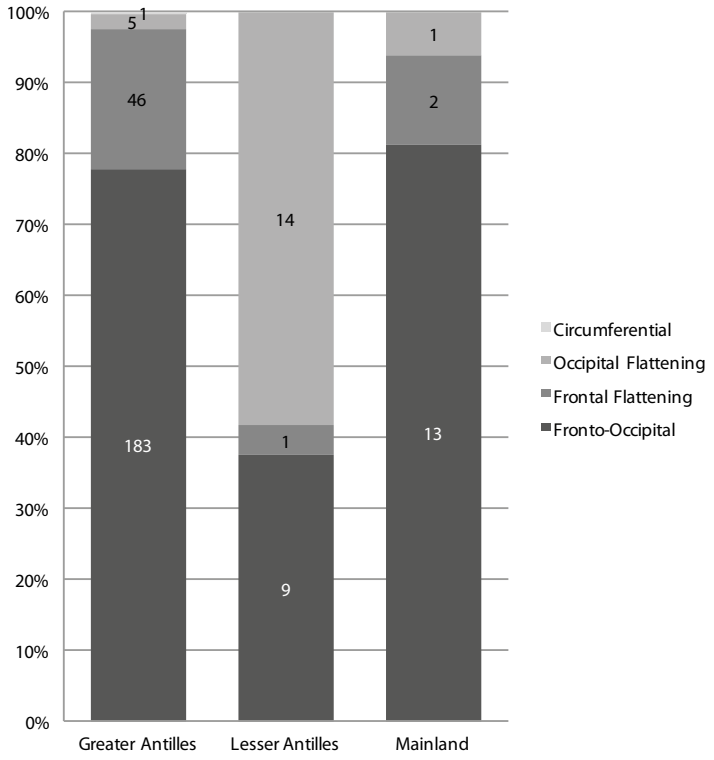
The regional prevalence rates for the Greater Antilles, Lesser Antilles, and Mainland are depicted in Graph 79. There is clear variation in the prevalence rates between the different regions: the rate seen in the Greater Antilles is relatively high whereas the mainland shows a much lower prevalence.

Graph 79 **Regional prevalence rates of intentional cranial modification.**

A Fisher's exact test was executed to determine if the observed differences in modification rates are statistically significant. The resulting $p<0.001$ indicates this is the case and that the three regions have markedly different prevalence rates.

Shape

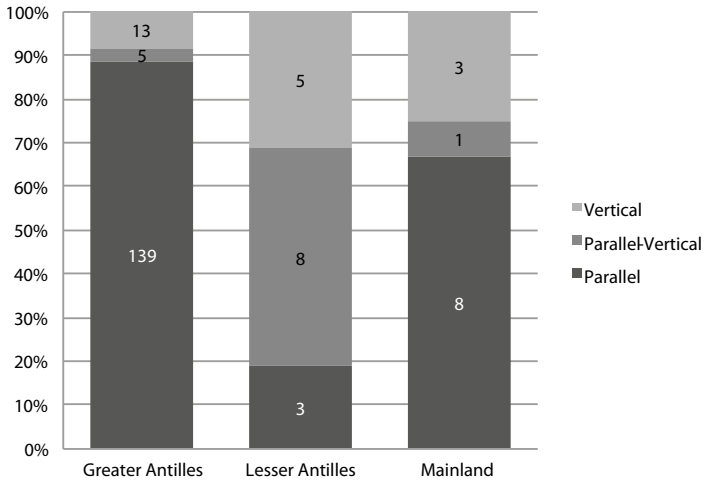
The types of cranial modification encountered in the sample are presented per region in Graph 80. A Fisher's exact test was executed and resulted in a $p<0.001$, suggesting there is a significant difference in the types encountered in the different regions.



Graph 80 **Types of cranial modification found per region.**

Studying the reported percentages per type, it is clear that the high number of occipital flattening cases in the Lesser Antilles is remarkable. This is partially due to preservation issues on the island of Guadeloupe, as has been explained previously. It is therefore unclear whether this represents an actual significant difference between regions or is an artefact created by the preservation issues.

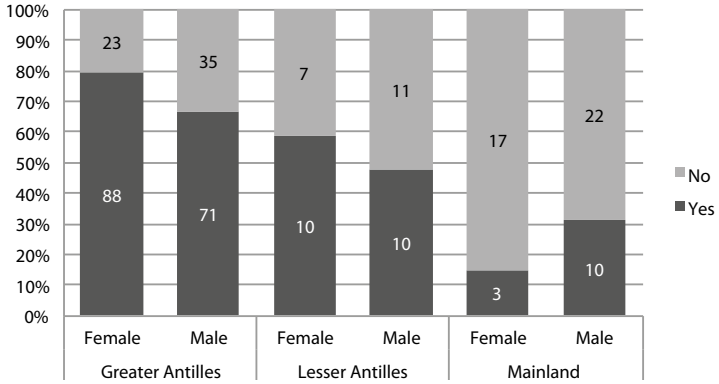
The ratio of the different subtypes encountered in each region is shown in Graph 81. The Lesser Antilles seems to stand out in in comparison to both the Greater Antilles and the Mainland. A Fisher's exact test produced a $p<0.001$, indicating a significant difference in subtypes among the three regions exists.



Graph 81 **Subtypes of cranial modification found per region.**

Sex

The rates of cranial modification among males and females in the three regions are visualised in Graph 82. The graph shows that the major differences can be found between the different regions, whereas the ratios within each region are roughly similar.



Graph 82 **Rates of modification among males and females per region.**

Several Fisher's exact tests were executed to test intra- and inter-regional differences. The results can be seen in Table 49. These results show that the rates within the regions are equal – with the exception of a (barely) significant difference in the male-female ratio in the Greater Antilles. The comparison of females and males across the regions both show significant differences as a result of variation in overall prevalence rates within each region.

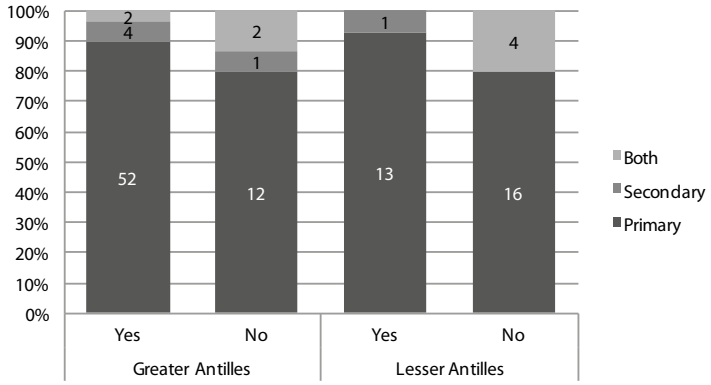
Table 49 Results of comparative analysis of sex and modification rates using Fisher's exact tests.

Greater Antilles	Lesser Antilles	Mainland	Females	Males
p=0.047	p=0.532	p=0.324	p<0.001	p=0.001

Burial Practices

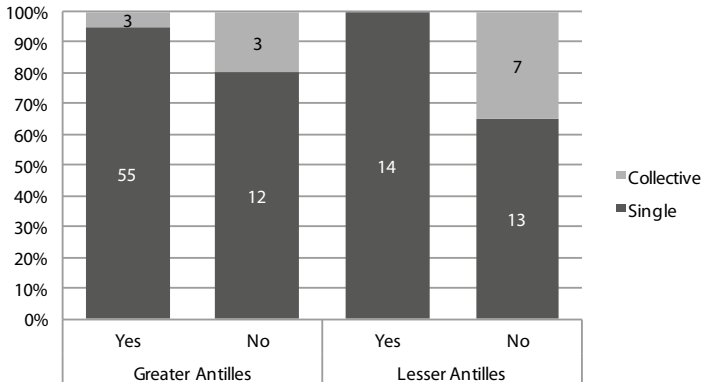
The contextual information from the mainland component of this sample is very limited, as a result of which only the burial practices of the Greater and Lesser Antilles could be compared.

The first variable investigated is burial type, shown for the two regions per cranial modification category in Graph 83. The graph shows the variety in burial practices encountered in the archipelago, although primary burials seem to be dominant. There is little intra-regional difference in the Greater Antilles, confirmed by a p=0.233 value produced by a Fisher's exact test. The Lesser Antilles show more diversity, likely due to the internal variation already noted in the region, with a Fisher's exact test result of p=0.070. Comparing the two regions shows no significant differences between the burial practices in the modified and non-modified categories, with Fisher's exact tests producing p=1.000 and p=0.640, respectively.



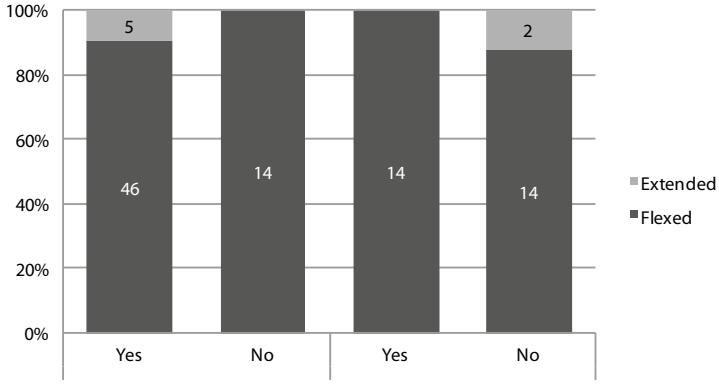
Graph 83 Relation between the type of burial and cranial modification in the Greater and Lesser Antilles.

Graph 84 shows the amount of individuals encountered in the grave context in relation to their cranial modification status in the Greater and Lesser Antilles. Single burials are dominant in both regions, with no significant difference detected between the modified and non-modified individuals in the Greater Antilles as shown by a non-significant p=0.097 result from a Fisher's exact test. The Lesser Antilles do show significant differences, with a Fisher's exact test result of p=0.026, between the two categories with collective burials reserved for non-modified individuals.



Graph 84 **Relation between the amount of individuals in a grave and cranial modification in the Greater and Lesser Antilles.**

The position of the body in the grave is predominantly flexed within both the Greater and Lesser Antilles. There are only a handful of exceptions. Several Fisher's exact tests were executed to investigate whether these differences were significant. There is no significant intra-regional variation with a p=0.576 for the Greater Antilles and a p=0.485 for the Lesser Antilles, nor any interregional differentiation with a p=0.576 for the comparison of modified individuals and p=0.485 for non-modified individuals.

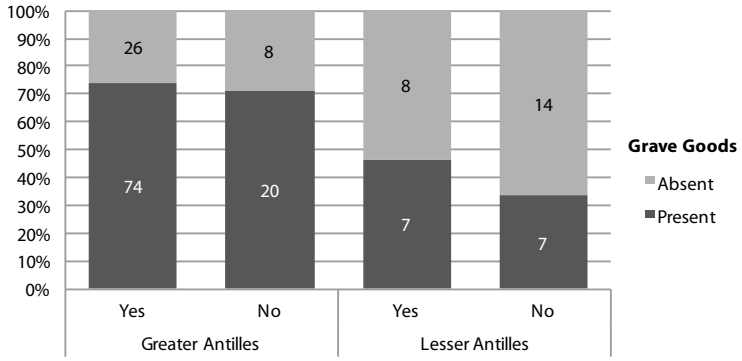


Graph 85 **Relation between body position and cranial modification in the Greater and Lesser Antilles.**

The orientation of the body in the burial context shows relatively similar patterns within both regions, as can be seen in Graph 86. Several Fisher's exact tests were run to determine differences within or between the regions with respect to burial orientation and modification status. The resulting non-significant values of p=0.556 for the Greater Antilles and p=0.344 for the Lesser Antilles confirm there is no intra-regional variation. The non-significant p=0.776 for the modified and p=0.400 for the non-modified individuals confirm the lack of interregional variation.

Graph 86 **Relation between body orientation and cranial modification in the Greater and Lesser Antilles.**

The relation between cranial modification and grave goods is expressed for both regions in Graph 87. The patterns within each region appear similar, suggesting little intra-regional differentiation between the modified and non-modified individuals. This is confirmed with the non-significant results of the Fisher's exact test, p=0.811 for the Greater Antilles and p=0.499 for the Lesser Antilles. There does appear to be variation in the overall rate of grave goods encountered in the region, as is evidenced by a significant Fisher's exact test result of p=0.011 for the comparison of the non-modified individuals. The modified individuals fail to reach the threshold of significance with p=0.064.



Graph 87 **Distribution of grave goods in relation to cranial modification in the Greater and Lesser Antilles.**

7.4 CHRONOLOGICAL PATTERNS

This section will provide a chronological overview of cranial modification practices in the Caribbean. The available radiocarbon dates and other contextual information needed to place samples in the right period vary substantially between different sites and limit our analysis of the temporal dimension of head shaping. Attempts were made to analyse patterns of modification in relation to the various cultural traditions of the region to gain a more intricate understanding of the temporal nuances of cranial modification and identity in the Caribbean. Unfortunately, the segment of the sample with sufficient contextual detail proved too small to undertake any meaningful analyses. Therefore, the temporal patterns presented here are based on the broader regional chronology. The previous analyses have already indicated that there is some merit to the regional boundaries, at least for the Greater Antilles and Mainland, and, consequently, these will be followed here to investigate modification practices. Combining all locations would increase the sample size, but simultaneously obscure interesting trends.

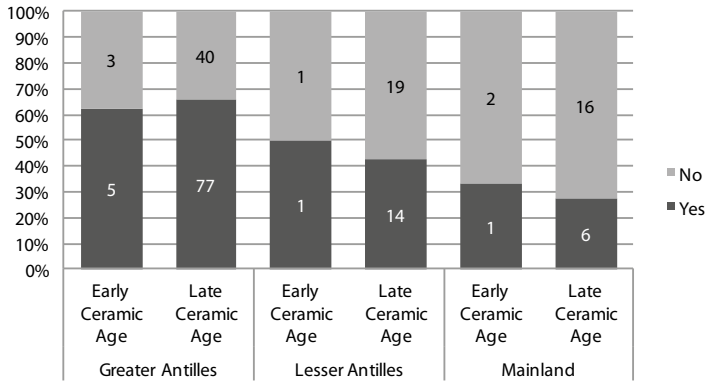
First, the head shaping practices in the Ceramic Age and Colonial period will be investigated for each region. Finally, the site of El Chorro de Maíta will be assessed to provide a more local view of cranial modification practices on the threshold between the pre- and postcolonial Caribbean.

Ceramic Age

The Caribbean Ceramic age has been divided into two phases corresponding to major social and cultural developments: the Early and Late Ceramic Age. Patterns of prevalence, shape, and sex distribution will be contrasted here to see if changes occur between the two phases.

Prevalence

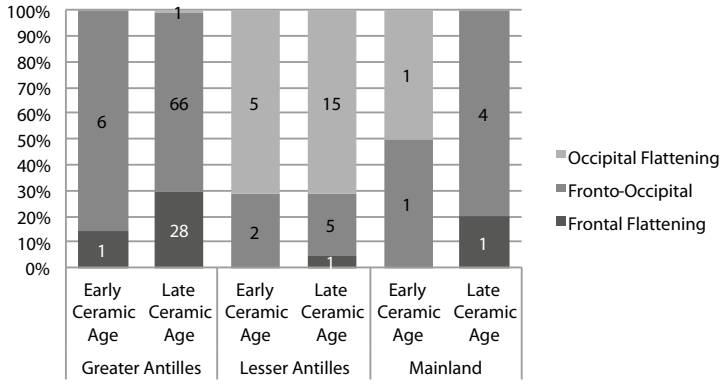
Graph 88 shows the prevalence rates for the Early and Late Ceramic Age for the Greater Antilles, Lesser Antilles, and Mainland. The prevalences look rather similar, suggesting no major shifts took place in head shaping practices between these periods. This is confirmed by Fisher's exact test comparing the early and late phases for each region, which produced three p-values of 1.000. However, the very small sample size for the Early Ceramic Age in each of these regions is problematic.



Graph 88 **The prevalence of cranial modification in each region in the Early and Late Ceramic Age.**

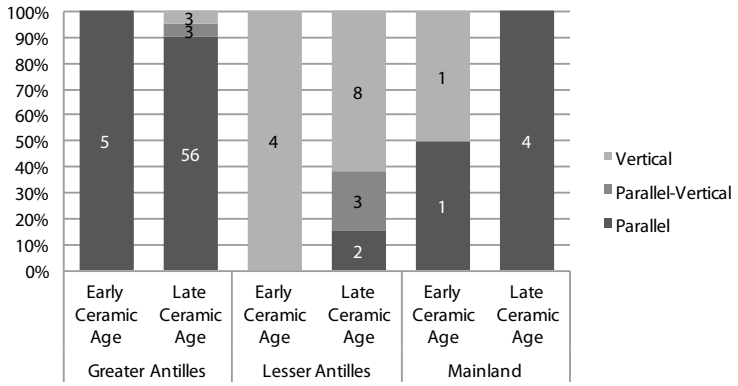
Shape

The different main types of modification have been displayed for each region and phase in Graph 89. Once again, major differences in sample size are seen. The overall proportions of the types seem similar in the Early and Late Ceramic Age on the Greater and Lesser Antilles. This is confirmed by the non-significant outcomes of the Fisher's exact test comparing the two phases for each region, p=0.692 and p=1.000 respectively. A shifting proportion is seen on the mainland, although the small sample size of in particular the Early Ceramic Age sample may cause a bias. A Fisher's exact test indicates no significant differences between the two phases with a p=0.524.



Graph 89 **Types of cranial modification found in each region in the Early and Late Ceramic Age.**

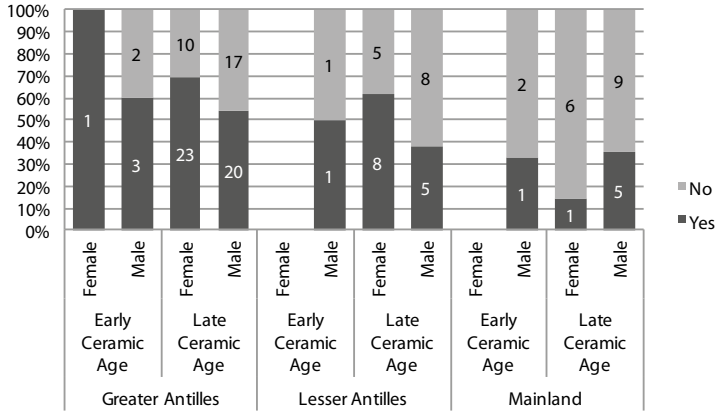
Graph 90 shows the different subtypes encountered in each of the regions in the Early and Late Ceramic Age. The small sample sizes in the Early Ceramic Age make this data difficult to interpret. The Greater Antilles seem to be characterised by parallel modification in both phases, whereas the Lesser Antilles show an inclination towards vertical modification.



Graph 90 **Subtypes of cranial modification found or each region in the Early and Late Ceramic Age.**

Sex

The prevalence rates for males and females are shown for both periods in each of the regions in Graph 91. Missing data and small sample sizes once again create issues, in particular the lack of females from the Lesser Antilles and Mainland in the Early Ceramic Age. Overall, the prevalence rates are relatively equal between the sexes of the same location and period. No major changes are observed between the Early and Late Ceramic age populations of the same region.



Graph 91 **Cranial modification and biological sex in each region in the Early and Late Ceramic Age.**

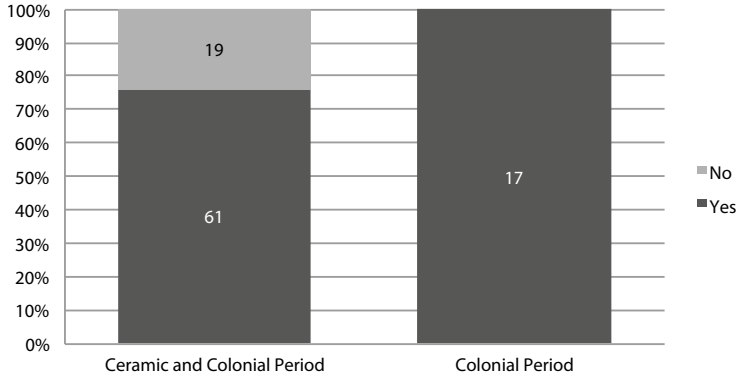
Colonial Period

The analysis of head shaping practices in the colonial period is restricted to the Greater Antilles, as this period is only represented by crania from Cuba and the Dominican Republic in the sample. The group Ceramic and Colonial period was formed by necessity and is used for individuals from a site with a Late Ceramic Age and early Colonial

component which could not be attributed with certainty to either period. Unfortunately, this turned out to be a relatively high number of crania in the current sample and these are shown here to complement our knowledge of head shaping practices in indigenous societies at this historic moment.

Prevalence

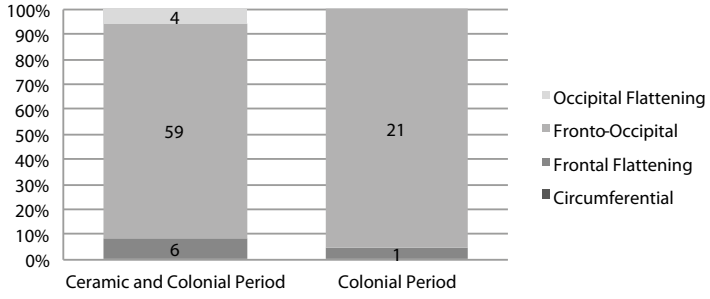
The prevalence of head shaping in the Late Ceramic and early Colonial period is seen in Graph 92. The Colonial period shows a prevalence of 100%, but this is unlikely to be a true prevalence rate. The 76% prevalence of the Ceramic and Colonial period category is very similar to the prevalence rate from Late Ceramic Age Greater Antillean locations and more likely to be realistic.



Graph 92 **Prevalence of intentional cranial modification in the Colonial period.**

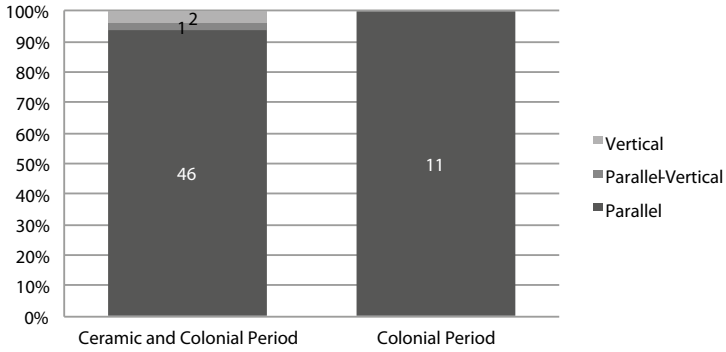
Shape

The main type of modification seen in this period is shown in Graph 93. The distribution of shapes is relatively similar, as is confirmed by the non-significant p=0.615 outcome of the Fisher's exact test.



Graph 93 **Types of intentional cranial modification in the Colonial period.**

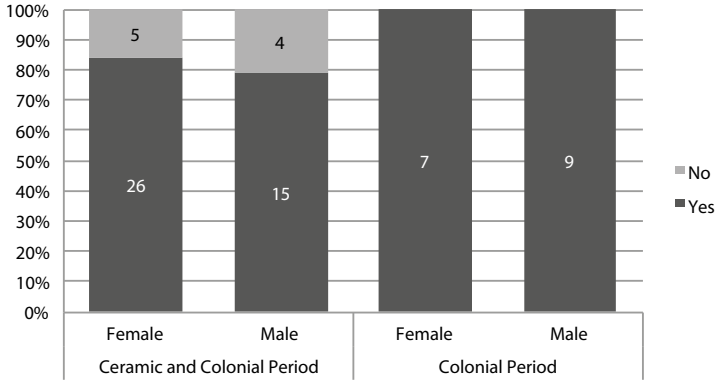
The subtypes present in the colonial period are shown in Graph 94. Again, the rates seem very similar and there is an undisputed preference for parallel modification of the occipital.



Graph 94 **Subtypes of intentional cranial modification in the Colonial period.**

Sex

The prevalence rates for males and females in the Colonial period are shown in Graph 95. This demonstrates the same issue discussed previously of a 100% prevalence rate in the Colonial period. The prevalence in the Ceramic and Colonial period is similar between males and females and this is confirmed by the non-significant p=0.715 result produced by the Fisher's exact test.



Graph 95 **Rates of modification among males and females in the Colonial period.**

Changing Community: El Chorro de Maíta

This brief look at the temporal dimension of head shaping practices in the Caribbean has shown that the lack of proper context for many individuals in the sample limits our understanding of changes in the custom through time. There is, however, an interesting

case study from the island of Cuba which may shed more light on the effects of intercultural contact on cranial modification. The site of El Chorro de Maíta, previously discussed in relation to individual CDM72B, has been dated to the pivotal moment of change at the beginning of the colonial period with evidence of interaction between Amerindians, Europeans, and Africans.

Prevalence

The prevalence of head shaping at the site of El Chorro de Maíta is relatively high with an adjusted prevalence of 89% of Amerindians showing evidence of cranial modification, as can be seen in Table 50. Removal of the individuals of suspected non-Amerindian descent is crucial, as their inclusion would obscure the indigenous head shaping practices.

Table 50 Prevalence of intentional cranial modification at El Chorro de Maíta. * Indicates suspected non-Amerindian ancestry.

ICM	Number of Individuals	Prevalence (%)	Adjusted Prevalence (%)	Adjusted Amerindian Prevalence (%)
Yes	58	79.45	85.29	89.23
Ambiguous	5	6.85		
No	7 + 3*	13.70	14.71	10.77
Total	73	100.00	100.00	100.00

The prevalence of head shaping at El Chorro de Maíta is relatively high, but comparable to the rates found at other Late Ceramic Age Greater Antillean sites. However, there is a unique aspect to the prevalence patterns found at the site. The original investigators of the skeletal assemblage noticed a peculiar pattern in the distribution of cranial modification at the site with children having significantly lower rates of modification than adults (Guarch Delmonte 1996).

This significant difference was confirmed in this study. Table 51 shows this difference, expressed both in percentages and actual individuals. It is immediately apparent that cranial modification rates are lower in the non-adult age group, which combines infants, children, and adolescents. These age categories were grouped together to create a more balanced sample size for statistical testing.

Table 51 Prevalence of cranial modification in adults and non-adults at El Chorro de Maíta.

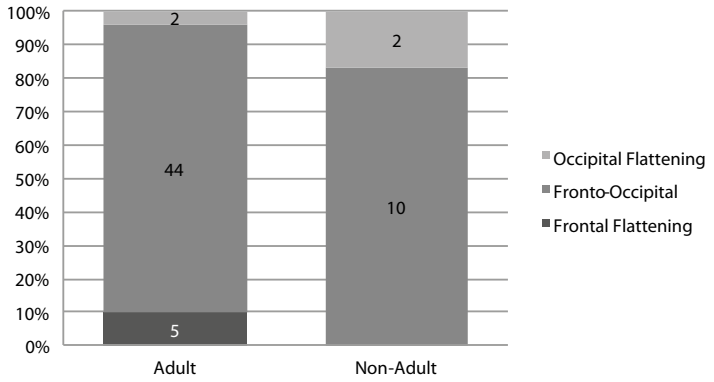
ICM	Prevalence (N)		Adjusted Prevalence (N)		Adjusted ancestry Prevalence (N)	
	Adult	Non-adult	Adult	Non-adult	Adult	Non-adult
Yes	85.45% (47)	61.11% (11)	91.67% (44)	64.71% (11)	95.65%(44)	68.75% (11)
Ambiguous	7.27% (4)	5.56% (1)				
No	7.27% (4)	33.33% (6)	8.33% (4)	35.29% (6)	4.35% (2)	31.25% (5)

To test the statistical significance, three Fisher's exact tests were carried out on the prevalence, adjusted prevalence and adjusted ancestry prevalence categories, as seen in Table 51. All three outcomes were statistically significant with p=0.026, p=0.015, and p=0.010, respectively. This means the null hypothesis can be rejected and that there is a statistically significant difference in the ratio of modified/non-modified individuals between the two age groups, irrespective of adjustments of the data for ambiguous cases and/or ancestry.

Similar comparisons for the prevalence rates between adults and non-adults were carried out for the most comparable skeletal assemblages in the sample: Juan Dolio, La Caleta, and Constanza. These sites are all from neighbouring Dominican Republic and the closest to El Chorro de Maíta in terms of age, all Late Ceramic Age or Early Colonial period, and overall sample size. These sites have similar proportions of modified and non-modified individuals in both age categories and produced statistically not significant outcomes in the Fisher's exact test. A further comparative test including all skeletal material from the Dominican Republic also showed no significant difference between the different age categories. This is the expectation if cranial modification practices are relatively stable over time. The significant difference between the age categories at El Chorro de Maíta points towards a shift in modification practices.

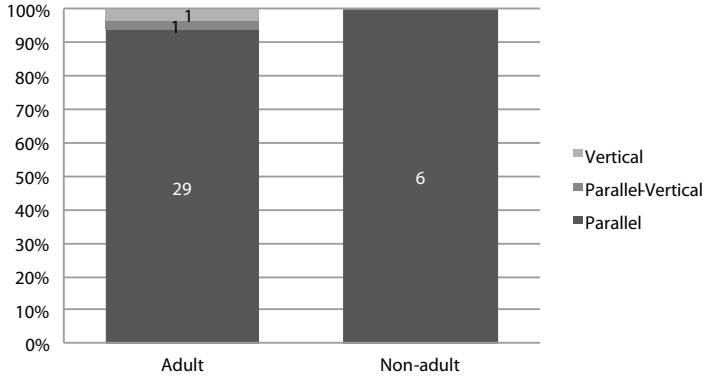
Shape

The distinct prevalence rates between adults and non-adults seen at El Chorro de Maíta warrant further investigation of differences in shape. The types of modification found in adults and non-adults at the site can be seen in Graph 96. Frontal flattening is only present in the adult sample and occipital flattening is far less prevalent among adults. A Fisher's exact test results in a p=0.140, indicating these differences are not significant.



Graph 96 **Relation between modification types and age categories at El Chorro de Maíta.**

Graph 97 shows the relationship between the subtypes and age categories at El Chorro de Maíta. Parallel modification is by far the predominant subtype found in both adults and non-adults. A Fisher's exact test produced a p=1.000, confirming the absence of any significant differences.



Graph 97 **Relation between modification subtypes and age categories at El Chorro de Maíta.**